Guidance

Landspreading: how to manage soil health

Updated 4 May 2023

Applies to England

Publication for Wales (https://naturalresources.wales/permits-and-permissions/environmental-permits/guidance-to-help-you-comply-with-your-environmental-permit/?lang=en)

Contents

This publication is available at https://www.gov.uk/government/publications/landspreading-how-to-manage-soil-health/landspreading-how-to-manage-soil-health

Use this guidance when you produce your benefit statement for your application to deploy mobile plant for landspreading.

To provide agricultural benefit or ecological improvement you may need to manage:

- the water content of the soil
- the pH of the soil
- the carbon to nitrogen ratio of the soil
- soil and crop nutrients
- contaminants
- pests and diseases
- salty whey and other high conductivity waste
- soil organic matter and applied agrochemicals
- organic manures
- oil and fat trap waste

This guidance also explains when you can level the land under a landspreading permit.

Manage the water content of the soil

If you need to manage the water content of the soil consider the:

- time of year
- crop cover
- soil type, texture and depth
- soil condition such as structure and drainage status

You can conserve water in the soil by injecting liquid wastes and using minimum tillage operations. If you use injection you will need to:

- consider soil conditions and under drainage
- address any issues and provide an assessment of the risks and a management plan in your benefit statement

An application rate of 250m^3/ha is approximately equivalent to 25mm of rain/ha.

Benefits and risks of applying waste with a high water content

Waste streams with a high water content are most likely to provide benefit during the months of active plant growth. This is between May and September.

Consider these benefits, the waste:

- can meet the water requirements of the crop
- will contain traces of plant nutrients
- can wash in fertilisers or manures

Consider these risks:

- run-off can occur on slopes, where the soil is saturated, compacted or has low permeability
- run-off and pollution issues, can be made worse if there is heavy rain during or shortly after spreading the waste
- rapid soil saturation where there is a high water table, resulting in anaerobic conditions and surface ponding

Consider the spreading technique you use. For example:

- a trailing shoe or dribble bar places the waste onto the surface of the soil and reduces odour and aerosol drift
- high trajectory application by splash plate or irrigation guns can lead to odour and aerosol drift that affects sensitive receptors

Manage soil pH

Soil pH is a measure of the acidity or alkalinity of the soil. It ranges from about pH 4.0 very acid (when most crops will fail) to about pH 8.0 for soils that are naturally rich in lime or are over-limed. Most plants can tolerate a wide range of pH conditions if a proper balance of other elements is maintained.

You can use a suitable waste stream to correct the pH of the soil to provide benefit.

You must consider:

- the rate of reaction – how quickly the soil reacts to the addition of

the waste
- the soil type – you will need to know this to decide on the suitability of the waste stream
- the pH amendment required
- crop requirements

For optimum soil pH see Table 1.1 Section 1 (https://ahdb.org.uk/knowledge-library/rb209-section-1-principles-of-nutrient-management-and-fertiliser-use) in RB209.

The soil pH significantly influences nutrient availability and the mobility of potentially toxic elements (PTEs), other metals and contaminants.

It is important to manage soil pH for ecological improvement schemes. The soil pH can affect how plant species and habitats develop on the land for treatment, restoration or maintenance.

You can also control the soil-borne disease clubroot using pH adjustment. For more details see clubroot management in crops (https://ahdb.org.uk/clubroot) on the AHDB website.

Table 1. Target pH for arable and grassland soils

Soil category	Arable soils	Grassland soils
Light sand soils	6.5	6.2
Medium soils	6.5	6.2
Deep clay soils	6.5	6.2
Deep silty soils	6.5	6.2
Organic soils (10 to 25% organic matter)	6.4	5.9
Peats (25% plus organic matter)	6.0	5.5

Effects of adjusting pH

The following can decrease pH:

- rainfall
- applying ammonium sulphate fertilisers
- applying organic manures
- natural soil processes

As soil pH decreases, the soil solution concentration of hydrogen ions increases.

At low pH (acidic) the concentrations of aluminium, manganese, iron and zinc in the soil solution can increase. This can affect phosphate uptake and induce a phosphorus deficiency in the plants.

The degree of chemical fixation into plant-unavailable phosphorus forms is lowest at soil pH 7.0 and increases as soil pH decreases. Phosphorus deficiency can also be seen in alkaline soils where reactions with calcium can fix phosphorus in unavailable forms.

Landspreading a waste stream that contains lime or has a high neutralising value adjusts the pH of the soil. This affects the chemical, physical and biological properties of the soil.

Consider the chemical effects of changing the pH of the soil, for example:

- several trace elements such as iron, manganese and zinc are less available as the pH increases from 5.0 to 7.5 or 8.0
- molybdenum availability increases at higher pH
- only a small fraction of soil phosphate is in the soil solution at any one time, although most plants seem to extract it from the soil with least difficulty at pH 6.5
- at pH values below 5.0, aluminium, iron and manganese are often soluble in sufficient quantities to cause harm to the growth of sensitive plants

You must not apply sewage sludge and other waste streams that contain metals to soils below pH 5.0. You must only apply it to soils below pH 5.5 when justified with appropriate technical expertise.

For further information on adjusting soil pH for agricultural crops see:

- soil acidity and liming in RB209 Section 1 Principles of nutrient management and fertiliser (https://ahdb.org.uk/knowledge-library/rb209-section-1-principles-of-nutrient-management-and-fertiliser-use)
- Agricultural Lime Association (http://www.aglime.org.uk/lime_calculator.php) – which provides a lime calculator based on soil type and cropping

Using lime to restore pH

The use of some manufactured fertilisers, cropping regimes, and natural leaching can all contribute to a decrease in soil pH over time.

The target pH, given in table 1 (in this guide), is always slightly higher than the optimum pH. This allows for longer periods between lime applications.

You can add lime to non-calcareous soils to help to restore the pH balance. Its addition has biological and chemical advantages.

Biological advantages include:

- the stimulation of heterotrophic soil organisms, which favour the formation of humus and encourage the elimination of certain organic intermediate products that are toxic to some plants
- improving soil structure
- the stimulation of bacteria that fix nitrogen from air, both non-symbiotically and in the nodules of legumes

Chemical advantages include:

- maintaining the nutrient balance in the soil
- reducing the mobility and uptake of PTEs
- healthy plant growth
- increasing nutrient availability and plant uptake

Compare liming materials

You can use the neutralising value to compare the liming properties of materials and wastes.

The neutralising value is expressed as a percentage of the effect that is obtained if pure calcium oxide is used.

For example, if a sample of ground limestone has neutralising value of 55, then 100kg of this material would have the same neutralising value as 55kg of calcium oxide.

Typical neutralising value properties are:

- ground chalk – 50%
- ground magnesium limestone (15 to 20% magnesium oxide) – 50 to 55%
- hydrated lime – 70%
- burnt lime not generally used in agriculture – 80 to 95%

Waste streams with a liming potential tend to have lower neutralising values which results in the need for typically higher application rates than for quarried limestone or chalk.

The reactivity of a liming material is based on how quickly the soil will benefit. Finer grained materials and dusts tend to react most quickly, typically in 1 to 2 years. Lumpy or poorly ground material is slower to react.

The reactivity in the soil of some waste streams, such as cement kiln dust is similar to quarried limestone or chalk because of its physical and chemical characteristics.

When you assess the benefit the waste gives the receiving soil, base it on how well the waste amends the soil pH. This means considering:

- how suitable the waste material is
- the soil type
- the pH amendment required
- cropping plans

The lime recommendation given in RB209 depends on the pH and the buffering capacity of the soil.

Deployments that use a liming material

To use a waste stream as a liming material you must:

- provide analytical evidence of the liming capability of the waste stream
- express this as a neutralising value, making sure the proposed application rate provides the correct lime requirement
- make the link with the soil type, cropping, soil pH, target pH and the field factor

The field factor is the amount of lime needed to raise the soil type selected by 1 pH unit. This reflects the buffering capacity of the soil.

Understand that:

- not all alkaline wastes are effective liming materials
- total calcium is not a suitable measure of liming ability

Manage the carbon to nitrogen ratio of the soil

Knowing the carbon to nitrogen ratio in both the waste and soil is important. For your landspreading activity you need to understand the implications of controlling the:

- available nitrogen
- total organic matter
- rate of decay

If your deployment only claims benefit from adding organic matter to the soil, you will need to consider the soil type, crop and the potential for nitrogen lock up.

Nitrogen lock up is when soil organisms start to break down the waste and need nitrogen to function. If the waste has a high carbon to nitrogen ratio, such as paper sludges and timber residues, the waste will not supply enough available nitrogen to the crop.

Not getting the carbon to nitrogen ratio right can:

- decrease crop growth and yield
- cause a decline in the soil organism population
- result in the need for manufactured fertilisers, especially after applying high carbon to nitrogen waste streams

How long nitrogen lock up lasts can depend on the:

- application rate of the waste
- carbon to nitrogen ratio of the waste
- soil temperature – although this has a minor effect

You are unlikely to be able to claim benefit from surface spreading a bulky organic waste on permanent grass fields. The waste may smother the grass at high application rates.

Incorporation may be difficult in well-established grass swards. You may be able to claim benefit where the waste is applied to a short-term ley, that is then ploughed during a rotation.

If you plan to spread organic waste on grassland, the Environment Agency recommend you split the application. For example, by using lower application rates for several sessions. This will allow the sward to incorporate the waste between applications.

You can harrow the grassland after you spread to:

- increase the rate of sward incorporation
- reduce the visual impact of the activity
- reduce the possibility of stock ingesting the waste when grazing or incorporating into silage or hay crops

Manage soil and crop nutrients

You will need to know:

- what nutrients are in the waste
- the soil and crop nutrient needs

You must not apply more nutrients than are needed by the soil and crop. Doing this may be a waste disposal not a waste recovery activity.

Rule 2.1.3 (https://www.gov.uk/government/publications/landspreading-how-to-comply-with-your-permit/landspreading-how-to-comply-with-your-environmental-permit#provide-a-benefit-statement) in Landspreading: how to comply with your permit explains how to meet the waste recovery requirements.

You can use RB209 (https://ahdb.org.uk/nutrient-management-guide-rb209) to work out the nutrients your soil and crop needs.

For further information on how to plan and control nutrient levels see Nitrates and phosphates: plan organic fertiliser and manufactured fertiliser use (https://www.gov.uk/government/publications/nitrates-and-phosphates-plan-organic-fertiliser-and-manufactured-fertiliser-use).

RB209 contains information on recommended soil indices for phosphorus, potassium and magnesium. Recommendations are also provided for sulphur, sodium and a range of micronutrients also known as trace elements. To control other trace elements you must use different guidance and appropriate expert advice.

Soil indices are a measure of the nutrient status of the soil. They indicate a nutrient concentration range in the soil. For example, phosphate at index 2 is the range in concentration between 16 and 25mg/l.

If you do not follow the recommendations in RB209 you must:

- provide appropriate technical justification in your benefit statement
- make sure the justification is relevant to the proposed waste and the land it will be spread to
- reference the information you used to make your justification

Waste composition varies. If your deployment proposes to rectify a deficiency of one essential plant nutrient (at a level recommended in RB209) other nutrients must not be unnecessarily over applied.

For your deployment application, you must demonstrate the benefits and assess the risks of all the nutrients in the waste stream. Any non-essential nutrient additions (that is the nutrient status of the soil is already at or above the recommended indices) from the waste stream must balance crop off-take. Therefore, resulting in no net increase in nutrient levels in the receiving soil.

Nitrogen

You can provide agricultural benefit by landspreading waste that contains nitrogen. This includes both plant available mineral forms and stable slow release organic forms.

You must do an assessment if your waste stream supplies the soil with nitrogen.

The nitrogen requirement of a crop depends on its type, yield and quality. If higher than average yields are expected the requirement may increase. Certain crops such as milling wheat may require extra nitrogen.

The amount of nitrogen made available by landspreading a waste stream must not cause the supply of nitrogen to exceed the specific crop need. If it does you will need to provide justification in your benefit statement. You can use the soil nitrogen supply (SNS) index system in RB209 to assess the crop nitrogen need.

To work out how much additional nitrogen is needed from the waste you must consider how much:

- is left in the soil and will become available to the next crop
- will be from other sources such as manures and manufactured fertilisers

Consider these 4 main forms of soil nitrogen:

- humus from older stable organic matter, this mineralises slowly and is important in soil structure
- recent organic matter from crop residues, manures, waste streams and dead soil biota
- biomass, comprising living soil organisms
- mineral nitrogen, comprising nitrate, ammonium and nitrite – this is the form that is plant available

Nitrogen in the soil is in constant circulation between these different forms.

Ammonia and nitrogen volatilisation

When you store and later spread waste streams with high nitrogen content to land there can be an increase in the concentration of ammonia in the air through volatilisation.

The ammonia can then settle-out on nearby land causing a fertiliser effect. This is known as nitrogen deposition.

Nitrogen deposition and ammonia volatilisation can affect sensitive

receptors in the local environment. When preparing your benefit statement, you must be aware of how it can:

- affect the availability of elements both essential and toxic to plant growth
- contribute to eutrophication
- lead to nitrogen enrichment of nutrient-poor soils
- disrupt the balance of sensitive ecosystems, such as in surface water causing either excessive growth or disappearance of plant species
- affect trees or vegetation by damaging foliage and retarding growth
- be acutely toxic to certain species of plants – for example, mosses and lichens which cannot tolerate increased ammonia in the air
- lead to increased risk of competition from neighbouring invasive species, such as fast growing grasses

For further information see the Code of Good Agricultural Practice for reducing ammonia emissions (https://www.gov.uk/government/publications/code-of-good-agricultural-practice-for-reducing-ammonia-emissions/code-of-good-agricultural-practice-cogap-for-reducing-ammonia-emissions).

If you have identified a sensitive receptor, such as a Site of special scientific interest (SSSI), you must check the site citation document for sensitive species. You can use the designated sites system (http://designatedsites.naturalengland.org.uk/SiteSearch.aspx) to search for a SSSI and download the list of 'operations requiring Natural England's consent' (known as the ORNEC list).

For further information see Manage SSSI land effectively (https://www.gov.uk/guidance/protected-areas-sites-of-special-scientific-interest#manage-sssi-land-effectively) in Sites of special scientific interest: managing your land.

You can get free or charged advice from Natural England (https://www.gov.uk/guidance/protected-areas-sites-of-special-scientific-interest#get-free-advice) about the site.

You must consider these sensitive locations if you are within:

- 500m of a European site, Ramsar site, Site of special scientific interest or a groundwater source protection zone 2
- 10m of any water course

When you do identify sites that may be vulnerable to ammonia emissions you need to:

- explain how you are addressing the risk in your benefit statement
- change the application rate or method to remove or, where this is not practicable, reduce the risk

You can use the UK Air Pollution Information System (http://www.apis.ac.uk/) to check local background levels as part of your benefit statement.

The Environment Agency may not agree a deployment if the properties of the waste and the degree of sensitivity of a receptor are unacceptable. Instead, you may need to re-submit a deployment form for using that waste stream on a different area of receiving land where the risks are not significant. If you have concerns at the deployment application stage you can contact the Environment Agency (https://www.gov.uk/government/organisations/environment-agency#org-contacts) for advice.

Reduce ammonia volatilisation

To reduce ammonia volatilisation consider:

- not using wastes containing high amounts of ammonium-N
- not using liquid wastes that tend to volatilise readily, especially if spread using high trajectory spreading techniques
- spreading on compacted and heavy soils with a low permeability
- looking at reducing losses from storage by covering the waste
- having an efficient waste delivery procedure
- using injection with slot closure by rollers – an effective method of reducing losses
- not spreading in hot, dry conditions

Manage phosphate, potash and magnesium

Your deployment can result in agricultural benefit by landspreading waste streams that provide phosphate, potash and magnesium.

For further advice on how to manage these additions see relevant

sections in RB209.

See also Protecting our water, soil and air (https://www.gov.uk/government/publications/protecting-our-water-soil-and-air).

Slow release nutrients in restoration schemes

In non-agricultural settings, for example in restoration schemes under SR2010 No 5, the soil will need to have adequate levels of organic matter. This will help to provide a reservoir of nutrients for plant growth.

For information on how to produce a restoration plan see Landfill operators: environmental permits (https://www.gov.uk/guidance/landfill-operators-environmental-permits/restore-your-landfill-site). This guidance is aimed at the landfill sector but can apply to operators creating restoration schemes under SR2010 No 5. You must provide evidence that your planned deployment is a waste recovery activity.

You can use sources of slow release nutrients to benefit established plants. Particularly where future additions are not practical. For example:

- compost, other organic wastes or manures
- woody mulch on the soil surface, which is slow to degrade

Benefits include to:

- protect the surface of the soil
- help retain decaying biomass from leaf fall
- return nutrients back to the soil

To maintain this type of site you can reapply mulch or reuse shredded trimmings from maintenance.

Manage sulphur

See RB209 for guidance on sulphur inputs relative to soil type, crop and soil index.

Certain waste types, such as gypsum, contain useful quantities of sulphur. This may provide all or some of the crop requirement at the chosen application rate.

From the receiving soil analysis for sulphur, consider:

- the soil analysis not being reliable
- the plant tissue analysis being more accurate
- being able to use grain analysis retrospectively

Biochemical and chemical oxygen demand

Biochemical oxygen demand measures the rate of oxygen uptake by microorganisms in a sample of water at a temperature of 20°C, over a period of 5 days and in the dark.

Chemical oxygen demand is used to indirectly measure the amount of organic compounds in water. Most applications of chemical oxygen demand determine the amount of organic pollutants found in surface water, making it a useful measure of water quality. It is expressed in milligrams for each litre, which indicates the mass of oxygen consumed for each litre of solution.

Manage contaminants

You may need to manage contaminants. These include:

- chemical, such as PTEs, other metals, sodium and chloride and other contaminants
- physical, such as plastics, other sources from human activity

For biological contaminants see the Manage pests and diseases section in this guide.

For chemical contaminants, you can use soil guideline values (https://www.gov.uk/government/publications/soil-screening-values-for-assessing-ecological-risk), where they are available, for assessing the ecological risk from your landspreading activity.

Most land will already have sources of metals, PTEs or other contaminants. These could be from atmospheric pollution or

previous land use. For example:

- historic lead particulates from exhaust emissions
- industrial air pollution
- pig slurry applications which were historically high in copper and zinc
- applications of slurry and manure, fertilisers or soil conditioners
- PTEs from sewage sludge applications
- water treatment sludge applications containing iron and aluminium
- previous waste applications

Where a waste stream contains metals, PTEs or other contaminants, you must know the existing levels in the receiving soil. Find out the levels in your receiving soil analysis and provide details in your benefit statement.

You must allow for the mobility and therefore availability of PTEs and other chemicals in the soil. Mobility is dependent on pH. Refer to the Manage soil pH section in this guide and the Sewage sludge in agriculture: code of practice (https://www.gov.uk/government/publications/sewage-sludge-in-agriculture-code-of-practice). The PTE limits apply to all waste streams not just sludge.

Typical concentrations of metals in topsoil

Table 2 shows typical concentrations of metals in soils for England and Wales.

Note, the data does not present the specific conditions or the concentration of metals on a specific area of receiving land. You must do a site-specific receiving soil analysis.

Table 2 Typical concentrations (mg/kg dry matter) of metals in soils in England and Wales

Metal	Ten percentile	Median	Ninety percentile	Arithmetic mean
Zinc	38	82	147	97

Metal	Ten percentile	Median	Ninety percentile	Arithmetic mean
Copper	9	18	37	23
Nickel	7	23	42	25
Cadmium	0.2	0.7	1.4	0.8
Lead	20	40	131	74
Chromium	15	39	64	41

Effect of some metals and other substances in soils

The information under this heading is taken from the former ‘Code of good agricultural practice for the protection of soil’, often referred to as the ‘Soil code’.

Further recommendations for many of these micronutrients are available in section 1 RB209.

You will need to assess the acceptability of a PTE or other contaminant addition to the soil as part of your deployment.

You must consider the impact on crop and animal health by landspreading.

For PTEs you must comply with tables 6.3 and 6.4 in the Sewage sludge in agriculture: code of practice (https://www.gov.uk/government/publications/sewage-sludge-in-agriculture-code-of-practice). This applies to all waste streams not just sludge.

Zinc

Zinc addition at the right concentration is beneficial for crop growth because it is an essential trace element.

Negative impacts of too much zinc include:

- toxicity to plants
- a health risk to animals

- restricted plant growth
- effects on how the plant deals with elements such as iron, resulting in chlorosis

You must also consider:

- concentrations of zinc, up to 2,000mg/kg of soil from materials such as mine-spoil may be tolerated by certain plants depending on the pH of the soil and other factors
- for clover and productive grass species at a pH of 6.0, the maximum recommended concentration is 1,000mg/kg
- zinc from industrial wastes, atmospheric deposition or sewage sludge is more available to plants, and sensitive species may be affected above about 300mg/kg of zinc in the soil when the pH is between 6.0 and 7.0

Animal health and zinc

Chlorosis usually occurs at concentrations well below those which cause any risk to animal health. Zinc affects animals by interacting with other elements, such as copper.

Zinc alone is unlikely to affect animals until they eat more than 300 to 1,000mg/kg of dry food, depending on the:

- type of animal
- form of the zinc
- balance of other nutrients in the diet

Zinc concentrations in herbage greater than about 220mg/kg of dry matter are likely to have a significant effect on how grazing livestock can metabolise copper.

Copper

Crops can benefit from the correct concentration of copper addition because it is an essential trace element.

Negative impacts of too much copper include:

- toxicity to plants if at high concentrations
- a health risk to animals

You must also consider that:

- copper is held by organic matter in the soil and the leaves of the

plants cannot take it up as easily as zinc, but it can accumulate in the roots
- soil pH has little effect on the amount of copper the plant takes up, except in very acid conditions (less than pH 4.5) when it appears to be more available and is taken up by acid tolerant species

At a soil pH of 6.0 or above:

- a total soil concentration of copper from geological materials of up to 500mg/kg of dry solids would allow the growth of productive grasses
- clovers and other sensitive species may be affected at 250mg/kg

Animal health and copper

The main risks to animals of too much copper include:

- if waste containing copper, such as pig slurry is applied to a growing crop, it can be adsorbed by the leaves – the resulting forage may be a health risk to grazing sheep
- when the concentration of copper in soil is more than 500mg/kg, the soil and plants are likely to exceed the toxic threshold and may poison susceptible animals, especially sheep and lambs
- a copper concentration in the diet greater than 10mg/kg of dry food is toxic for the most susceptible breeds of sheep
- if you let some livestock graze on copper contaminated soil, you must only allow them to graze for short periods and with adequate herbage so that the amount of soil eaten is kept to a minimum

The effect of a given concentration of copper on some livestock depends on its chemical form and on how it interacts with other elements.

Cattle are unlikely to be affected by copper.

Lead

Lead in soils with a pH of over 6.0 is not usually toxic to plants but can be dangerous to livestock eating soil contaminated herbage.

There is a legal limit of 1mg/kg lead in fresh food for sale. It is unlikely this limit will be exceeded. However, it could be when vegetables are grown and sold from a soil which contains lead at more than about 300mg/kg of dry solids. You must make sure that the crop is not contaminated by waste soil so that this limit of 300

mg/kg is not exceeded.

Lead is not available to plants where the soil has a pH of more than 7.0.

Animal health and lead

You must consider:

- that monogastric animals such as pigs, poultry and horses are considerably more at risk of lead poisoning than ruminants, such as cattle and sheep
- if contaminated soil is eaten by grazing animals, the lead may be absorbed by them whatever the soil pH
- that the chemical and physical form of the lead will affect its absorption

Cadmium

The total cadmium concentration limit in soil is 3mg/kg of dry solids. This limit protects the food supply to humans and animals. Plant growth is not affected at this level.

You must not exceed this limit when you apply waste to land.

Cadmium is often found naturally with geological deposits of lead and zinc. Plant roots take it up and move it to the leaves and seeds. This effect is greater at low pH. Take up varies depending on the physical and chemical form of the cadmium and the type of plant.

Excess cadmium in the soil can be a hazard to:

- human health – it builds up in the food chain
- animal health through ingestion – it builds up, especially in the kidneys and the liver

Also consider:

- if land is contaminated by wastes from lead mines, the high concentrations of lead and zinc will have a much greater effect on plants and animals than the cadmium
- much of the cadmium added to agricultural soils still comes from phosphate fertilisers

Arsenic

Arsenic can be toxic to animals and crops. It is adsorbed and stored

by plant roots. However, it does not move freely to leaves or stems.

You must consider that:

- high concentrations may kill crops
- concentrations above 500mg/kg can affect animals who may ingest soil when grazing, this can increase levels in their liver and kidneys and in extreme cases, poison them
- concentrations of 250mg/kg of dry soil are not likely to cause any ill effects to plants or animals
- soil concentrations in land used to grow fresh produce should not exceed 50mg/kg of dry soil – this will minimise the risk of exceeding legal limits in food (generally 1mg/kg, separate limits apply to certain food categories)

Fluoride

Fluoride in soils is normally present as insoluble calcium fluoride. In this form plant roots do not readily take it up.

If soil that is high in fluoride, or grass that is contaminated by waste materials containing fluoride, is eaten over a long period, the teeth and bones of livestock can suffer from fluorosis.

A total concentration of fluoride, from whatever source, of 500mg/kg of dry soil could result in the diet of grazing animals exceeding the safe limit of 30mg/kg of dry matter.

Nickel

Nickel is toxic to most plants.

To protect crops or animals the limit for nickel is 75mg/kg of dry soil at pH 6.0 to 7.0 for land receiving sewage sludge.

Chromium

The chromate (VI) ion is toxic to plants and animals.

However, due to the conditions found in organic waste materials or in soil, it will only exist as the relatively inactive chromium (III) ion.

Chromium (III) is unlikely to be toxic to plants except in extremely acidic soils.

Land which has sewage sludge applied to it must contain chromium at less than 400mg/kg of dry soil or 600mg/kg if landspreading to

grassland.

Mercury

Mercury is very toxic to humans and animals. Soil concentrations of mercury should not be greater than 1 mg/kg of dry soil.

Plant roots do not take up mercury effectively.

Selenium

The safe concentration of selenium is 2mg/kg of dry matter in plants

Livestock are not normally poisoned until they take in selenium at more than 5mg/kg of dry food. To minimise risk, make sure the concentration of selenium in soil is kept below 3mg/kg.

Soils naturally high in selenium are very rare but may be a risk to grazing livestock where they occur.

Molybdenum

High molybdenum levels in soil may result in needing to take precautions to limit the amount livestock can take in. High molybdenum in plants with more than 5mg/kg of dry matter reduces the availability of copper to livestock and may cause a copper deficiency.

You must not apply waste to land if it will raise soil concentrations of molybdenum above 4mg/kg of soil. However, if the concentration in the soil is naturally higher than this value and livestock are receiving copper therapy, you can apply sewage sludge which only contains trace levels of molybdenum. Get veterinary advice before you take any action.

Some clay and shale soils naturally contain molybdenum at more than 100mg/kg of soil.

Sodium and chloride

Salt water can deposit sodium and chloride in the soil. Plants growing on sea-flooded land may be damaged by lack of oxygen or by the soil around their roots being disturbed.

High chloride levels restrict plant growth and decrease the ability of their roots to take up water from the soil.

High levels of sodium in the soil will disperse clay particles and cause problems in soil structure, especially in non-calcareous soils.

See Manage salty whey and other high conductivity waste in this guide. This includes information on long term risk to clay soils.

Iodine

You must test for iodine if the waste you are proposing to use is a potential source.

Iodine is an essential dietary trace element. However, excessive intake can imbalance the synthesis of thyroid hormones and may cause serious health problems. The Animal By-Products Regulations (ABPR) require that blood is treated to prevent risk to human and animal health. The treatment can involve using chemicals such as iodine. If you want to spread for example, treated blood, abattoir or lairage waste, you must provide information on the treatment chemicals.

See the Animal By-Products Regulations (https://www.gov.uk/government/publications/landspreading-how-to-comply-with-your-permit/landspreading-how-to-comply-with-your-environmental-permit#animal-by-products-regulations) section in the Introductory note in Landspreading: how to comply with your permit.

You need to be aware of the risk that antimicrobial function of iodine as a bactericide, viricide and fungicide. This could potentially cause adverse effects in soil to which waste streams such as abattoir wastes treated with iodine is spread.

Physical contaminants

The Environment Agency considers that deliberate landspreading of physical contaminants is a waste disposal activity. Your operation must be a waste recovery activity. Physical contaminants can:

- adversely affect the countryside or places of special interest either directly or at a distance, such as from wind-blown litter
- be taken up by grain harvesting and grass cutting, including by silage making machinery and the resulting silage
- cause a disbenefit, for example, resulting in extra cleaning requirements for low depth root crops such as potatoes, cabbage and cauliflower

- be picked up by grazing livestock and other animals, including pets

Do not accept any waste that requires treatment or sorting to remove physical contaminants.

Other contaminants

Your waste analysis may identify high concentrations of an element that the Sewage sludge in agriculture: code of practice (http://www.gov.uk/government/publications/sewage-sludge-on-farmland-code-of-practice) does not include as a PTE. The addition may have significance on the background levels in the locality, such as underlying geology and soil mass of the cultivation layer.

For example, the addition of iron, aluminium and manganese from the application of water clarification sludge.

You can get information on background soil concentrations from:

- published research on soil
- local sampling
- geo-chemical surveys
- advanced soil geochemical atlas of England and Wales (http://www.bgs.ac.uk/)

Do not use information published about soil properties to replace a regular programme of sampling and analysis.

Nutrient leaching

You need to assess the potential for nutrients to leach or run-off into water courses or groundwater which could cause eutrophication or pollution. For example, if the nutrient addition from landspreading waste exceeds the current crop need. This can occur when waste applications are managed over a crop rotation.

The Environment Agency will not normally approve phosphorus additions where the soil is above recommended index levels and adding phosphorus exceeds any rotational crop off-take.

Manage pests and diseases

Be aware that waste may contain pests and diseases. These include pathogens such as bacteria, viruses and other microorganisms. The wastes may contain harmful bacteria from food and vegetable processing, including escherichia coli, listeria monocytogenes and salmonella serotypes.

Pests and diseases could infect crops and harm human and animal health.

You must not store or landspread waste that contains pests and diseases unless you can provide information to demonstrate that you will manage the risks.

You must not apply vegetable wastes, washwaters and soil from the following sources:

- farms or land where pests and diseases have been recorded
- waste streams from industrial washing, grading, packing and processing of imported vegetables

Find out if the waste:

- comes from land and gardens where the waste could contain fungi, bacteria, or nematodes which may be harmful to crops, or encourage the spread of plant pathogens
- contains other plant diseases
- has been sanitised by the waste producer, they must do this if there is a risk from pests and diseases

You must confirm in your benefit statement that the waste has been correctly sanitised. If it has not, you must show that there is no risk of spreading pests and diseases.

You must get any untreated waste tested. Using untreated waste is a high risk.

These waste types may need testing to check they do not present a hazard:

- municipal and household food waste
- plant matter
- wastes from food processing, including dairy products

Make sure that the levels of pathogenic agents and potentially

infectious stages of parasites in the waste soil:

- are the same or less than the background levels in naturally occurring soils
- will not have adverse effects on the intended future use of the land receiving the soil

Examples of common soil borne diseases

Here are some examples of some common soil borne diseases:

- potato diseases such as potato cyst nematodes – can also attack other solanaceous plants, such as tomato, aubergine and some weeds such as bittersweet
- allium diseases such as onion white rot – can also affect, leeks, garlic, chives, shallots and other salad crops
- brassica diseases such as clubroot and verticillium stem stripe
- beet diseases such as beet necrotic yellow vein virus (also known as rhizomania) – mainly affects sugar beet, can also infect fodder beet grown for feeding livestock and weed beet can also spread the disease

There are many other pests and diseases that can seriously damage crops and plants. You can find further information:

- on the UK Plant Health Information Portal (https://planthealthportal.defra.gov.uk/)
- in An introduction to clubroot in oilseed rape and field brassicas (https://ahdb.org.uk/clubroot) on the AHDB website
- Verticillium stem stripe in oilseed rape (https://ahdb.org.uk/verticillium-stem-stripe) on the AHDB website
- in the AHDB Crop walkers guide: Allium (https://media.ahdb.org.uk/media/Default/Imported%20Publication%20Docs/Allium%20crop%20walkers%20guide.pdf)
- in the EIP-AGRI Focus Group IPM practices for soil-borne diseases (https://ec.europa.eu/eip/agriculture/sites/agri-eip/files/eip-agri_focus_group_on_ipm_practices_for_soil-borne_diseases_final_report_2015.pdf) report.

There may be other sources of information you can use.

You must report some pests and diseases. See how to report a pest or disease (https://planthealthportal.defra.gov.uk/pests-and-diseases

/reporting-a-pestdisease/) on the UK Plant Health Information Portal.

Waste from imported vegetables

You must not spread diseased or foreign plant waste on agricultural land.

The Department for Food and Environmental Affairs (Defra) set controls and restrictions on the import, movement, keeping of certain plants, plant pests and other materials such as soil. They are particularly concerned about the disease risk from imported potatoes.

You must know where the vegetable waste came from if there is potential for it to contain material from another country.

See Plant health controls (https://www.gov.uk/guidance/plant-health-controls) for imports and exports, certification schemes, plant passporting, listed quarantine plant pests and who to contact.

You must get advice from the Animal and Plant Health Agency (APHA) (http://www.fera.defra.gov.uk/plants/plantHealth) if you suspect that applying the waste risks spreading pests and disease from imported waste.

You can search for more detailed advice about specific pests or organisms on the UK Plant Health Risk Register (https://secure.fera.defra.gov.uk/phiw/riskRegister/).

Tree and plant pathogens

You must not use wastes that are infected with tree pests and diseases. If you suspect infection you must assess the waste.

For how to identify, report, prevent and minimise the introduction, spread and impacts of tree pests and diseases in the UK, see the Forestry Commission and APHA guidance tree pests and diseases (https://www.gov.uk/government/collections/tree-pests-and-diseases).

For specific tree and woodland problems you can use the Forestry Research pest and disease resources (https://www.forestresearch.gov.uk/tools-and-resources/pest-and-disease-

resources/) webpages. For example, for phytophthora ramorum and phytophthora kernoviae which are reportable fungus-like pathogens.

Many other tree pests and diseases are reportable. To find out see the Forestry Commission and APHA guidance on tree pests and diseases (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/741074/Tree_PD_Matrix_update_2018_v3.pdf).

If you are proposing to spread waste wood and related materials from outside of the UK you must see information on bio-security measures for Importing and exporting wood and timber products (https://www.gov.uk/government/collections/importing-and-exporting-wood-and-timber-products) on the Forestry Commission website.

Invasive non-native plants

Your landspreading activity must not allow certain invasive and non-native plants to grow in the wild. The full list of plants is given in schedule 9 of the Wildlife and Countryside Act.

For how to identify, control and dispose of invasive non-native plants that can harm the environment see How to stop invasive non-native plants from spreading (https://www.gov.uk/guidance/prevent-the-spread-of-harmful-invasive-and-non-native-plants).

Some of the species listed in schedule 9 are aquatic plants which you can potentially spread to land with controls in place. However, you must see the permit's introductory note for restrictions on spreading these close to a water course. You must also consider ditches and drains.

For Japanese knotweed see How to stop Japanese knotweed from spreading (https://www.gov.uk/guidance/prevent-japanese-knotweed-from-spreading).

See also:

- treatment and disposal of invasive non-native plants: RPS 178 (https://www.gov.uk/government/publications/treatment-and-disposal-of-invasive-non-native-plants-rps-178)
- GB Non-Native Species Secretariat website (http://www.nonnativespecies.org/)

Harmful weeds

There are the 5 harmful (injurious) weeds listed in the Weeds Act. These weeds can affect pasture and can contaminate hay.

The 5 weeds are:

- common ragwort – poisonous to livestock, particularly horses
- spear thistle
- creeping field thistle
- broadleaf dock
- curled dock

See stop ragwort and other harmful weeds from spreading (https://www.gov.uk/guidance/stop-ragwort-and-other-harmful-weeds-from-spreading) for how to:

- stop harmful weeds spreading onto land used for grazing livestock or growing crops
- dispose of them
- report them if they have spread

See also GB Non-Native Species Secretariat (http://www.nonnativespecies.org/) website.

Animal health and notifiable diseases

If you propose to use waste soils, see the information for each relevant waste code in Landspreading: benefits and risks of the waste types you can use (https://www.gov.uk/guidance/landspreading-benefits-and-risks-of-the-waste-types-you-can-use).

Landspreading can introduce animal pathogens. You must find out if the waste soil comes from land that was occupied by livestock with infectious animal diseases.

You must make sure that the levels of pathogenic agents and parasites at a potentially infectious stage in waste soils will not have adverse effects on:

- animal health
- the planned use of the land receiving the soil

The probability and extent of pathogenic activity in any waste soil depends mainly on the previous use of the land. For example, some animal pathogens in dredging spoil are persistent. Consider also if it is appropriate to apply lairage waste during animal disease outbreaks to prevent disease transmission.

These infectious diseases are covered by the Animal Health Act and include for example, foot and mouth disease, anthrax, Newcastle disease, Aujeskys disease.

For further information on animal pathogens and infectious diseases see notifiable diseases in animals (https://www.gov.uk/government/collections/notifiable-diseases-in-animals). This lists the notifiable diseases and includes what to do if you suspect a notifiable disease and how to prevent them.

Manage salty whey and other high conductivity waste

This section is mainly for salty whey waste. It is also relevant for other types of salty and high conductivity waste.

Salty whey wastes can include:

- a high salt content, usually in the form of sodium chloride and potassium chloride
- yeast cell debris with high protein content
- other compounds such as nitrate and sulphate which can add to the high electrical conductivity of the waste

Benefits include:

- the presence of sodium in moderate to high amounts
- large concentrations of nitrogen, phosphorus and potassium greater than 1 kg/m^3
- crops such as sugar beet and carrots can use the potassium and sodium as plant nutrients
- sodium may increase the palatability of grass

Salty wastes can cause soil and crop problems. Salts added to soils can:

- replace calcium and magnesium ions for sodium through cation

exchange, which can significantly harm the soil structure
- increase the osmotic pressure of soil water due to excess chloride, which reduces the crop water uptake and induces artificial drought conditions
- cause leaf scorch through direct application
- be toxic to plant growth

You can cause these problems if you apply salty whey waste to soil:

- under the wrong conditions
- repeatedly over cropping seasons
- with a high soil electrical conductivity in dry conditions – the highest risk is during dry summer months when grass swards are often injected with wastes

You can reduce the risk of salt scorching or soil damage by:

- placing wastes on the soil surface when applying waste to an established crop
- applying at a low rate
- landspreading the waste in multiple small applications over several months

Keep to between 2,000 and 4,000uS/cm conductivity when applying waste to crops. Wastes with a high conductivity can cause leaf scorch in green crops. This will harm crop growth and yield. Some crops are more tolerant of salt than others so you must know which crop is, or will be grown, on the land that receives the waste. For example:

- maize, peas and beans are the most sensitive crops
- barley, sugar beet, kale and oilseed rape are more tolerant

See RB209 (https://ahdb.org.uk/projects/RB209.aspx) for more details on the salt sensitivity of different crops.

For your benefit statement, you must be able to:

- justify the use of high conductivity wastes to tolerant and intolerant crops
- show that the landspreading activity will cause no harm or a risk of salt damage
- confirm that you will use appropriate application rates

The Environment Agency will:

- raise the potential of salt damage with you if you have not accounted for it
- assess your approach to avoiding salt damage

Interpreting the analysis on salt

You must know if the laboratory reports the salt as sodium or as sodium oxide. Sodium recommendations are given as kg/ha of sodium oxide and not as sodium. You must convert sodium to sodium oxide. To do this multiply the sodium amount by 1.348.

For more conversions see RB209 page 46 in Section 4 Arable crops.

RB209 recommends adding sodium to most soils where beet is grown. This excludes fen peat and some silt soils, which generally contain adequate sodium. Sodium is commonly applied as agricultural salt at 375kg/ha (200kg/ha sodium oxide) without any adverse effect on soil structure, even on soils of low structural stability.

Long term risks to clay soils

Long-term addition of sodium could replace the calcium present in a clay dominated soil. This loss of calcium can cause the clay soil to slump. This is most commonly seen on clay soils affected by salt water flooding. Avoid landspreading salty wastes on soils which are susceptible to salt water flooding.

Salty wastes can have a similar effect in soils to oily wastes. See the Manage oil and fat trap wastes section in this guide.

Manage soil organic matter and applied agrochemicals

Applications to land of waste high in organic matter may affect the activity of applied pesticides, herbicides and other agrochemicals. This may result in agricultural disbenefit and applies to these waste codes:

- 19 05 03 composted waste bio-bed material
- 19 05 03 compost from source segregated biodegradable waste
- 20 02 01 waste from the shredding of source segregated garden waste
- 20 02 01 mulch

Use Landspreading: benefits and risks of the waste types you can use (https://www.gov.uk/guidance/landspreading-benefits-and-risks-of-the-waste-types-you-can-use) for more details.

Many agrochemicals are attracted to organic matter, particularly when they are used on soils with a high organic matter content greater than 10%.

Microorganisms can breakdown the agrochemicals held by the organic matter. Chemical processes such as hydrolysis and oxidation may also contribute to the degradation process. How quickly the processes take depends on the chemical structure of the agrochemical product being used.

Consider that this may reduce its effectiveness in the field. For example, with pre-emergent residual herbicides and with other soil applied agrochemicals.

If you are landspreading on sandy soils, consider that applied products containing herbicides or other agrochemicals risk leaching rapidly into the soil. This can cause root and soil damage.

Manage organic manures

Organic matter in soil is an accumulation of partly decayed and partly combined plant and animal residues. Soil microorganisms continually break this material down so the organic matter content in soil is always changing. Adding plant residues and other organic material regularly replenishes the organic matter. You can find nutrient management guidance on organic manures in section 2 of RB209 Organic materials.

Compost is a soil conditioner and a source of plant nutrients. A compost that meets one of the following definitions will typically contain a small, if any, crop available nitrogen. However, it will contain useful amounts of organic nitrogen and total phosphate and potash content.

For any compost spread under standard rules permits the processes and the end products must meet these definitions in the relevant composting permit:

1. Compost means a solid particulate material that is the result of composting, which has been sanitised and stabilised, and which confers beneficial effects when added to soil, used as a component of growing media or used in another way in conjunction with plants.
2. Composting means the managed biological decomposition of biodegradable waste, under conditions that are predominantly aerobic and that allow the development of thermophilic temperatures as a result of biologically produced heat and that result in compost.

You must only use compost derived from source segregated biodegradable waste on agricultural land. The exception to this is where the compost has also been partially derived from sludges from urban waste water treatment. You can use compost from non-source segregated biodegradable waste on land that will not be brought back into agricultural use under SR2010 No 5.

The Quality protocol: compost (https://www.gov.uk/government/publications/quality-protocol-for-the-production-and-use-of-compost-from-waste) provides more information on source segregated biodegradable waste.

You must not produce compost or treat any composted materials under the 3 mobile plant landspreading permits.

You must not use compost on agricultural land that was produced with any of these wastes:

- non-biodegradable waste such as plastic, foils, glass, metal, plasterboard, bricks or stones
- non-source-segregated wastes such as road sweepings, sewage screenings and grit
- wastes containing hazardous contaminants such as treated and painted timber products
- wastes containing non-biodegradable fractions that cannot be separated by pre-treatment

The compost must not contain diseased or unsuitable biodegradable waste. See the Manage pests and diseases section in this guide.

If a compost meets the end of waste test you do not need a permit

or deployment to spread it to land. It must comply with BSI PAS 100: Specification for composted materials (PAS 100) (https://shop.bsigroup.com/ProductDetail?pid=000000000030360308) and the Quality protocol: compost (https://www.gov.uk/government/publications/quality-protocol-for-the-production-and-use-of-compost-from-waste).

If you find the compost supplied does not meet the standard required by PAS 100 because for example, it exceeds the thresholds for metals, you may still be able to landspread it. You will need to provide a site specific assessment of the risks from the proposed compost application. You can use PAS 100 for more information on substances likely to be present in compost and the relevant thresholds. You will need to buy PAS 100.

You must:

- account for the potential contaminants and environmental risks posed by the compost
- identify and analyse all substances likely to be present

Base this on the compost input materials and the composting process.

For guidance on using organic manures on agricultural land see:

- Using nitrogen fertilisers in nitrate vulnerable zones (https://www.gov.uk/guidance/using-nitrogen-fertilisers-in-nitrate-vulnerable-zones)
- Rules for farmers and land managers to prevent water pollution (https://www.gov.uk/guidance/rules-for-farmers-and-land-managers-to-prevent-water-pollution)
- Protecting our water, soil and air (https://www.gov.uk/government/publications/protecting-our-water-soil-and-air)

Benefits and risks

Here are some benefits of adding organic matter to the soil, it can:

- replenish organic content which is naturally broken down by microorganisms
- increase the amount of available mineralised nitrogen for crop uptake
- act as a soil conditioner

- stabilise poorly structured soils and help drainage
- improve the workability of heavy soils by increasing granulation and reducing plasticity and cohesion
- increase resistance to drought in light soils and improve water retention across most soil types
- increase resistance to compaction
- increase resistance to erosion in light soil
- increase nutrient retention
- supply a substrate for various beneficial organisms, such as bacteria and earthworms

Potential risks from applying waste high in organic matter include that it can:

- increase the likelihood of mineral deficiencies especially magnesium and copper
- impede the effectiveness of applied herbicides – see the Manage soil organic matter and applied agrochemicals section in this guide
- contain pests and diseases
- contain physical contaminants

Soil organic matter analysis

Use your waste analysis to measure soil organic matter. If you are using the Walkley Black method for soil organic matter, you must make the following calculation adjustment: reported per cent soil organic carbon multiplied by 1.72.

The organic matter content of a soil is lower in arable soils (typically 2 to 7%) than under grassland (typically 8 to 15%) because of continual oxidation due to cultivation.

An organic soil is still mainly mineral but with 6 to 20% organic matter.

Peaty soils are low density black soils derived from vegetable matter and contain more than 20% organic matter.

Sandy and silty soils typically have lower organic matter content than clay soils.

You can raise the organic matter content of soil, but it is a slow process. It is only achievable with many applications of organic material over time. Incorporating the right type of waste into the soil acts as a conditioner so it will help the process.

You may have to justify application rates of highly organic wastes based on the per cent of organic matter content in the soil.

Soil organic matter status ranges from very low (less than 1%) to very high (more than 8%). Use these values as a guide:

- very low to moderate – less than 1% and up to 3% – typically does not require justification
- moderate – more than 3% to 5% – maintenance dressings can be applied without justification
- high – 5% to more than 8% – justification is required

Your justification needs to:

- explain why high levels are appropriate for the receiving land
- support the explanation with appropriate technical expertise
- address the increased metal levels in your benefit statement

Mineral soils will typically have a maximum of between 6 and 10% organic matter, depending on the clay content. Above these percentages a soil is classified as organic mineral soil and at 20% or greater, a peaty soil. See page 14 in Think Soils (https://ahdb.org.uk/thinksoils) on the AHDB website.

For a soil with moderate organic content the typical rate of loss of organic matter is between 0.75 and 1.25t/ha/yr. To counteract this loss the soil will require applications of farmyard manure at between 10 and 25t/ha/yr. Adding organic matter needs to allow for losses through decomposition.

How you calculate the per cent organic matter is based on how the results are given in your waste analysis. For:

- dry matter – it is 100 minus % ash
- the sample as received – it is (100 minus (% ash)) multiplied by (dry matter divided by 100)

For further information British Standard BS 3882: Specification for topsoil (https://www.standardscentre.co.uk/bs/BS-3882-2015/?s=1) is available to buy.

Manage oil and fat trap wastes

Food production creates wastes likely to contain animal and vegetable oil. These include for example, chocolate manufacture, dairy and meat processing, rendering and oilseed crushers. It does not include waste mineral oils which are not of animal or vegetable origin.

A secondary treatment process splits out all or part of the oil or fat content from the waste. A trap collects the waste oils any residual matter is skimmed from the surface.

Benefits and risks

The solid content of the waste varies depending its source and production process. This affects its plant nutrient content.

You must get suitably qualified advice to quantify the effect of fat or oil (vegetable or animal) on the soil. A simple assessment is not sufficient. You must measure the oil or fat content to define the application rate. Fatty or oily wastes must not cause harm.

Consider these potential benefits:

- some oily wastes, such as those produced from fish processing, can have a high protein content and hence high nitrogen content of more than 1 kg/m^3
- applications to light soils may be more beneficial than to heavier soils

Consider these risks. The waste may:

- have an adverse effect on plant growth if is 4% or more fat content
- coat leaves – this affects respiration and photosynthesis when applied to standing crops, including grass
- if applied at high application rates, coat the soil particles and produce a waterproof barrier – this can cause stunting or die-back
- cause anoxia in the soil when high application rates form a layer of fat in or on the soil
- result in nitrogen lock-up due to the high carbon to nitrogen ratio

You will need to prevent any potentially negative impacts to the soil

and growing crop. Consider:

- the negative effects on crop growth from adding animal fat – even with a low fat content (compared to wastes with other fats and oils)
- the proposed application rate for an oily waste – you may need to apply smaller amounts over time
- placing the waste on the soil surface to avoid coating the plant's leaves on growing crops
- incorporating the waste into bare soils and stubbles as soon as you can after receiving it

Oily wastes can affect soils in the same way as wastes with a high salt content – see the section Manage salty whey and other high conductivity waste in this guide.

When you can level land

Levelling the land can provide agricultural benefit or ecological improvement. However, you can only use your landspreading permit for levelling or raising land within the permitted limits.

You must meet the requirements for waste recovery, see rule 2.1.3 (https://www.gov.uk/government/publications/landspreading-how-to-comply-with-your-permit/landspreading-how-to-comply-with-your-environmental-permit#provide-a-benefit-statement) in Landspreading: how to comply with your permit.

You can for example:

- bring unusable areas of an agricultural field into production
- restore, reclaim or improve the land under SR2010 No 5 or a similar bespoke permit
- improve drainage
- improve the landform to reduce erosion and run-off
- protect buried services
- fill or repair gullies or other areas affected by soil erosion
- spot treat a small area of land affected by erosion

Spreading means applying an even, shallow layer of waste and then incorporating it into the soil profile (rooting zone) using standard agricultural operations, such as ploughing.

Land restoration under SR2010 No 5

If you plan to restore land under SR2010 No 5 or a similar bespoke permit, you must justify the quantity of waste you intend to use. Provide plans and diagrams that clearly show the scale of the project and the intended final ground levels.

Operations under SR2010 No 5 allow you to spread waste to previously developed land. This includes both improvement of land and creation of a soil profile where there is no existing soil profile on the site.

Guideline spreading volumes and depths

Levelling the land under a landspreading permit is limited by the type, amount and the density of the waste.

See these example spreading volumes and depths for waste spread evenly with a bulk density of 1000 kg/m^3:

- 250 t/ha spread depth is 2.5cm
- 1,500 t/ha spread depth is 15cm
- 5,000 t/ha spread depth is 500cm

These depths are based on the maximum spreading rates under landspreading permits. These are a guide, the actual depths you use will depend on the type of waste and the bulk density.

You must comply with the R10 activities in your permit which sets limits on the quantity and type of waste you can apply per hectare. For example:

- 250 t/ha applies to most waste types listed in SR2010 No 4 and 6
- 1,500 t/ha can be used for 02 04 01 Soil from washing and cleaning sugar beet under SR2010 No 4
- 5,000 t/ha applies to all wastes listed in SR2010 No 5 and for 17 05 06 Dredging spoil from inland waters or for all wastes under SR2010 No 4

When you can spot treat the land

You may spread waste over a smaller area of land. For example, you can spot treat small, eroded areas of a field provided you keep to the permitted spreading volumes and depths. You must complete spot treatment before the deployment ends. You must state in your benefit statement if you are proposing to spot treat the land.

Apply for a bespoke deposit for recovery permit

If you cannot meet these requirements, you can apply for a bespoke deposit for recovery permit. See Waste recovery plans and deposit for recovery permits (https://www.gov.uk/government/publications/deposit-for-recovery-operators-environmental-permits/waste-recovery-plans-and-deposit-for-recovery-permits).

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