Air Quality and Waste Management

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FSA FARM SUSTAINABILITY ASSESSMENT BY SAI PLATFORM

Compiled by : NIAB

Waste Management

Best practice :

Waste is separated and stored in accordance with any relevant legal requirements.

Have a waste management plan in place which aims to reduce waste, and if this is not possible re-use and recycle waste

FSA51 Are waste materials properly and legally stored on your farm?

FSA52 Do you reduce, reuse, and recycle waste?

Waste Management

Waste costs money, and is often a hidden cost on farms. Waste disposal can also be costly, and it therefore makes sound business sense to use the “waste hierarchy” to reduce, re-use, and recycle waste wherever practical. The era when all types of farm waste could be conveniently disposed of together in holes in the ground on the farm has gone – this no longer acceptable to governments, local communities (who may be harmed by leachates from waste dumps) and buyers.

Wastes often pose risks to people and the environment, especially if stored or disposed of thoughtlessly. Typical farm waste includes both non-hazardous and hazardous solid and liquid waste streams. You need to perform a risk assessment based on knowledge of the wastes your business produce and the environment in which you operate to determine the best course of action in order to reduce risks to the community and the environment.

Agricultural waste

These are some examples of farm waste. There may be other types, and some products have been listed more than once as they fall into different waste categories.

1 Animal Health Products — Swabs and dressing, used sheep dip, syringes, medicines.

2 Building Waste — Concrete, wood, plasterboard, tiles, soil, stone, asbestos roof sheeting.

3 Cardboard and Paper

4 Agrochemicals — Concentrates, washings, treated seeds

5 Hazardous waste — Antifreeze, batteries, oils and lubricants, brake fluids and hydraulic oils, asbestos containing materials. These materials are subject to special rules.

6 Metal, wood, glass and rubber — Tree pruning and hedge trimmings, oil drums, scrap wood e.g. fence posts, empty gas cylinders, wood shavings, pallets.

7 Plastic Packaging — Feed sacks, fertiliser bags, agrochemical packaging, oil containers, miscellaneous packaging, animal health packaging.

8 Non-packaging plastic waste — Crop covers, fleeces, silage plastic, baler twine and netwrap, polytunnel film.

9 Vehicle and machinery waste — Redundant equipment and machinery, worn parts, tyres, antifreeze/ coolants, batteries, oils and lubricants, oil soaked rags and paper towels.

10 Agricultural solid waste — Manure, by-products of harvesting (e.g. Straw and processing).

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Waste Management

Waste is any discarded substance or object. Examples of various types of waste, produced as a result of farming activities, are listed here.

In managing waste, the first goal is to maximise the economic benefit whilst maintaining acceptable environmental standards.

Minimising waste (rather than recycling waste) is often the best option for improving profitability and minimising pollution. A waste management plan must be in place, based around the following hierarchy of options:

- **Reduce** the amount of waste generated
- **Reuse** the waste product on the farm or provide it for others to use
- **Recycle** (including composting) the product either on-farm, such as with land application of manure, or off-farm, such as with plastic recycling programmes.
- **Energy recovery**...and only as a final resort
- **Disposal**

It is likely the volume of waste produced will make it necessary to store waste on farm, or in a communal waste storage facility, until there is enough waste for disposal. If this is the case then consideration must be given on how best to store waste to minimise any risks to the community and the environment associated with waste storage.

How to store waste

How to answer YES

Show that you assess the risks of storing waste to humans and the environment. The risk will depend on what types of waste are to be stored, for example hazardous waste that could spill (such as vehicle oils) are higher risk than inert solid materials (FSA51).

Demonstrate all waste is stored appropriately and in accordance with any relevant legal requirements (FSA51).

Show that you investigate whether it is possible to reduce the amount of waste generated (FSA52).

Be able to show routes of waste disposal and how you minimise waste by reusing or recycling where reduction is not possible(FSA52).

Show you are aware of, and be able to demonstrate compliance with national legal obligations with respect to reuse, disposal and recycling of both hazardous and non-hazardous waste (FSA52).

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How to store waste

When creating a storage facility for waste, consider:

How much space you are likely to need

Whether the store should be secured

What type of waste is going to be stored – and
Whether the store is appropriately built for these materials

Segregation of hazardous from non-hazardous waste

Whether the store requires any appropriate signage.

When positioning a waste store consider the proximity to:

Residential areas to avoid risks to human health

Conservation areas

Watercourses, including drains, wells and boreholes.
Do not place waste stores in an area liable to flooding

Pedestrian routes, including roads or paths.

Minimise the risk to humans and the environment.

Depending on what types of waste are stored on farm ensure measures are in place to minimise the risk to humans and the environment. Aspects to consider when storing waste include:

Should the store be bunded to contain spillages?

Is appropriate Personal Protective Equipment available to the operator?

Is appropriate equipment in place to contain a spill if it occurs? A 'spill kit' may include items such as sandbags and covers to ensure waste does not enter drains.

Consider the fire risk when storing waste.

Place stores away from areas with a higher fire risk such as near grain dryers and welding or grinding workshops. The store should have easy access for fire-fighting vehicles.

Store and manage waste streams separately.

Waste Management

An example of a template for a waste management plan:

Identify the sources of waste on the farm and determine the actions you take, or could take, to reduce, re-use and recycle.

Waste source	Actions to reduce	Actions to re-use	Actions to recycle

Further reading and examples:

University of New Hampshire, USA

Pesticide Storage and Disposal

Video

Pesticide Stewardship Alliance, USA

How to clean caged CPP tanks for recycling

Latin America (CropLife)

How to perform triple-rinsing

Video

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Managing greenhouse gas emissions

Best practice :

Implement methods to improve energy efficiency

Implement methods to minimise greenhouse gas emissions

Use a recognised tool to measure greenhouse gas emissions

FSA71 Do you take measures to maximise energy use efficiency, including optimising farm equipment, optimising electricity use, etc?

FSA72 Do you identify sources of greenhouse gas and do you measure and monitor your emissions?

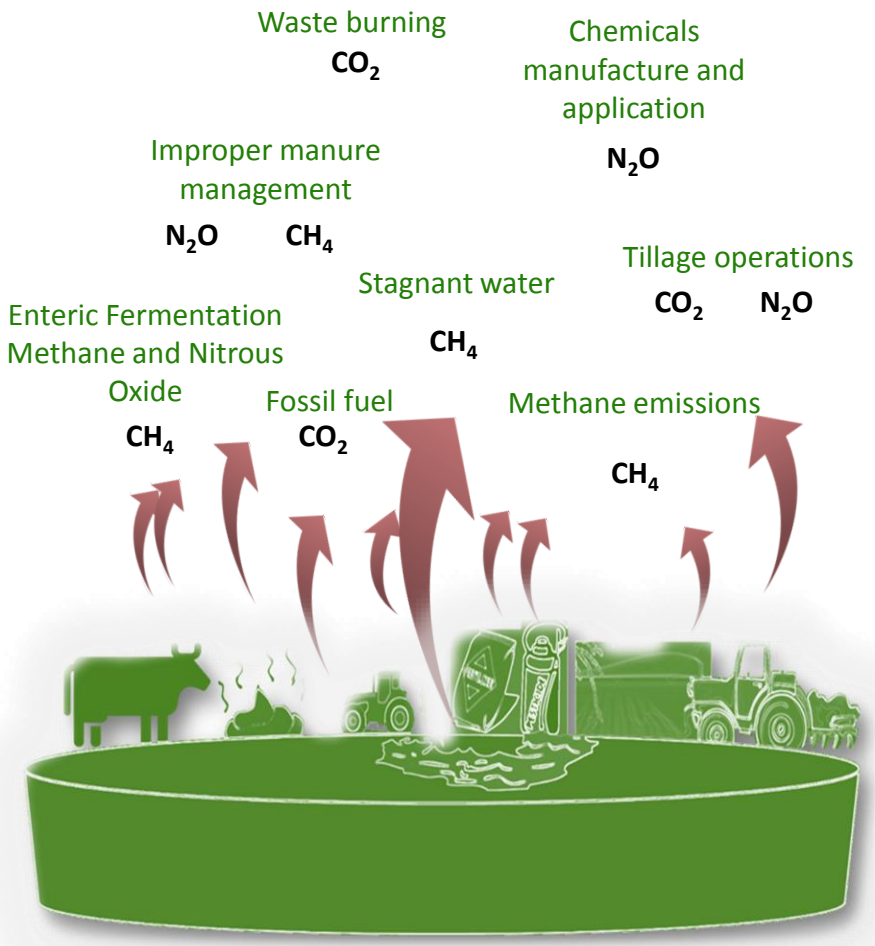
Managing greenhouse gas emissions

Gases that trap heat in the atmosphere are called greenhouse gases (GHGs). GHGs warm the Earth by absorbing energy and slowing the rate at which the energy escapes to space, acting like a blanket trapping in the heat. In 2010, global agriculture was responsible for 24% of GHG emissions[1] and therefore plays a significant part in global warming.

It is possible to reduce GHG emissions by improving energy efficiency and by using renewable energy sources. On the farm it is important to understand the main uses of energy either directly (including domestic purposes) or indirectly (through contracting agricultural services) as a first step towards reducing energy use and lowering associated GHG emissions.

Farming is a serious emitter of GHGs. The main contributors are:

- Nitrous oxide (N_2O), mainly through nitrogen fertiliser use, soil tillage, manure management and peat land cultivation and energy use for producing inputs and carrying out field operations. N_2O is around 300 times more potent as a GHG than CO_2.
- Methane (CH_4), mainly from fermentation from the digestive system of livestock, paddy rice cultivation, manure management and energy use for producing inputs. CH_4 is over 20 times more potent as a GHG than CO_2
- Carbon dioxide (CO_2), mainly through conversion of land, such as forest and savannah to crop land or grassland, but also via machinery use and transport.



Where nutrient supply is excessive or unbalanced, expensive inputs are wasted, water is often polluted and greenhouse gas emissions increase.

1. Climate Change 2014 Mitigation of Climate Change

Managing greenhouse gas emissions

Major components of energy use include:

- Fuel use in transporting inputs to the farm
- Fuel use for on-farm activities, such as ploughing/tillage, spraying, harvesting, pumping water, and the on-farm transport of product and people
- Fuel use for post-harvest treatment and storage of products, such as for grain drying and milk refrigeration
- Transport of products to the processing factory or depot
- Fuel for domestic use, feeding and housing of farmers, employees and families

Avoid wasting energy, avoid unnecessary operations and upgrade or replace energy inefficient plant or equipment.

Review the processes you carry out on the farm with respect to greenhouse gas (GHG) emissions:

- Optimise soil fertility and nutrient use
- Maintain or enhance soil organic matter
- Maintain soil cover with crop residues, mulch or cover crops
- Use conservation tillage practices such as reduced/ minimum/ zero tillage, direct drilling and strip cropping

Land management to reduce greenhouse gas emissions

How to answer YES

Develop an energy management plan with the aim of reducing energy consumption and improving energy efficiency (FSA71, 72).

Show that an audit of basic energy use has been performed and assess how much energy and fuel is used, where and for what activities (e.g. tillage, pumping, drying, cooling, transport) (FSA72).

Show that you are adopting measures to minimise greenhouse gas emissions through maximising energy use efficiency (FSA71).

Show inputs in crop production are monitored, use a sustainable agriculture assessment tool to determine GHG emissions and describe planned or current actions to reduce the carbon footprint (FSA72).

Land management to reduce greenhouse gas emissions

Besides increasing organic matter and lowering GHG emissions, good soil management will provide economic benefits by increasing crop productivity, improving nutrient use efficiency and enhancing air and water quality.

Optimise soil fertility and nutrient use

a. Build organic matter / leverage good rotations
- Long diverse rotations, perhaps including short grass leys.
- Reduce tillage to protect organic matter.
- Add diversity of manures and composts, cover crops, leverage valuable crop residue.

b. Avoid compaction / maintain adequate drainage
- Reduce and controlled traffic, low pressure tyres, respect soil conditions.
- Appropriate subsoiling
- Maintain and invest in drains

c. Soil test and plan & optimise nutrients
- Soil testing complete and regular
- Optimise nutrient quantity/ balance, plus type, timing, application, quality and spec.
- Consider technology including precision-ag, soil scanning, n-sensor.

Soil & cover crops (& manures and compost)

a. Choose targeted mix of multiple species in rotation
- Aim for 5-6+ species with a mix of rooting / depth and vigour
- Include some legumes
- Manage seeding rate and cost

b. Plan timing of drilling and establishment, end of life
- Establish early, if you have moisture
- Consider small N dose, respect cover crop – main crop rotations (e.g. brassicas)
- Plan end of life strategy (moisture, drilling spring crop, trash management)

c. Use diversity of organic amendments.
- Farm Yard manure
- Digestate / composts / green waste.
- Cover crops, crop residue, rotational leys/rotations

Reduce tillage

a. Reduce ploughing (inversion)
- Avoid inversion ploughing if possible
- Reduce ploughing frequency
- Reduce ploughing depth

b. Reduce depth of cultivation
- Reduce cultivation depth
- Reduce cultivation passes
- Maintain subsoiling

c. Reduce width of cultivation
- Strip tillage
- Direct drilling

Managing greenhouse gas emissions

COOL FARM ALLIANCE

The Cool Farm Tool is a free online greenhouse gas, water and biodiversity calculator for growers.

It will help to understand the costs and benefits of fuel, electricity, fertiliser and energy-intensive on-farm activities (such as ploughing), and provide an insight into potential money-saving activities to reduce GHG emissions.

Greenhouse gases, what are they and how can they be reduced?

There are four common greenhouse gases. This slide identifies them, the on farm activities that produce them and what can be done to reduce them.

Checklist for energy conservation

Efficient use of energy becomes increasingly important with rising energy costs. This is an opportunity to assess the tasks carried out on the farm and how the carbon footprint can be reduced, saving money.

Further reading and examples:

- The Natural Resources Conservation Service (NRCS): Energy tools
- USDA: Energy
- FAO: Climate-smart agriculture, Soils help to combat and adapt to climate change
- Climate Smart Agriculture: Building resilience to climate change
- UN Environmental: Learning to use the land so it produces fewer greenhouse gases
- State of Wisconsin: Energy efficiency best practices guide: agriculture

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Managing greenhouse gas emissions

There are four common greenhouse gases and on farm sources:

Carbon dioxide (CO_2)	Nitrous oxide (N_2O)	Methane (CH_4)	Ozone Depleting Gases
Soil tillage, burning waste and vehicle or diesel engine emissions	Soil tillage and application of nutrients	Animal production and waste management	Soil fumigants or use in refrigeration units

Reduce the amount of CO_2 produced

- Improve efficiency of fertiliser application
- Avoid crop burning
- Implement renewable energies solutions on farm
- Reduce vehicle usage

Reduce the amount of N_2O produced

- Reduce or make more efficient the use of soil nutrients and fertilisers
- Use cover crop
- Practice no-tillage or conservation tillage
- Avoid crop burning

Reduce the amount of CH_4 produced

Manage manure properly (do not spread it on the fields, do not accumulate it in lagoons or pools, implement biogas systems where possible)

Managing greenhouse gas emissions

Checklist for energy conservation

Field operations

- Reduce number of operations
- Match implement to tractor size
- Operate tractors at optimal speed
- Combine field operations
- Improve field efficiency
- Minimise depth of tillage
- Minimise use of tillage
- Take advantage of crop conditions
- Maintain machinery
- Consider alternative implements for similar operations

Heating and cooling

- Insulate heated and cooled spaces
- Use strips doors and loading dock seals
- Use high efficiency boilers, furnaces and cooling equipment
- Maintain boilers, filters and steam systems
- Run heating and cooling systems only as needed and never simultaneously
- Use multiple appropriately sized units (boilers, compressors, etc.) instead of a single large unit
- Install radiant heat where appropriate (not recommended for greenhouses)
- Use heat or energy recovery for ventilation air
- Consider automated controls

Greenhouses

- Grow lighting
- Schedule off-peak hours
- Stagger lighting to minimise peak loads
- Arrange lights in accordance with manufacturer's recommendations
- Adjust intensity to crop needs

Electric Motor (pumps, fans, conveyor belts)

- Install high efficiency motors
- Use variable frequency drive control
- Replace standard V-belt with high efficiency belts

Pumps

- Repair air leaks
- Use large headers
- Maintain minimum necessary pressure
- Use synthetic lubricants

Lighting

- Use efficient fixture (bulbs and ballast)
- Design lighting for desired light levels
- Maintain fixtures and lamps
- Use occupancy sensors and other intelligent controls

Managing air pollution on your farm

Best practice :

Monitor air quality and identify sources of air pollution.

Implement mitigation measures to manage air pollution risks.

FSA69 Do you periodically assess the risks to humans and the environment of air pollution and take appropriate measures on farm to mitigate possible risks?

FSA70 If there is a significant risk that farming activities will cause air pollution, do you identify sources and monitor the air quality at the farm and its surroundings?

Managing air pollution on your farm

Air pollution occurs when harmful or excessive quantities of substances are introduced into the atmosphere. The effects of poor air quality can been felt in:

- The community, where it causes health problems, contributing to respiratory and cardiovascular diseases
- The environment, by impairing vegetation growth and causing eutrophication, both of which can lead to biodiversity loss.

On farms there are many potential sources of air pollution, so consider which activities you take that might contribute and put in place to manage them. For example:

- Farms are responsible for 88% of UK ammonia emissions[1]. The use of a nutrient management plan helps to reduce these emissions, as well as reducing the farms fertiliser costs.
- Stubble burning can have a significant impact on the area's air quality. It is important to consider whether you can reduce impact to the local community (e.g. only burn when the wind direction means local communities will not be affected?).

1. New guide for farmers to help reduce air pollution from ammonia

Managing air pollution on your farm

Air can be contaminated by a range of very different particles such as:

- Gas: carbon dioxide, nitrous oxide, ammonia, hydrogen sulphide, volatile organic compounds etc.
- Particulates: dust, pollen, soot, smoke, liquid droplets (pesticide aerosols), lead etc.

Measures to manage air emissions may include:

- Building air flow control
- Chimney design
- Spreading manure or crop spraying when wind direction is away from residential/ pubic areas
- Immediate ploughing/ working slurry into the soil
- Covering any slurry/ manure stores
- Using low trajectory spreaders with high droplet sizes
- Using manure additives.
- Avoid burning crop residues

Any air pollutant must be characterised, monitored, controlled and treated as necessary, paying particular attention to applicable laws and regulations, or in the absence of local laws and regulations, in a manner that minimises the impact on the environment and community.

Systems encouraging the community to voice concerns relating to air quality should be in place. Develop a system to record the complaints and be able to show that you have acted upon them.

How to answer YES

Have performed an audit of farm activities, assessing possible air pollution sources and ranking them to determine the activities with the greatest risk to human health and the environment (FSA69).

Show that the air quality from any high risk sources, or during high risk activities, is monitored (FSA70).

Be able to show that measures to avoid, reduce or remedy the causes of air pollution have been applied (FSA69, 70).

Managing air pollution on your farm

Exercise:

Draw a table and list the on-farm activities that may contribute to air pollution.
List actions that could be taken to reduce the impact on the community and on the environment.

Activity	Problem	Solution

Further reading and examples:

WHO :
Health aspects of air pollution

Defra, UK: Spreading slurry more effectively saves money, protects health and protects habitats

Video

WION: Paddy stubble burning in Haryana, Punjab is declining Delhi's air quality

Video

Regional District of Okanagan-Similkameen, BC Canada: Best practices for agricultural waste disposal

Video