Code of good agricultural practice for the protection of air / Ministry of Agriculture, Fisheries and Food; Welsh Office, Agriculture Department.

MAFF ENVIRONMENT matters

CODE OF GOOD AGRICULTURAL PRACTICE FOR THE PROTECTION OF AIR

Code of Good Agricultural Practice for the Protection of Air

MINISTRY OF AGRICULTURE,
FISHERIES AND FOOD

WELSH OFFICE
AGRICULTURE DEPARTMENT

1992

MAFF ENVIRONMENT matters

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PART A.
GENERAL INFORMATION

Introduction

About this Code

1 This Code of Good Agricultural Practice for the Protection of Air is a practical guide to help farmers and growers avoid causing air pollution from odours, ammonia and smoke, or from greenhouse gases which cause global warming. It will help you dispose of your wastes in ways which reduce the risk of causing nuisance or annoyance from air pollution.

It is not a statutory code. Following this Code will not provide a defence such as "best practicable means" (paragraph 10) if you cause air pollution. Nor will it protect you from legal action although it should lessen the chance that this will happen. If you are in any doubt about what the law requires contact the local authority Environmental Health Department.

2 The Code describes the main causes of air pollution from different agricultural activities. In each Section, good agricultural practice is set down in a way which takes account of the need to avoid causing pollution or nuisance while allowing economic farming to continue. The Code was written using the latest information available. Any new practices not covered should follow the general principles laid down in the Code.

3 This Code does not give advice on noise, spray drift from pesticides or air pollution caused by dust. You should read the Code of Good Agricultural Practice for the Protection of Water if there is also a risk of causing water pollution from any particular agricultural activity.

Air pollution problems

4 Agricultural activities which involve housed livestock, storing wastes or spreading livestock wastes are those most likely to cause odour problems. Advice on minimising odour nuisance is given in Sections 2 to 8 of this Code.

5 Dark smoke or smoke nuisance from agriculture and horticulture can be caused by the burning of crop residues, packaging, plastics, tyres, waste oil or animal carcases in the open or in unsuitable equipment. Advice on how to minimise the need to burn these materials and on how to avoid producing dark smoke or causing smoke nuisance when burning is given in Sections 9 to 17 of this Code.

6 Agricultural activities can give off various gases which help to cause atmospheric problems. Advice on how to minimise the amount of gases given off is given in this Code. Ammonia, which contributes to making soils acid is covered in Sections 2 to 8, along with odours. Section 18 covers greenhouse gases which contribute to global warming - carbon dioxide, methane, nitrous oxide and chlorofluorocarbons (CFCs).

Laws controlling air pollution - general

7 The local authority Environmental Health Department is responsible for enforcing legislation on odour nuisance and smoke. Under Part III, Section 79, of the Environmental Protection Act 1990, local authorities have a duty to inspect their areas to detect any statutory nuisances and to take reasonably practicable steps to investigate complaints of statutory nuisance which are made to them.

8 Section 79 of the Act defines statutory nuisances as including:

- Any premises in such a state as to be prejudicial to health or a nuisance.
- Smoke emitted from premises so as to be prejudicial to health or a nuisance.
- Any dust, steam, smell or other effluvia arising on industrial, trade or business premises and being prejudicial to health or a nuisance.
- Any animal kept in such a place or manner as to be prejudicial to health or a nuisance.
- Any other matter declared by any enactment to be a statutory nuisance.

9 Where a local authority Environmental Health Department is satisfied that a statutory nuisance exists, or is likely to occur or recur, it has a duty to serve an abatement notice under Part III, Section 80 of the Act requiring:

- The abatement of the nuisance or prohibiting or restricting its occurrence or recurrence.
- The execution of such works and the taking of such other steps as may be necessary for any of those purposes.

A person served with an abatement notice may appeal to a Magistrates' Court within 21 days of being served with the notice.

Apart from action taken by a local authority, any person aggrieved by a statutory nuisance can take proceedings in a Magistrates' Court.

10 It is an offence to contravene or fail to comply with an abatement notice without reasonable excuse. You could be fined up to £20,000 in a Magistrates' Court if you commit an offence under this part of the Act. It is usually a defence to show that you have used the "best practicable means" (which is defined to have regard amongst other things to local conditions and circumstances, to the current state of technical knowledge and to the financial implications) to prevent or counteract the nuisance. Since the law relating to statutory nuisances is not straightforward, you would be well advised to consult a suitably experienced lawyer if difficulties arise, and should certainly do so if you are served with an abatement notice.

Laws controlling planning consents

11 Legislation governing planning consent for developments also includes provisions which relate to the avoidance of nuisances.

The Town and Country Planning General Development Order 1988 (the GDO) sets out certain types of development which may be carried out on agricultural land without planning permission. However, you will need planning permission for certain new facilities (such as livestock buildings, slurry storage and sewage sludge facilities), and for extensions or alterations to similar structures, where these will be within a distance of 400 metres from the boundary of any protected buildings (such as houses or schools). This rule has been introduced to reduce the number of potential odour problems coming from new livestock buildings or waste storage facilities being built close to housing developments.

12 For livestock buildings, slurry stores and sewage sludge facilities which do not require planning permission under the GDO, a prior notification system is now in force. You must notify the local planning authority of such developments. The local planning authority must then decide within 28 days whether it wishes to approve details of the siting, design and external appearance of the proposed development. Where prior approval is required the development must not begin until such approval has been obtained.

13 The Town and Country Planning (Assessment of Environmental Effects) Regulations 1988 require an environmental assessment to be carried out for certain types of major project which are likely to have significant effects on the environment.

In the case of agriculture, environmental assessments are likely to be required for new pig units (more than 400 sows or 5000 fattening pigs) and new poultry units (more than 100,000 broilers or 50,000 layers or other poultry including turkeys). Under current planning regulations, new units of this size will almost certainly need planning permission. You should talk to the local planning authority about the need for an environmental assessment before you send in a planning application. This may involve preparing an environmental statement covering the possible environmental effects of a project eg, emissions of offensive odours, and the measures to be taken to reduce these effects.

Laws controlling dark smoke

14 The Clean Air Acts 1956 and 1968 prohibit the emission of dark smoke from chimneys of buildings or from trade premises. Land on which an agricultural or a horticultural business is carried on is considered to be a trade premise.

15 The Clean Air (Emission of Dark Smoke) (Exemption) Regulations 1969, provide for the exemption of the burning of certain matter from Section 1 of the Clean Air Act 1968, which applies to trade premises. In certain circumstances the regulations allow the burning of carcases of animals or poultry and containers contaminated by any pesticide, provided, amongst other things, there is no other reasonably safe and practicable method of disposing of the matter other than burning (paragraphs 155, 169 and 192).

16 Under the Clean Air Act 1968 (subject to the exemptions given in paragraph 15) the occupier of the premises and any person who causes or permits the emission of dark smoke is guilty of an offence. Everyone who is involved in agriculture and horticulture should take all practicable steps to prevent the emission of dark smoke.

Laws: smoke control areas

17 In some cases a farm may fall within a "smoke control area" as declared by local authorities under the Clean Air Act 1956. It is an offence to emit smoke from the chimney of any building caused by the burning of an unauthorised fuel in these areas. You should ask your local authority about any local smoke control areas.

Laws: prescribed processes

18 Part I of the Environmental Protection Act 1990 establishes a new pollution control system for certain "prescribed processes". The Environmental Protection (Prescribed Processes and Substances) Regulations 1991 set out the processes which pose a particular risk of air pollution and are subject to special controls. Those prescribed processes of particular interest to farmers are given in the list (see box overleaf). Under the Act, Her Majesty's Inspectorate of Pollution (HMIP) and local authorities have powers to control pollution over a range of processes. Those activities which are affected need an authorisation. This would normally be from the local authority for farm scale processes.

The requirements for the local authority air pollution control system mean that:

- You must not operate a prescribed process designated for local authority control without their authorisation. The process must be operated using BATNEEC (Best Available Techniques (including technology) Not Entailing Excessive Cost).

  The Secretary of State for the Environment's Process Guidance Notes (available from HMSO) for all the main processes include detailed descriptions of the techniques to be applied in order to meet the BATNEEC objective.

- If you operate a prescribed process you must submit a detailed application to the local authority, for authorisation. You have to pay a fee with the application for authorisation as well as an annual charge for the authorisation to continue in effect.

If you carry out a prescribed process which is exempted from local authority control because of size or volume, you should aim wherever practicable to meet the standards set out in the appropriate Process Guidance Note, to reduce the possibility of nuisance.

Prescribed Processes

Prescribed processes include many of interest to farmers such as:

- general waste incineration processes under 1 tonne an hour;
- waste oil burners;
- straw combustion processes between 0.4 and 3 MW net rated thermal input;
- wood combustion processes between 0.4 and 3 MW net rated thermal input;
- poultry litter combustion processes between 0.4 and 3 MW net rated thermal input;
- animal carcase incineration under 1 tonne an hour;
- treatment and processing of animal or vegetable matter including:
  - fur breeding;
  - animal feed compounding;
  - production of compost for mushrooms.

Some processes covered in the Process Guidance Notes, for example, any process under the heading of 'treatment and processing of animal or vegetable matter', are exempt from controls when carried out on a farm and when they do not involve the manufacture of goods for sale. Others may be exempt below a certain size of operation, for example animal carcase incineration below 50 kg/hr.

Advice

19 Farmers can get free general advice on preventing pollution from the Agricultural Development and Advisory Service (ADAS). You can also get information from local authority Environmental Health Departments and Waste Disposal Authorities. Detailed design and planning services are available from ADAS, other independent consultants and equipment suppliers.

PART B.
ODOURS AND AMMONIA

Introduction

20 This Section describes the main causes of complaints about odours, outlines the sources of odours and how they can be measured. It also defines good agricultural practice to minimise odour problems. Ammonia is included in this Section because methods of controlling odour generally reduce the release of ammonia.

Causes of odour problems

21 Complaints from the public about odours caused by agriculture and industry are recorded and reported every year by the Institution of Environmental Health Officers. Numbers of agricultural odour complaints can be looked at in two ways: by animal type or by source point.

22 The number of complaints varies considerably with the type of animal. In the years 1987/88 to 1989/90 pigs were on average the cause of 650 justifiable complaints annually (47%), poultry 339 (25%), cattle 298 (22%) and horses kept for riding 95 (7%).

23 In the same years the spreading of slurry or manure was on average the major source of justifiable complaints about odours from agriculture at 613 annually (44%), followed by farm buildings 350 (25%), slurry or manure stores 289 (21%), animal feed products (swill boiling) 74 (5%) and silage clamps 56 (4%).

24 Most farm odours come from several sources. For example, odours from buildings are mainly caused by the breakdown of faeces and urine. Other sources of odour are from waste food spilt onto floors, the scent glands of animals, and the animals' feed.

25 When slurries, silage effluent and solid manures are spread on land, they may also be a source of odour, either during or after the spreading takes place.

Ammonia

26 Livestock production is the major source of ammonia in the atmosphere, mainly arising from livestock buildings, waste stores and spreading wastes on land. Loss of nitrogen as ammonia reduces the potential value of the waste as a fertiliser. Following deposition to land as a gas or as ammonium salts in rainfall, ammonia can have effects on natural vegetation. These include direct damage to plants and changes in the sort of plants present in heathland due to the enrichment of the soil with nitrogen and acidification of soils. Acidification may cause long term damage to trees.

Minimising odours by good agricultural practice

27 It is not possible to avoid all odours from agriculture, because often the right techniques do not exist. Even where there is a solution, the cost may sometimes be too high. This is recognised by the legislation which refers to "best practicable means", which takes financial implications into account.

However, by using good agricultural practice and appropriate control systems, you can minimise odour problems from both new and existing installations. The aim is to minimise the escape of odours beyond the farm boundary, and where practical, stop it entirely. This is done by firstly reducing the amount of odour coming from the source and then allowing air movement and distance to reduce any problem, by diluting the odour.

28 You should carry out good agricultural practice as described in the following Sections of this Code:

- Section 3 describes good agricultural practice to minimise odour nuisance from housed cattle, pigs and poultry.
- Section 4 describes good agricultural practice to minimise odour nuisance during the storing and handling of slurry or manure.
- Section 6 describes good agricultural practice to minimise odour nuisance from the spreading of livestock wastes on agricultural land.

In situations that could be particularly sensitive, you may need to go beyond good agricultural practice and use more rigorous treatment and control measures. Section 7 describes methods of treating livestock wastes to give further odour reductions during storage and spreading. Before investing in any of these you may need to get the advice of an independent consultant.

29 If an odour complaint has been made to the local authority Environmental Health Department and they decide the complaint is justifiable, then you should take the following steps:

Firstly, discuss the matter with the Environmental Health Department and find out the cause and source of the odour causing the complaint.

Secondly, compare the management practices and systems which you use for housing livestock, handling and storing manure or slurry, and spreading livestock wastes, with those set out in Sections 3, 4 and 6 of this Code. Make any changes that are needed.

Thirdly, evaluate the improvements. At this stage, the amount of odour given off may have reduced enough to solve the problem.

If the improvement has not been enough, get advice on the techniques you need to use to reduce odour still further. Keep the local authority Environmental Health Department informed of proposals at all stages of the process.

Odour Measurements

Agricultural odours are caused by a large number of chemical compounds. No single compound has been identified which can be measured and used to assess odour.

"Olfactometry" is the method used to measure smells. It normally relies on using the human nose as a detector. It is based on the assessments of a group of people, called a 'panel', under controlled laboratory conditions. Samples of odorous air are collected on site and transported to the laboratory.

Odour threshold value is most commonly used to measure an odour. It is the number of volumes of odour free air needed to dilute an odour until it is smelt by 50% of the panel members. The odour threshold value is commonly expressed as an odour concentration (odour units per cubic metre (m^3)).

Background odour concentrations measured in rural areas are typically 30 odour units per m^3. There are few if any situations where farm odour concentrations at source are more than 5,000 odour units per m^3 air, whereas industrial odours may have to be diluted over a million times to reach the odour threshold value.

Housed Livestock Systems

Introduction

30 This Section describes good agricultural practice to avoid odour nuisance from housed cattle, pigs and poultry. It also covers silage making.

31 It is essential to maintain a high standard of hygiene and cleanliness. If you don't, all other measures to control odours are likely to fail.

General points of good practice

32 There are a number of general points of good practice which should be followed:

- Whenever possible, collect and transfer slurry every day to a suitable store. Dung from non-bedded, concreted areas, should also be dealt with in this way.
- Keep concrete areas around buildings clean and free from any build-up of slurry or manure.
- Remove and dispose of all dead animals, birds and foetal remains as soon as possible. (For safe methods of disposal see Section 14 of this Code, and Section 12 of the Code of Good Agricultural Practice for the Protection of Water).
- Maintain drains and repair broken or badly laid concrete to prevent effluents from ponding.
- Where bedding is used, use enough to keep animals clean. Stock covered in manure can add to the amount of odours produced. Store bedding materials in a dry condition to avoid moulds and dust forming and the loss of capacity to absorb liquids.
- Manage drinking systems to avoid overflow and spillage.

Cleaning buildings

33 Livestock buildings need to be cleaned regularly.

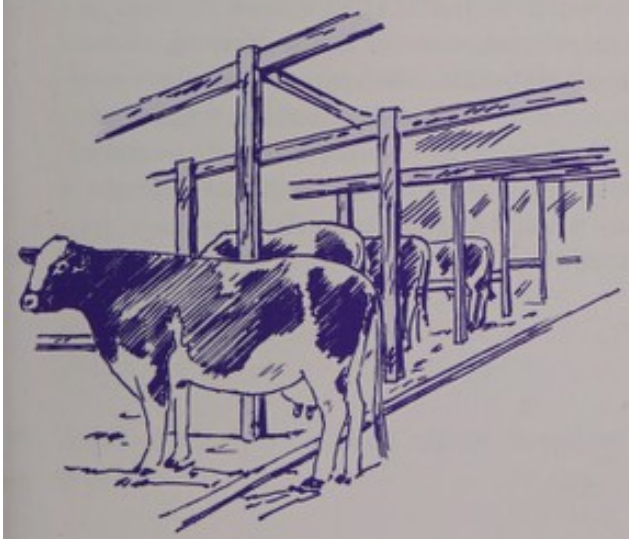
If livestock are produced in batches, thoroughly clean and disinfect buildings after each batch of stock is removed. Remove thick deposits of dust from the surfaces inside the building and in particular from all ledges, ventilation shafts and cowls.

If livestock are not produced in batches, thoroughly clean and disinfect individual pens as they become empty.

Clean out grit and sediment from slurry channels, collection systems and stores. Thick sediments encourage micro-organisms to grow. This produces odours.

Open concrete areas

34 Keep areas of concrete which livestock use to the minimum necessary as these areas will be fouled by manure. Pipe or channel waste water rather than letting it flow across open concrete. Information on the disposal of dirty water from buildings and yards is given in Section 4 of the Code of Good Agricultural Practice for the Protection of Water.



Cattle

35 The space allowances and amount of bedding for cattle should meet the MAFF Code of Recommendations for the Welfare of Cattle. For dairy cows loose housed in yards, good management is essential to maintain a balance between stocking density and the amount of litter you use.

36 Providing cubicles of suitable dimensions for the size of the cows is crucial for maintaining the cleanliness of the animals. Keep cubicles well maintained. Unless you use mats, you should keep bedding clean and topped up daily.

Scrape cubicle passages and other heavily soiled areas regularly, typically twice daily.

37 Dairy and parlour buildings need to be washed and cleaned frequently. Where disinfectants are used make sure you have the correct type and quantity of disinfectant and the right volume of wash water. If you use high pressure hoses take care to avoid splashing manure onto walls, ceilings and milking equipment.

NOTE: COLLECT CONTAMINATED WASH WATER AND DISPOSE OF IT IN A WAY THAT WILL NOT CAUSE WATER POLLUTION.

Pigs – general

38 The space allowances for lying areas should meet the recommendations set out in the MAFF Code of Recommendations for the Welfare of Pigs. Suitable extra space should be given for exercise and dunging.

39 Odour problems are minimised if pens are kept clean. Dirty pens can be caused by a number of factors including poor management and building design. Overstocking or understocking, poor ventilation design, wrong pen shape, poor floor surfaces, incorrect construction of pen divisions as well as badly sited feeding and watering facilities, can all contribute to dirty pens.

Pigs – solid manure systems

40 Bedded systems often don't absorb all the effluent produced. Appropriately placed drainage and suitably sized and constructed collection tanks should be part of such systems. Effluent should not be allowed to flow across open concrete.

41 Wherever possible you should clean non-bedded, concreted dunging areas every day.

Pigs – slurry systems

42 Less odour comes from fresh slurry and therefore you should remove slurry from buildings while it is fresh if this is practicable.

43 Clean slats give off less odour. Well designed and installed slats should be self-cleaning and minimise the risk of injury to the pig.

Poultry – general

44 Increasing stocking density increases odour production. Follow the recommended space allowance in the MAFF Code of Recommendations for the Welfare of Domestic Fowls. The type of feed, the humidity in the building and the amount of litter, if used, all contribute to the amount of odour produced. To reduce odour maintain any manure stored within the house in a dry condition.

Poultry – caged laying birds

45 Frequently removing the manure which is collected on belts beneath cages to a store or spreader outside the building helps to reduce odour. How often you need to remove the manure will vary from daily to twice weekly depending on the system design. Do not add water to poultry manure as this can result in strong, unpleasant odours.

Prevent leaking drinkers spilling water onto manure belts or into manure stores.

46 If the manure is stored beneath the caged area, air drying the manure will reduce odour formation. One way of achieving this is to separate the manure store from the birds with a slotted floor. The manure is scraped each day to fall through the slots into a storage area beneath the floor. If the ventilation air leaves the building by going through the slotted floor this increases air drying of the stored manure.

Poultry – deep litter systems

47 The drier the litter is in poultry houses for broilers, growers, breeders or layers, the lower the risk of odour from the buildings. In many cases keeping the litter dry will be enough to avoid problems. The following points will help to achieve this:

- Buildings should be adequately insulated with suitable materials which have a vapour barrier to prevent deterioration of the insulation.
- A well designed ventilation system should be provided.
- Direct fired gas or oil heaters put extra moisture into the house. Indirect heating systems avoid this problem.
- Drinkers should be designed to minimise spillage. If suitable for the type of stock, nipple and drip cups (or similar system) are preferable to hanging bowl drinkers, as they minimise water spillage. The drinking system must be maintained at the correct height by frequently adjusting them to bird eye level to avoid spillage and wet litter.
- The number of birds in the space available should be in line with the MAFF Code of the Recommendations for the Welfare of Domestic Fowls. This will prevent over-loading the litter. Litter should be 10-15cm deep which should be enough to absorb the manure load.
- Feeds which contain certain oils and animal fats which are poorly absorbed by the birds can result in the manure being greasy, causing capping of the litter and odour production. Rations should be adjusted to minimise this problem if it occurs.

Ventilation of livestock buildings

48 Ventilation systems in livestock buildings have two functions: firstly to control temperature and humidity and limit the concentration of poisonous gases, and secondly to make sure that clean air is evenly distributed under a wide range of weather conditions.

Poor ventilation can result in humid conditions which give rise to the production of unpleasant odours, high levels of ammonia and poor animal health. Maintain ventilation

fans and check that they are running at the correct airflow for the numbers and weight of animals present.

49 The position and design of ventilation outlets will affect the dilution of odours from buildings. For new buildings you should get advice on the most favourable ventilator outlet position for your site conditions. The higher the outlet is, the more the odour will be diluted by air movement. Ventilation outlets positioned along the sides of buildings below a slatted floor and immediately over a slurry collection channel can produce very strong odours.

Biological treatment of odorous air

50 Odorous air can be treated by passing it through an air cleaning device such as a film or mist of water in an air scrubber. Many systems use a material with a large surface area, which micro-organisms can become attached to. Many odorous compounds are nutrients for the micro-organisms which clean the liquid, so it can be recycled. An alternative biofilter system uses a moist mixture of peat and heather or lightly packed soil.

At the moment, costs of buying and running these air cleaning devices are likely to be too high to be considered as a practical method of controlling odour from most livestock buildings.

Feeding and food stores

51 Odours can be absorbed by dust particles and then carried in the air. Finely ground feeds and long feed drops (into bins or onto floors) increase amounts of dust. Using liquid-feeding systems or pelleted feed can reduce dust and may help to reduce odours.

52 Keep foods such as milk by-products (whey, skimmed milk), yeasts and molasses which can produce strong odours in properly constructed covered tanks or silos. The delivery area should be concreted and all spillage and wash water should be piped into the foul-drainage system.

SAFETY NOTE: DO NOT ALLOW EFFLUENT FROM SWILL OR WHEY TANKS AND FROM ENSILED PRODUCTS TO ENTER SLURRY CHANNELS AS THIS MAY CAUSE LETHAL GASES AND ODOURS TO BE RELEASED.

53 The collection and treatment of swill by cooking is controlled by the Diseases of Animals (Waste Food) Order 1973. Premises have to be approved and licensed by MAFF. Processing of swill often causes odour complaints.

Using automatically controlled systems which avoid excess steam injection can reduce odours and save fuel. Enclosed treatment systems stop nearly all escaping steam and greatly reduce odours from cooking. Odours can also be reduced by maintaining the treatment equipment properly and by avoiding spilling the feed. Letting swill cool before feeding it to the pigs may help to reduce odours.

Silage

54 Controlling odours from silage clamps, once these have been opened for daily use, can be difficult because of the large surface area exposed. Well-made silage smells a lot less than silage which is badly made.

55 You should take the following precautions to control odours from silos and during the handling and disposal of silage effluent:

- Do not let silage effluent flow across open concrete; it should be collected in a channel and taken to a suitable storage tank.
- Apply silage effluent with a slurry spreader suitable for the area which effluent will be spread on (see Section 6). Do not spread silage effluent on fields where it is likely to cause odour problems. Do not apply silage effluent to land where it could cause water pollution (see Section 7 of the Code of Good Agricultural Practice for the Protection of Water).
- Do not add silage effluent to slurry stores if the store or the land the slurry will be spread on could cause odour problems.

SAFETY NOTE: ADDING SILAGE EFFLUENT TO SLURRY PRODUCES LETHAL GASES AND STRONG ODOURS VERY QUICKLY. NEVER ADD SILAGE EFFLUENT TO SLURRY IN CONFINED SPACES OR IN BUILDINGS.

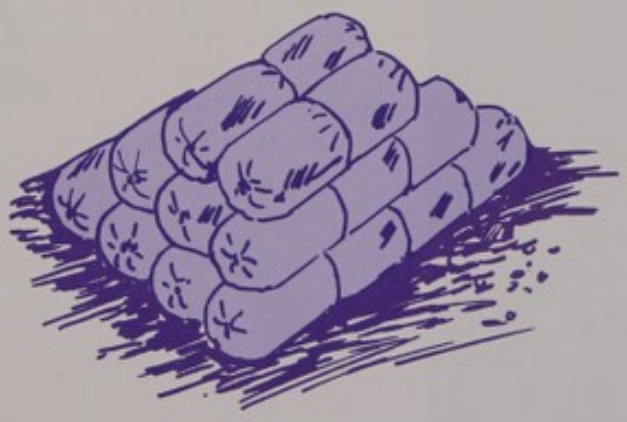
56 The design and construction of new, substantially enlarged or substantially reconstructed silos and effluent tanks must comply with the Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) Regulations 1991.

57 Consider making baled and wrapped or bagged silage where silos could cause an odour nuisance. Baled silage has the advantage of being enclosed until you use it and only a small quantity is exposed at any time. Careful use of this technique can help to limit the amount of odour released.

Effect of housing on ammonia emissions

58 Approximately 35% of ammonia emissions from agriculture in the UK are from livestock buildings. Measurements have shown that ammonia losses are increased if the walls and floors are constantly covered with layers of faeces or urine. The depth is less important than the surface area. Removing slurry frequently by flushing or scraping and washing floors will help control ammonia emissions from cattle and pig buildings.

59 For poultry, the rapid air drying of droppings in laying houses and the maintenance of dry, crumbly litter in broiler houses will reduce ammonia loss.



Storing Slurry and Manure

Introduction

60 This Section describes good agricultural practice for the design and management of manure and slurry stores in order to reduce potential odour nuisance.

61 Storage of manures and slurries is also one of the most important ways of avoiding water pollution at times of the year when spreading them to land is likely to cause pollution. A detailed description of the design and management of slurry and manure storage facilities is given in Sections 2 and 3 of the Code of Good Agricultural Practice for the Protection of Water.

Solid manure storage

62 To minimise odours from manure stores, you should encourage natural composting to take place within the store by helping air to penetrate into the bulk of the manure. Make sure that there is enough bedding in the mix to allow air to penetrate.

63 The design of the store is also important. If the store has walls, preferably they should be constructed so that there is a series of gaps at least 25mm wide to allow air into the manure. It is also preferable to have low, long, narrow stores, no more than 10-15m wide and no taller than 3m high. A series of stores will mean that one store can be filled and left to compost for a period of time while a second is filled.

64 You should provide a way of safely collecting and containing any run-off from the store, to avoid causing water pollution (see the Code of Good Agricultural Practice for the Protection of Water).

Storage of slurry and dilute effluents

65 The design and construction of new, substantially enlarged or substantially reconstructed slurry stores must comply with the Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) Regulations 1991. The Code of Good Agricultural Practice for the Protection of Water gives advice on the design, construction and management of stores for slurry and dirty water. General points of good management to avoid odour nuisance are described below. Siting of stores in order to avoid odour nuisance is covered in Section 8 of this Code.

66 Do not add feeds such as milk or whey or silage effluent to slurry or dirty water if there is a high risk of causing odour problems because of the location of the slurry store, or from spreading the waste. Where practicable, you should contain silage effluent in a separate collection tank.

SAFETY NOTE: THE ADDITION OF SILAGE EFFLUENT OR WHEY TO SLURRY CAN RELEASE LETHAL GASES. NEVER ADD THESE MATERIALS TO SLURRY IN CONFINED SPACES OR BUILDINGS.

67 If slurry is frequently agitated in store there will be a frequent release of odours. If possible, above ground circular stores located where there is a high risk of causing odour problems should be equipped with an efficient agitation system which can break up any crust or remove any sediment. This will then need to be used only when the tank is going to be emptied.

68 If slurry is stored in a lagoon or an above ground tank, it can be easier to manage if it has been mechanically separated (see Section 7). Mechanical separation removes coarse solids from the slurry leaving a liquid that can be easily pumped. This liquid can be stored without having to mix it frequently, which can reduce the amount of odour released.

69 If cattle slurry contains a lot of straw bedding material, a self-draining, weeping walled store can be used.

The contents of the store are removed for spreading once they are dry enough. Usually, these solids are only emptied once a year. The liquids draining from the store pose a potential odour problem. They should be spread in a place and using equipment which will minimise the risk of odour problems and water pollution (see Section 6).

Storage of poultry manure

70 Poultry excreta has a dry matter content of 20 to 24%. It is best to handle it as a semi-solid. It should not be diluted with water, as this can result in strong unpleasant odours.

Laying-hen manure which is collected on belts can be air dried in the poultry house as described in paragraph 46.

71 Broiler litter, when well managed in the house, should have a dry matter content of at least 65%. To avoid it becoming wet and causing odour problems you should, where practical, store it under cover, on a base which will not let liquids pass through, until you spread it on the land. Do not burn it under uncontrolled conditions in the open (see Section 16 of this Code).

72 If you use field heaps, they should be put as far away as practical from residential housing, and not within 10m of a watercourse, ditch or field drain. Narrow "A"-shaped heaps shed rainwater more easily and prevent manure from becoming very wet.

Producing Compost for Mushrooms

Introduction

73 Producing compost for mushroom growing involves mixing ingredients, mainly straw and manure, and adding water. The process can give rise to odours. This Section gives advice on the legislation which applies, and on practices which will minimise odour emission.

Laws

74 Production of compost on which mushrooms will be grown is a 'prescribed process' and requires an authorisation from the local authority Environmental Health Department, under Part I of the Environmental Protection Act 1990 (see paragraph 18). This will be based on the Secretary of State's Guidance Note on production of compost for mushrooms. The Note sets out controls and alternative technologies for new and existing processes.

However, any process for the manufacture of compost other than for sale, carried out on a farm or agricultural holding, is exempt from the above legislation. That is to say if compost is produced and used at the same location and by the same grower for growing mushrooms, or produced at one location and transferred to another location for use by the same grower, the process is exempt.

Processes at locations which are exempt are still subject to Part III of the Environmental Protection Act 1990 which relates to statutory nuisances (paragraphs 7-10).

Good practice

75 In order to minimise the production of odours you should adopt the measures outlined in paragraphs 76-78. A good standard of general management is important. Keep the composting yard and surrounding areas clean and avoid the ponding of liquids which could give rise to odours.

76 If poultry manure or other manure is stored prior to composting, follow the guidelines given in paragraphs 70-72, in order to prevent it becoming too wet. If practical, very wet and potentially odorous material should not be accepted or stored at a composting site.

77 To avoid producing odours, encourage as much air as possible to penetrate into the material which is being processed. To do this you may have to limit the width and height of windrows or heaps and carefully manage the amount of water applied. Turn compost frequently to minimise anaerobic conditions which will cause odours to be produced.

78 Run-off and leachate which is contained in storage tanks should be aerated by suitable equipment. Spray heads that are used to moisten the compost with leachate should work at low pressures and produce large droplets to reduce drift and possible odour problems.

NOTE: DO NOT LET LEACHATE ENTER WATERCOURSES. GUIDANCE ON HOW TO AVOID WATER POLLUTION IS GIVEN IN THE CODE OF GOOD AGRICULTURAL PRACTICE FOR THE PROTECTION OF WATER.

Land Spreading of Livestock Wastes

Introduction

79 This Section describes factors which affect the amount of odour emitted by spreading livestock wastes on land. It describes good agricultural practice and the choice of spreading machinery to minimise odour nuisance.

80 Odours released during spreading of livestock wastes to land cause about 44% of all complaints of odours from agriculture. Odours from spreading manures and slurries can be smelt a long distance from the field, depending on the weather, type of waste, and method of spreading.

Factors which affect levels of odour emitted and its dispersal

81 Generally, the highest odour emissions occur while spreading of waste is actually taking place. With conventional splash plate spreaders, the odour concentration can be 7 to 15 times greater during spreading than immediately afterwards. Odour emission during the next 8 to 12 hours may also be high enough to cause a nuisance.

82 A number of factors affect the amount of odour emitted during and after spreading slurry or manure. These include the type of livestock (pig slurry tends to be most odorous), whether the waste contains waste milk or silage effluent (these increase the amount of odour released) and the method and length of storage. The type of spreading equipment used and rate of application to land are also very important (paragraphs 87 and 92-100).

83 The weather conditions which are least suitable for spreading are high humidities and very light winds or clear, still nights. These conditions prevent odour from dispersing, and so increase the risk of causing a nuisance.

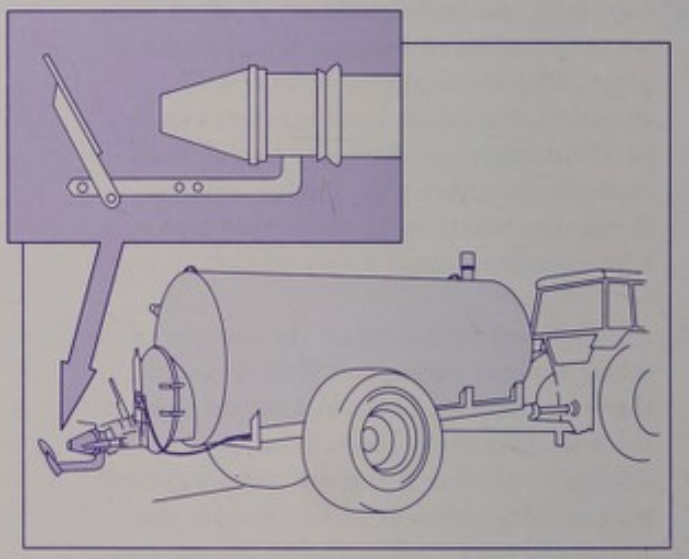
The best spreading conditions are where air mixes to a great height above the ground, which are typically sunny, windy days, followed by cloudy, windy nights. These conditions cause odours to be diluted quickly.

84 The location of the fields where the slurry or manure will be applied, the direction and strength of the wind, and distance from houses are extremely important to get enough dilution and dispersal of the odour and so avoid problems.

Losses of ammonia during land spreading

85 Approximately 35% of ammonia emissions from agriculture in the UK result from spreading livestock wastes on land. Most of the loss of ammonia to the atmosphere from manures and slurries takes place as the material is being spread on land and during the following 12 hours. Any attempt to reduce and control losses must take place as soon as possible after spreading. Injecting, or rapidly incorporating the waste into the soil will have a significant effect in reducing emissions.

Figure 1: Conventional 'Splash Plate' Slurry Spreading Mechanism



See paragraph 94 for situations where using this type of spreading mechanism is likely to be acceptable. Machines giving a low trajectory and large droplets are best.

Precautions when spreading manure and slurry

86 Use a weather forecast to help choose suitable conditions for spreading (paragraph 83). Check wind direction in relation to nearby houses before spreading. Avoid spreading in fields close to and upwind of houses unless slurry is band spread, injected or has been treated to effectively reduce its odour.

87 Avoid applying more than 50 m^3/ha (4500 gallons to the acre), or 50 tonnes/ha (20 tonnes per acre) at one time if odour could be a problem. Always apply slurry and manure in a way that avoids the risk of causing water pollution. See Section 2 of the Code of Good Agricultural Practice for the Protection of Water for detailed information on assessing the risk of causing water pollution and the land area needed for different classes of stock.

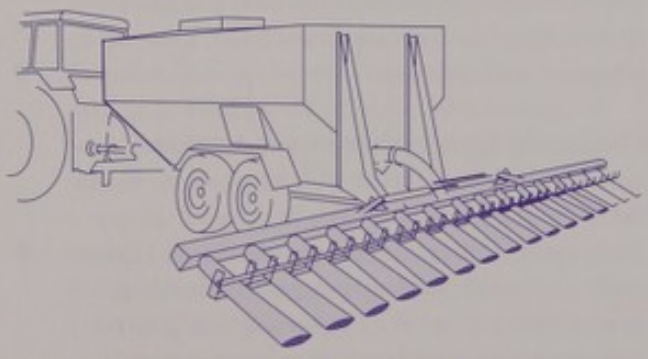
88 On bare land, lightly cultivate the land after surface spreading to mix in the material as soon as possible.

89 When spreading slurry use a spreader which is suitable for the location of the fields it will be used in (paragraphs 94-100).

Avoid over-filling tankers or spreaders. Do not spill manure or slurry on roads. This may be an offence under the Highways Act, 1980. Clean the outside of spreading machinery regularly.

90 Unless slurry is band spread, injected or has been treated to reduce odour effectively, avoid spreading at weekends, bank holidays or in the evening.

Figure 2: Band Spreader for Slurry



This type of mechanism can reduce odour emissions by 55 to 60% as compared with a convential splash plate spreader.

Precautions when spreading sewage sludge

91 Spreading of sewage sludge is controlled by the Sludge (Use in Agriculture) Regulations 1989. Follow the Code of Practice for Agricultural Use of Sewage Sludge. Care should be taken to choose application sites so that odour nuisance is not caused. In general, the factors which affect odour nuisance are the same as those for slurry and manure.

Choosing slurry spreading equipment

92 Choosing suitable slurry spreading equipment is, in many cases, the most important decision to be made when planning a waste handling system to minimise odour problems.

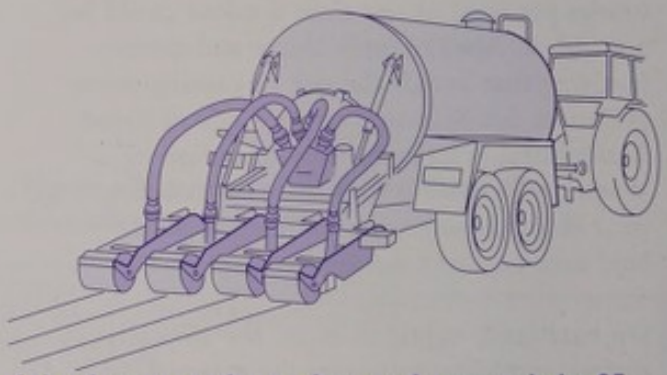
93 Volatile odorous compounds in slurries are released when the slurry is directed onto a splash plate or similar device. This causes the jet of slurry to shatter into very small drops and releases odorous compounds directly into the air.

Often, it is this concentrated release of odour which causes problems. One tanker may spread three or four loads an hour, causing a series of such events.

94 Choose the type of slurry spreader that is suitable for the fields it will be used in. If the fields which the slurry will be spread on are away from houses, then you can use a tanker with a conventional splash plate spreading device (see Figure 1). Tankers which give a low trajectory and large droplets are best.

95 When the fields are close to and upwind of houses, choose a machine which has reliable information on its ability to control the amount of odour which is emitted.

Figure 3: Slurry injector



Injection can reduce odour and ammonia by 85 to 90% as compared with a conventional splash plate spreader.

The band spreaders and injectors described in paragraphs 96-99 below provide a series of choices for controlling odour and ammonia. The costs of buying and running equipment vary in relation to the amount of control achieved. It may be necessary to separate slurry mechanically, or to remove coarse solids to make sure that the spreader works properly.

Alternatively, you could treat the slurry before it is spread to reduce the amount of odour emitted to an acceptable level (see Section 7).

96 Band spreaders discharge slurry at ground level through a series of trailing pipes (see Figure 2). Measurements of odour show a reduction of 55 to 60% compared with conventional splash plate spreaders.

97 Shallow channel application uses a mechanism to make grooves 50-70mm deep in the soil, 200-300mm apart. The slurry is directed into the channel immediately behind the cutting blade. As with band spreaders the odour can be reduced by 55 to 60% compared with conventional spreaders.

98 Shallow injection applies slurry at a depth of 50-80mm in grooves 250-300mm apart. The groove is then closed again by press wheels or discs. The amount of odour emitted is about 85% less than from conventional spreaders. Ammonia emissions are reduced by 90 to 95%.

99 Deep injection equipment applies slurry at a depth of 120-300mm in the soil using injector tines, spaced about 500mm apart (Figure 3). The amount of odour emitted is about 85% less than from conventional spreaders. Ammonia emissions are reduced by 90 to 95%.

Band Spreaders
Slurry is pumped to a manifold distributor, often in a rapid succession of pulses to make sure that all pipes are supplied at the same rate. The trailing pipes may hang loosely or can be more rigid with a small metal shoe which rides along on the surface, parting the crop and making sure that waste is applied directly onto the surface of the soil.

Deep injection
A winged tine may be used to loosen the soil over a strip about 20cm wide so that slurry is mixed into the soil. However, as with all injection systems the method has limitations: it may not be usable when the soil is heavy, dry, frozen or stony and where there are steep slopes. Deep injection generally requires a more powerful tractor compared with other systems.

100 The following points should help you choose slurry spreading machines to reduce odour emissions. Manufacturers should be able to provide such information. Look for:

- A reduction in the amount of odour emitted during spreading of at least 50% compared with a conventional splash plate distribution device.
- Good control of application rate, so that the machine can give rates ranging from 20m³/ha (1800 gallons per acre) to 50m³/ha (4500 gallons per acre), when operating at a suitable speed.

Irrigation of liquid wastes

101 Dilute effluents and separated slurry are usually applied using sprinklers or travelling irrigators. A detailed description of such systems is given in Section 4 of the Code of Good Agricultural Practice for the Protection of Water.

102 Odour problems can arise when silage effluent, waste milk or the liquid from weeping wall stores or manure stores is added to dirty water or separated slurry.

There will be some situations when storage will be needed for the dirty water or separated slurry to avoid causing water pollution. However, storing them for long periods will encourage odours to develop and extra care must be taken to avoid nuisance when such liquids are spread.

103 Application systems should be designed for the particular site. Where there is a risk of causing an odour nuisance choose sprinklers or irrigators providing a low trajectory and operating at a low pressure to produce large droplets.

Spreading solid manures

104 Spreading solid manures, including mixtures of bedding and manure, poultry manure, solids from weeping wall stores, and the solids from mechanical separators, can sometimes produce as much odour as spreading slurry. Because the material is solid, it cannot be applied by injection which would reduce the release of odour.

105 Wherever possible, store manure in a way that will encourage natural composting. This process, when carried out correctly, as outlined in Section 4, reduces the concentration and offensiveness of odour released during spreading.

106 When odorous or partly composted manure has to be applied to land, do not spread it close to houses. Where practicable, you should spread it onto arable land and bury it immediately by ploughing.

Treatment of Livestock Wastes

Introduction

107 This Section describes methods of treating livestock wastes to give further reductions in odour emissions during storage and spreading beyond those that would result from the good practice described in Sections 4 and 6 of this Code.

108 Biological treatment of livestock wastes and odour emissions from buildings is a step beyond currently accepted good agricultural practice. However, the use of these techniques may be necessary in exceptional situations.

Aerobic and anaerobic treatment can be expensive, as the costs of buying and running the treatment systems must be added to the cost of collecting, storing and spreading the waste. It is important that you get advice to make sure that the treatment you intend to use works efficiently and is suitable for the specific problem.

109 The type and degree of treatment that is needed depends on how serious the odour problem is. In some cases, the source odour concentration may need to be reduced by as much as 95% before the odour problem is reduced enough. (See page 13 for definition of odour concentration).

Mechanical separation

110 Mechanical separation can be useful as an aid to improved waste management. There is a range of mechanical separators available for livestock slurries. It is important that the correct machine is chosen for the slurry produced on a particular farm.

111 The process removes coarse solids from farm slurries. The solid portion, 10 to 20% of the original slurry volume, can be stacked and stored in a similar way to farmyard manure. If this solid is produced by a separator which gives high dry matter solids, this portion will compost readily to produce a relatively mild smelling material which is unlikely to cause a nuisance.

112 The separated liquid portion, which is 80 to 90% of the original volume, flows easily and can therefore be pumped to a store and handled by the band spreaders or slurry injectors described in Section 6, without causing blockage problems. After separation, storing the liquid portion is easier because there is less risk of a crust forming and solids settling. Therefore, mixing in store only needs to be carried out occasionally so odours released during storage are reduced.

113 The separated liquid portion of slurry can be applied in the spring to arable crops or grass after silage cuts. This makes good use of the nutrients in the waste. The separated liquid leaves very little solid residue on crops and avoids one of the sources of odour associated with whole slurry.

114 Mechanical separation is usually a necessary treatment before aerobic treatment (aeration) because it is easier to aerate separated liquid than a mixture that contains large particles which need extra power input to keep them in suspension and more oxygen to give odour control.

Choice of mechanical separator

For pig slurry of 2 to 4% dry matter a wedge wire screen or vibrating screen will work satisfactorily. The dry matter content of the separated solids will be 8 to 12%. These solids will self-drain if they are held in a suitable store.

Separators which press, squeeze or screw the slurry against a fabric belt or perforated stainless steel screen will produce a solid with a dry matter ranging from 18 to 30%. These solids can be composted.

Biological treatment – general principles

115 Techniques for treatment of manure, slurries, and other organic effluents using micro-organisms are well developed.

There is a range of treatments for agricultural slurries and other effluents, examples of these are set out in Figures 4 and 5.

116 Any treatment of slurry by micro-organisms relies on steady flow conditions to encourage their rapid continuous growth. Therefore, it is essential that the daily loading rate of slurry should be kept within the design standards of the particular treatment system. Variations in load will alter the retention time; a very large load may flush out the micro-organisms which will lead to treatment failure.

There are two basic methods of treatment - aerobic (with a good supply of oxygen always present) and anaerobic (without oxygen).

Retention time: This is the average time that slurry will stay in the container that treatment takes place in. For continuous flow systems, normal retention time in days is the volume of the treatment vessel divided by volume loaded every day.

Aerobic treatment (aeration)

117 Treatment of slurries and farm effluents by aerobic biological treatment systems which are correctly designed and used should be capable of reducing the amount of odour emitted during and after land application by up to 90%.

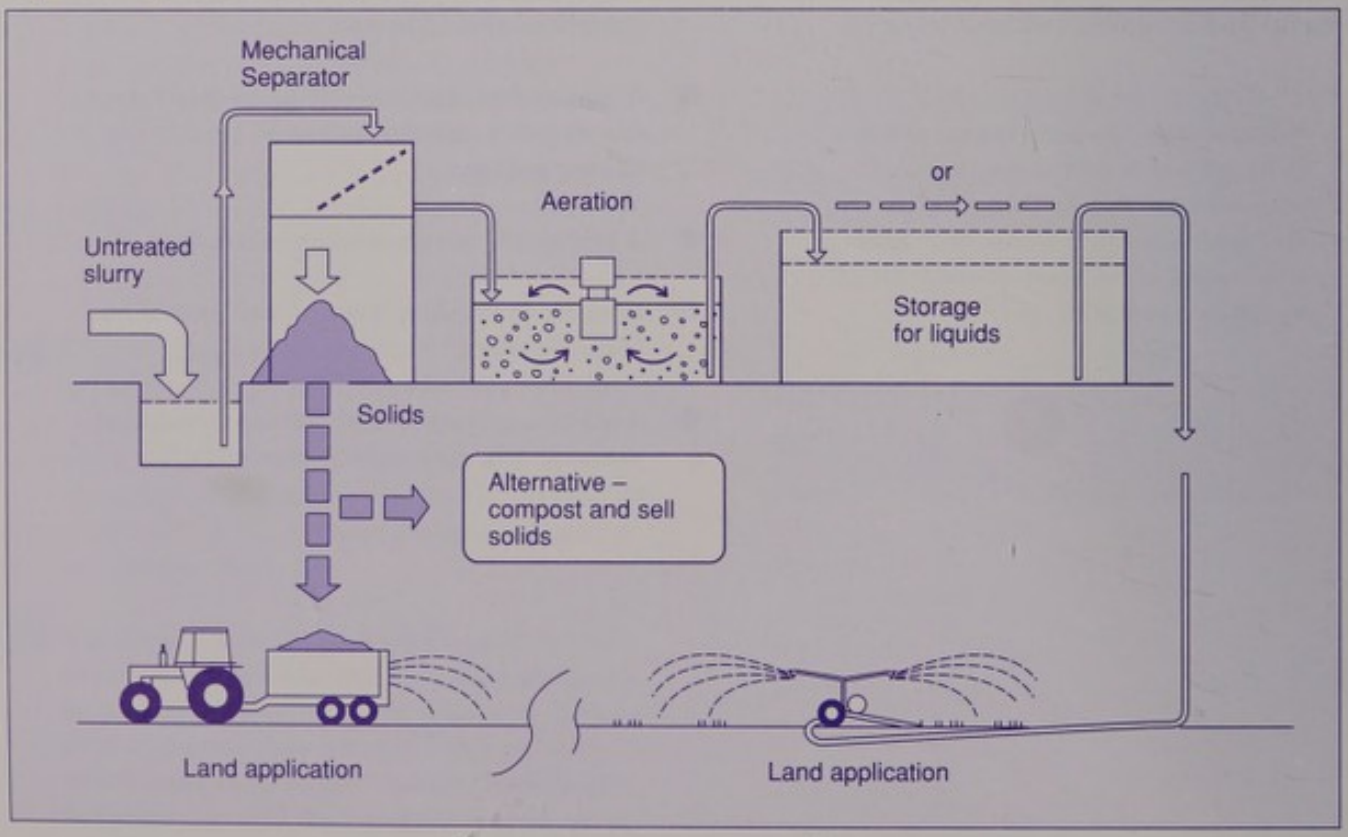
118 Aerobic treatment is usually only suitable for separated slurry or dilute effluents. Solids in the waste increase the amount of oxygen needed and also increase the energy needed for mixing. The most efficient oxygen transfer occurs when very small bubbles are used. Currently the most successful aerators are "sub-surface" and "venturi jet", whilst "compressed-air sparge systems" are more efficient in deep tanks. Aerators should supply a minimum of 1 kg of dissolved oxygen for each kilowatt hour they use, if they are to be economical. The following conditions should be met:

- A reasonably constant volume of slurry each day to give controlled retention time in the treatment tank.
- A slurry dry matter content of less than 3%.
- Absence of bedding material and animal hair from the slurry.
- A suitable oxygen concentration throughout the treatment tank achieved by effective mixing.

119 Continuous flow aeration systems can successfully treat slurries to reduce odour nuisance with retention times of as little as 2 days. In these systems odour can be controlled at the treatment tank as well as at spreading. Increasing the retention time during treatment will allow you to store the treated slurry for at least a month or more before the odour returns.

120 If a batch system is used much of the odour will be driven out into the air above the treatment tank when treatment starts.

Figure 4: Options for Slurry Treatment – Aeration



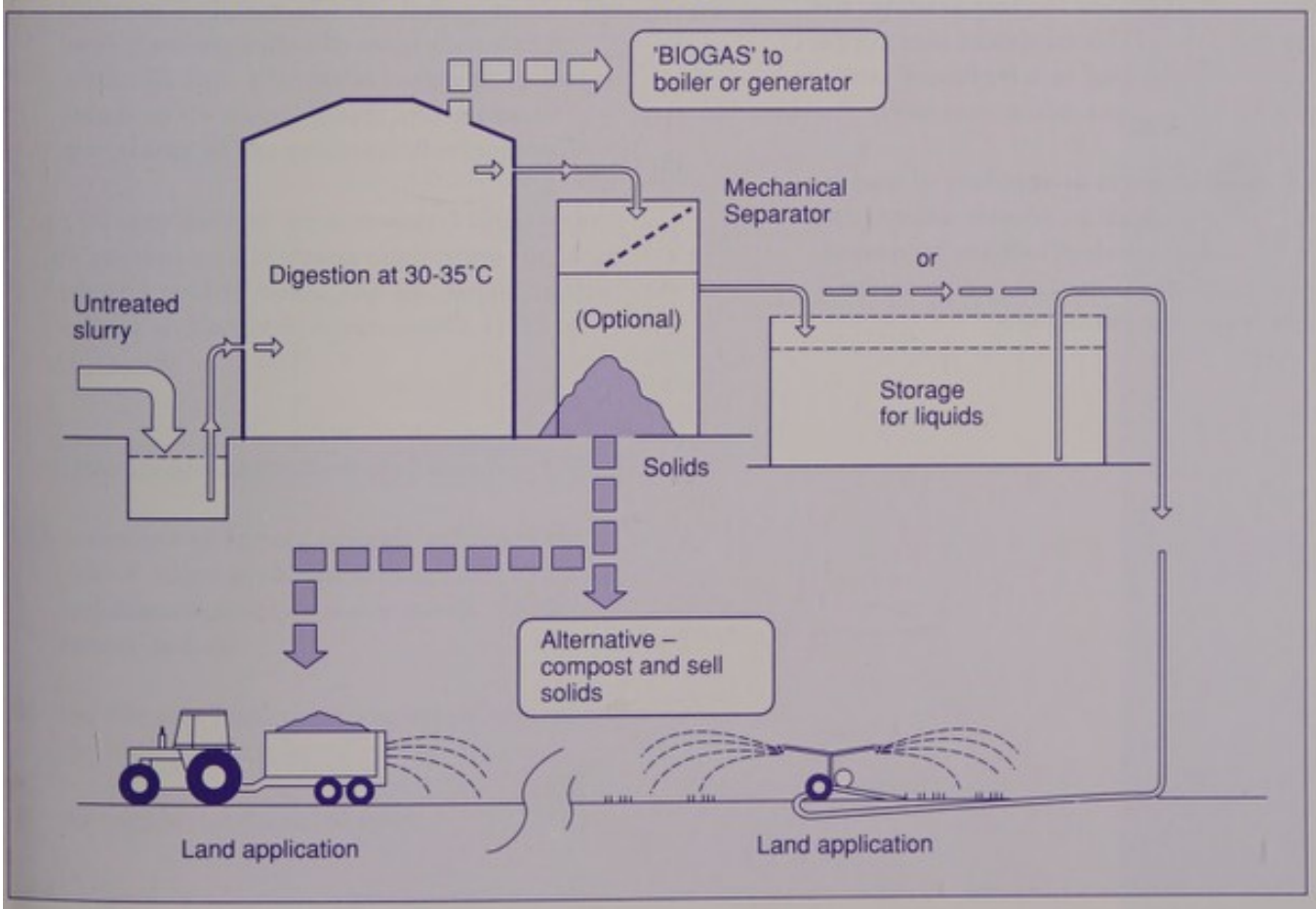
Anaerobic digestion

121 In a properly designed and run system, the odour emitted during and after spreading anaerobically digested slurry will be reduced by up to 80% and it will be less offensive. The digested slurry can be stored for several months after it has been treated before offensive odours return.

122 Anaerobic digestion of livestock slurries involves using micro-organisms to turn the complex organic substances into less complex compounds. This process is done in the absence of oxygen and at temperatures normally between 30 and 35°C. The end products of digestion are biogas (a mixture of 60 to 70% methane and 30 to 40% carbon dioxide) and a stabilised treated slurry. The biogas may be used for heating or generating electricity. It is not necessary to separate the slurry before treatment. Performance of the digester is affected by:

- Temperature - below 25°C the digestion process is very slow.
- Dry matter content - 6 to 8% is the optimum.
- Retention time in the digester - the optimum time for pig slurry is 12 days; for cattle and poultry slurry it is 20 days.

Figure 5: Options for Slurry Treatment – Anaerobic Digestion



Treating odours by additives and other methods

123 Several kinds of additives are available that act in different ways and which are claimed to control odours. The main ones are: oxidising agents, deodorants which react with odorous compounds, masking agents, biological agents, feed additives and miscellaneous chemicals.

These additives vary in their effectiveness. Current evidence shows that they are not generally a long-term solution to reducing odour problems. However, additives may be useful as a short-term emergency treatment for a batch of slurry or a store which is causing a nuisance.

124 Electrolytic methods are also available for treating slurry. This treatment uses copper electrodes immersed in a treatment tank, and is claimed to reduce odour nuisance.

125 Ask manufacturers or suppliers of additives and other methods to provide independent proof of their product's ability to control odours when it is used according to the manufacturer's instructions.

Siting of Livestock Buildings, Manure and Slurry Stores

Introduction

126 When you are planning the location of new livestock buildings or waste storage facilities or extensions or alterations to existing structures, it is essential to consider the risk of odours and noise causing nuisance. By law you need to get planning permission for livestock buildings and any structures intended to contain slurry or sewage sludge sited within 400m of the boundary of protected buildings such as houses or schools.

For livestock buildings, slurry stores and sewage sludge facilities which do not require planning permission under the Town and Country Planning General Development Order 1988, a prior notification system is now in force. You must notify the local planning authority of such developments. The local planning authority must then decide within 28 days whether it wishes to approve details of the siting, design and external appearance of the proposed development.

You may need an environmental assessment in support of a planning application for large pig and poultry units. The legislation on this subject is described in paragraphs 11-13 of this Code.

Factors affecting odour problems

127 A number of factors strongly influence the risk of odour problems arising from livestock buildings, manure or slurry stores. These factors include:

- the distance from neighbouring properties and the local topography;
- the number and type of stock;

- the prevailing wind direction in relation to neighbouring properties;
- the management of the livestock and housing system used;
- the type and size of slurry or manure store and the way in which it is managed;
- the type of feed used.

The distance of a site from a potential complainant is very important as odours are diluted in the atmosphere. The longer the distance, the more the odour will be diluted by dispersal. However, distance alone is often not enough to avoid odour nuisance and it is important to take the other factors into account.

128 Good management of livestock housing and manure stores which takes account of the factors outlined in Sections 3 and 4 of this Code will reduce potential odour problems.

129 A number of factors have a large effect on the odour concentration downwind and on the direction of dispersal. Strong wind mixes the air and increases dilution, so exposed sites may aid odour dispersal. The frequency and distribution of wind direction and wind speeds can affect the site chosen, so that odours are carried away from housing. You may need specific advice on weather influences such as wind direction, atmospheric stability and odour dispersal.

130 Woodlands and shelter belts can act as barriers and help odour dispersal. Shelter belts and plantations must be correctly laid out with trees spaced to allow 40 to 50% of the wind to pass through them. Get advice on a suitable layout and the best types of tree to plant.

Siting of existing livestock units

131 A large number of existing livestock units and existing waste storage facilities are situated close to houses and similar properties. It is important to follow the advice given in this Code to help reduce potential odour problems in such cases.

Government guidance to local planning authorities requires them to consider carefully applications for new housing development near existing livestock units. Where farmers are made aware of such proposals, they may wish to draw potential odour problems to the local planning authority's attention.

Siting new livestock units

132 Building new livestock units and their associated storage facilities in close proximity to housing can cause particular problems. Siting of such new units should take account of the factors outlined in paragraphs 127-130. Paying attention to these factors may also help you to obtain local authority planning approval, when necessary, for the siting of new units.

PART C.
SMOKE POLLUTION

General Principles

133 This part of the Code deals with the risk of causing air pollution by smoke from the burning on agricultural and horticultural premises of carcases and waste materials arising from agriculture.

In agriculture, dark smoke and smoke nuisance are most frequently caused by burning waste materials in the open or in unsuitable equipment.

134 Under the Clean Air Acts 1956 or 1968 it is an offence to burn any material which produces dark smoke unless an exemption applies (paragraphs 14-16). Part III of the Environmental Protection Act 1990, which relates to statutory nuisances, also applies (paragraphs 7-10). Certain prescribed processes are subject to specific controls under the Environmental Protection (Prescribed Processes and Substances) Regulations 1991 (paragraph 18).

135 Minimise the need to burn waste materials by:

- Firstly, reducing the use of materials if possible.
- Secondly, recycling materials where appropriate.
- Thirdly, using alternative environmentally acceptable methods of disposal wherever this is practicable, as set out in Sections 11 to 16.

136 Where burning cannot be avoided, Sections 11 to 17 of this Code give advice on methods of burning which avoid producing dark smoke or smoke nuisance.

137 Make regular and frequent assessments of the appearance and odour of smoke produced when burning waste materials in the open. If dark smoke is emitted or if the smoke is likely to cause a nuisance take action immediately to put the problem right.

Dark smoke

Smoke is finely divided particles of matter suspended in the air as a visible cloud. Dark smoke can arise from incomplete combustion of organic compounds.

Dark smoke production will be avoided if the temperature is high enough for ignition and if enough oxygen is available to keep the material burning at this temperature for long enough for combustion to be completed.

Measuring of dark smoke

The darkness of smoke from chimneys can be measured by comparing its shade with a graduated scale. For the purpose of this Code the Ringelmann Chart should be used as described in British Standard 2742 – Use of Ringelmann and Miniature Smoke Charts. This scale starts at 0 and increases up to a maximum of 5. Dark smoke is defined as 2 or more on the Ringelmann Chart and represents 40% obscuration.

Reducing the Volumes of Waste Materials for Disposal

Reducing waste

138 Using materials, packaging and equipment carefully can extend their useful life and reduce the amount of waste produced. Using suitable machinery and regularly maintaining it will reduce wear and prolong the useful life of items such as tyres.

139 Take waste disposal into account when choosing products to bring on to the holding. Wherever practicable, choose those methods, equipment and husbandry practices which give extended life and produce relatively low amounts of waste for disposal.

Recycling

140 You should recycle wastes on the holding by re-using materials wherever practicable. Some wastes can also be recycled by specialist operators. For this, different waste materials usually need to be sorted out, and stockpiled in good condition for them to be collected or delivered to the operator. Some local authorities and commercial companies also run recycling programmes.

141 Recycling straw by processing it into added value products can also be considered as good practice as long as the processes are controlled to avoid causing water pollution and producing odours and harmful gases.

Ease of disposal

142 If packaging and disposable materials for crop protection, mulching or crop storage are brought onto the holding, you should consider how easy it is to dispose of the waste. If possible choose materials which can be disposed of safely and economically without burning them. Consider using materials which biodegrade after they have been used.

143 Only burn materials which cannot practically be disposed of in any other way, which burn easily and which do not produce dark smoke or poisonous by-products when burnt under suitable conditions.

144 Ask the local Waste Collection and Disposal Authority about facilities for the disposal and collection of difficult wastes.

Plastic Materials

Introduction

145 Do not burn plastics in the open on agricultural holdings because this can cause large amounts of dark smoke and poisonous by-products which can be extremely harmful to health.

146 If you burn plastics in an incinerator, the installation may require authorisation by the local authority under Part I of the Environmental Protection Act 1990 (paragraph 185).

Repeated use of plastics

147 Consider reusing plastic materials on the farm or holding. If an item can be used several times before it becomes unserviceable, the quantity of material which needs to be disposed of will be greatly reduced.

148 To maximise recycling take care when handling and using plastics. Use suitable equipment and methods of handling to make sure that the plastic item is not damaged. Carefully reclaim and re-use items such as crop covers for mulching.

Alternative uses

149 If a plastic material cannot be re-used for its original purpose, try hard to make use of it for other things. However, never use containers that have held agricultural chemicals and persistent, poisonous or harmful substances for any other purpose. (See paragraph 171 of the Code of Practice for the Safe Use of Pesticides on Farms and Holdings).

Recycling

150 Recycle polythene materials using specialist recycling companies. Suitable items include:

- silage bags and sheets
- polythene inners from fertiliser "big bags"
- 50 kg fertiliser sacks
- pallet covers
- polythene covers from greenhouses

151 Materials for recycling should be clean and free from soil. Keep different types of items separate. Store the material in one safe place ready to be collected.

Choosing materials

152 When choosing plastic materials to use in crop husbandry, if recycling is not practical, then choose those materials which are biodegradable. Biodegradable plastic materials are likely to be unsuitable for recycling.

153 If plastic items such as plant pots or trays are re-used, their life can be increased by choosing more durable products. This reduces waste. If returnable items are thrown away because of their appearance, using a more durable type of plastic, a different colour or different type of returnable container may enable each unit to be used more times.

154 Save plastics which cannot be recycled and dispose of them to the local authority or commercial licensed landfill sites, or incinerators.

Containers contaminated by pesticides

155 Paragraphs 171-180 of the Code of Practice for the Safe Use of Pesticides on Farms and Holdings gives details of preferred disposal methods and all precautions to take when disposing of or burning these containers. The Code has a statutory basis under Part III of the Food and Environment Protection Act 1985 and should be read by all farmers.

Under the Clean Air (Emission of Dark Smoke) (Exemption) Regulations 1969, dark smoke emitted by the burning of containers which are contaminated by any pesticide or by any toxic substance used for veterinary or agricultural purposes is exempt from the prohibition in Section 1 of the Clean Air Act 1968 **provided that the following conditions are satisfied:**

- there is no other reasonably safe and practicable method of disposing of the matter;
- the burning is carried out in such a manner as to minimise the emission of dark smoke;
- the burning is carried out under the direct and continuous supervision of the occupier of the premises concerned or a person authorised to act on their behalf.

There are few circumstances where other practicable methods of disposal cannot be found. Many specialist contractors now offer well-managed disposal services.

Part III of the Environmental Protection Act 1990, which relates to statutory nuisances, also applies if you do resort to burning (paragraphs 7-10).

Dark smoke risk

156 Rubber tyres produce large amounts of dark smoke and may give off poisonous substances when burnt in the open. Do not burn tyres and other rubber materials on agricultural holdings.

157 Ask tyre suppliers to take away old tyres from the premises when new ones are fitted to agricultural machinery.

Disposal off the farm

158 Dispose of large numbers of tyres to specialist waste removal operators or contractors. Small quantities of tyres may be accepted by licensed local authority sites, but you may need to get special permission from the site operator.

CODE OF GOOD AGRICULTURAL PRACTICE 13

Waste Oils

Sources

159 Waste oil comes from the servicing of agricultural machinery. The main types of waste oil are used lubricating oil from engines and oil from hydraulic systems.

Recycling

160 Collect used oil drained from machinery during routine servicing and store it in suitable leak-proof containers. Store surplus oil in a central store and dispose of it to waste oil dealers. Different types of oil should be kept separate.

NOTE: NEVER DISPOSE OF WASTE OIL INTO SOAKAWAYS, WATERCOURSES, DRAINS OR SEWERS AS IT CAN CAUSE SERIOUS WATER POLLUTION.

Waste oil burners

161 You can burn waste oils for heating on farms provided that you obtain approval for the installation of the burner to be used from the local authority Environmental Health Department. Under Part I of the Environmental Protection Act 1990 such burners must comply with the Secretary of State's Guidance Note for waste oil burners less than 0.4 MW and waste oil or recovered oil burners less than 3 MW net rated thermal input (paragraph 18).

NOTE: THE DESIGN AND CONSTRUCTION OF NEW OR SUBSTANTIALLY ENLARGED OR RECONSTRUCTED STORAGE FACILITIES FOR STORING MORE THAN 1500 LITRES (330 GALLONS) OF OIL TO BE BURNT FOR AGRICULTURAL PURPOSES MUST COMPLY WITH THE CONTROL OF POLLUTION (SILAGE, SLURRY AND AGRICULTURAL FUEL OIL) REGULATIONS 1991. THE CODE OF GOOD AGRICULTURAL PRACTICE FOR THE PROTECTION OF WATER GIVES FURTHER ADVICE.

Animal Carcases

Introduction

162 There are a number of ways to dispose of animals that die on the farm. The best way is to send them to a licensed knackerman, licensed landfill site or licensed incinerator operator. If a notifiable disease is involved, disposal is subject to the MAFF State Veterinary Service animal health controls.

163 Disposal methods on the farm, such as burial, incineration or burning in the open may cause water or air pollution, particularly if they are not done correctly.

164 The Code of Good Agricultural Practice for the Protection of Water gives advice on how to avoid causing water pollution from burying carcases. Consult the National Rivers Authority if there is any doubt over the suitability of a proposed burial site.

Never dispose of carcases in or near watercourses, boreholes or springs. Apart from being prosecuted for causing water pollution, there is a serious risk of you spreading disease to animals on neighbouring farms.

Notifiable diseases

165 If you think that a notifiable disease has caused ill health or death you must report it to the Divisional Veterinary Officer at the local Animal Health Office of the Ministry of Agriculture, Fisheries and Food or Welsh Office Agriculture Department. Carcases should be available for post-mortem examination in these cases. Always consider the possibility of anthrax if death is sudden or unexplained.

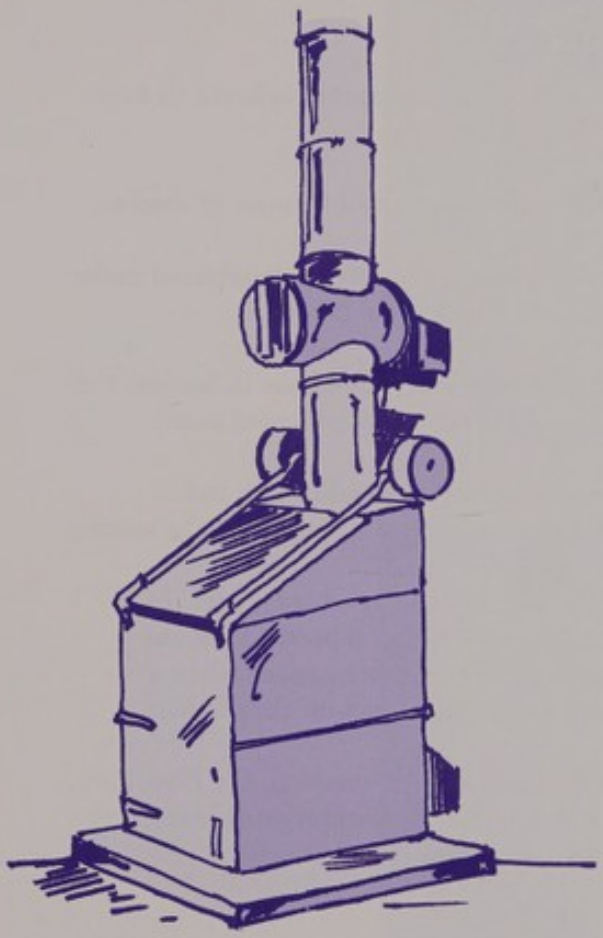
Incineration

166 If animal carcases are burnt on farm it should be done in an incinerator wherever possible. The incinerator used should be fitted with a secondary combustion chamber so that high temperatures can be achieved throughout incineration to give complete combustion of all products. Get advice about siting, choosing, installing and running incinerators, chimneys, associated buildings and carcase storage facilities.

If you intend to install an incinerator designed for or to be operated at loading rates of more than 50 kg/hour you must first get approval for the installation of the appliance in question from the local authority Environmental Health Department under Part I of the Environmental Protection Act 1990. It must comply with the Secretary of State's Guidance Note on animal carcase incineration processes under 1 tonne an hour (paragraph 18).

For units below 50 kg/hour the Clean Air Act 1956 which prohibits the emission of dark smoke from chimneys and Part III of the Environmental Protection Act 1990 which relates to statutory nuisances still apply (paragraphs 14-16 and 7-10).

167 Incinerate dead animals as soon as possible. Do not exceed the design loading rate of the incinerator at any time.



Open burning

168 Using suitable on site incineration equipment is strongly preferred to open burning.

169 Under the Clean Air (Emission of Dark Smoke) (Exemption) Regulations 1969, emission of dark smoke, caused by the burning of carcases of animals or poultry which:

- have died or are reasonably believed to have died because of disease;
- or have been slaughtered because of disease;
- or have been required to be slaughtered under the Animal Health Act 1981;

is exempt from the prohibition in Section 1 of the Clean Air Act 1968, provided that:

- there is no other reasonably safe and practicable method of disposing of the matter;
- and the burning is carried out under the direct and continuous supervision of the occupier of the premises concerned or a person authorised to act on their behalf.

The Environmental Protection Act 1990, Part III, which relates to statutory nuisances, still applies (paragraphs 7-10).

If burning is essential, follow the general precautions on open burning given in paragraph 196. A shallow pit should be dug with cross trenches to provide a good air supply to the base of the fire. Use only dry fuels which are not likely to produce dark smoke and which burn easily. Do not use tyres or liquids as a fuel and do not use the fire to dispose of other materials not recommended for burning. Gas fired equipment may be used to start the fire. Place the primary fuel in the base of the fire and place the carcases on top. Use enough fuel to ensure that the carcases are completely burned. Do not overload the fire with carcases. Burning should begin as early in the day as possible.

Fuels Produced on the Farm

Introduction

170 Straw and other crop residues can be used as animal feed, for animal bedding and, where markets exist, for paper pulp and for manufacturing board. Excess amounts of straw can be sold to other agricultural holdings or to straw merchants. Residues can be mixed into the soil. The burning of crop residues will be banned before the 1993 harvest unless specifically exempted by the legislation (paragraph 186).

Straw and wood as fuel

171 Straw is a useful energy source and may provide a cost effective and environmentally acceptable fuel for furnaces that are designed to burn it. Other crop residues, wood and litter from stock can also be used as alternative fuels.

Choosing equipment

172 Straw or wood fuelled furnaces should be properly designed for the purpose and have facilities to give adequate control over combustion in order to prevent the production of dark smoke. If units of over 400 kW (0.4 MW) rated thermal input are used, you must obtain approval for the installation of the appliance in question from the local authority Environmental Health Department under Part I of the Environmental Protection Act 1990. It must comply with the requirements of the Secretary of State's Guidance Notes on either straw combustion processes between 0.4 and 3 MW net rated thermal input or wood combustion processes between 0.4 and 3 MW net rated thermal input, depending on the fuel used (paragraph 18).

Chimney height approval may be required under Section 6 of the Clean Air Act 1968.

173 Equipment with a thermal input of less than 400 kW (0.4 MW) is still subject to the provisions of the Clean Air Act 1956 which prohibits the emission of dark smoke from chimneys (paragraphs 14-16). Part III of the Environmental Protection Act 1990, which relates to statutory nuisances, also applies (paragraphs 7-10).

Using and maintaining equipment

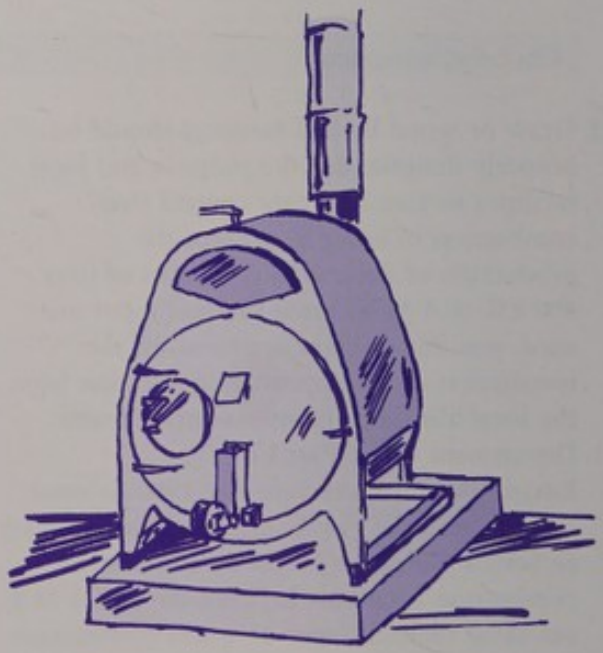
174 Efficient burning of fuel will prevent the production of dark smoke. It is important to choose suitable equipment and operate it correctly. Automatic fuelling equipment that is properly set up and maintained can provide the most stable operating conditions and will automatically provide the heat that is needed at any particular time.

175 Many boilers and heaters have a large chamber and are designed to burn a single charge of fuel. These units should be designed so that the supply of primary and secondary air can be controlled to give efficient burning of the large charge of fuel without producing dark smoke.

176 Do not try to prolong the burning of a large charge of fuel by reducing the air supply. This will give inefficient combustion and cause dark smoke. With large charge boilers, if heat is needed over a long period, they should be used in conjunction with water-based thermal storage systems or the boiler itself should have a large water content so that it stores the heat.

177 To avoid producing dark smoke only burn fuels that the burner is designed for and which are recommended by the manufacturer. Do not burn animal carcases, plastics, tyres or other rubber materials in straw or wood burners. Store fuel for the burner under cover. Always make sure that the fuel is dry. Adjust the primary and secondary air supply to give efficient combustion and minimum dark smoke emission.

178 Get burning equipment cleaned and serviced regularly. Scrape or brush internal heat transfer surfaces to keep them in a clean condition and free from char and other deposits. Do not carry out uncontrolled burning of a charge of fuel in the furnace to remove deposits of char from the internal surfaces of the boiler, as this is likely to produce dark smoke.



Using litter from poultry and other animals as a fuel

179 If litter from poultry or animals is to be used as a fuel in heating appliances for space heating or agricultural processes, specialised equipment designed for this type of fuel should be used. Automatic fuelling should be part of the system. Air supply for primary and secondary combustion should be controlled to give high combustion efficiency.

180 The plant should be operated in a way which minimises the emission of dark smoke. Monitoring the appearance and smell of the flue gases should be carried out at least once a day.

181 If a unit of over 400 kW (0.4 MW) net rated thermal input is used you must get approval for installation of the appliance in question from the local authority Environmental Health Department under Part I of the Environmental Protection Act 1990. It must comply with the requirements of the Secretary of State's Guidance Note on poultry litter combustion processes between 0.4 and 3MW net rated thermal input.

182 Equipment with a thermal input of less than 400 kW (0.4 MW) still comes under the provisions of the Clean Air Act 1956 which prohibits the emission of dark smoke from chimneys (paragraphs 14-16). Part III of the Environmental Protection Act 1990, which relates to statutory nuisances, also applies (paragraphs 7-10).

183 If you wish to install straw, wood or animal litter fuelled heating systems you will normally need professional help to design such an installation.

Other Waste Materials

Introduction

184 Under the Clean Air Act 1956 or 1968 it is an offence to burn waste materials if the burning produces dark smoke (paragraphs 14-16). Part III of the Environmental Protection Act 1990, which relates to statutory nuisances, also applies (paragraphs 7-10).

185 If waste materials are to be burnt in an incinerator which is designed or operated at rates of more than 25 kg/hr, you must get approval for the appliance in question from the local authority Environmental Health Department, under Part I of the Environmental Protection Act 1990. It must comply with the Secretary of State's Guidance Note on general waste incineration processes under 1 tonne an hour.

Crop residues

186 The burning of cereal straw and stubble, the residues of field peas and beans harvested dry, linseed and oil seed rape is controlled by the Crop Residues (Restrictions on Burning) (No 2) Regulations 1991. Included in these Regulations are requirements about: the area to be burned, firebreaks, distances from vulnerable objects such as trees, hedges, buildings, days of the week and times for burning, supervision and other safety requirements, notifying relevant authorities and neighbours, and incorporating ash after burning. Guidance Notes on the Regulations were issued to all farmers in England and all cereal producers in Wales in 1991 .

187 The Clean Air Act 1968, the Health and Safety at Work etc Act 1974, the Highways Act 1980 and the Environmental Protection Act 1990 also apply.

188 After 1992, there will be a general ban on the burning of crop residues. Exemptions will be granted for the burning of residues from lavender, hops, potatoes, herbage seed and reeds. There may be other exemptions in certain circumstances and the above controls (or equivalent) will continue to be used.

Wood waste

189 Wood waste is produced during forestry operations, orchard pruning, demolition of buildings, estate maintenance, and building construction and maintenance.

190 Larger items of timber and waste wood can be used as firewood. Therefore, it is preferable to process these into burnable lengths for domestic use or dispose of them to specialist dealers in this material. Arrangements with contractors for forestry work and woodland clearance should include an agreement for the disposal of any waste wood that is produced.

191 Trimmings from woodland or orchard pruning may be converted to wood chips where practicable. If they have to be burned, follow the guidance in Section 17.

192 Under the Clean Air (Emission of Dark Smoke) (Exemption) Regulations 1969, emission of dark smoke caused by the burning of timber and any other waste matter (other than natural or synthetic rubber, or flock or feathers), which results from the demolition of a building or clearance of a site in connection with any building operation or work of engineering construction (within the meaning of Section 176 of the Factories Act 1961), is exempt from the prohibition in Section 1 of the Clean Air Act 1968, provided that the following conditions are satisfied:

- there is no other reasonably safe and practicable method of disposing of the matter;
- **and** the burning is carried out in such a manner as to minimise the emission of dark smoke;
- **and** the burning is carried out under the direct and continuous supervision of the occupier of the premises concerned or a person authorised to act on their behalf.

If in doubt, get advice from the Environmental Health Department of the local authority before burning any waste.

Paper sacks and other packaging

193 Where practicable, paper sacks and other packaging that are not contaminated by pesticides should be stockpiled and sent for recycling, for example to a board mill. If recycling is not possible, burn paper sacks carefully in small quantities as long as this does not cause a nuisance (paragraphs 7-10).

Litter from poultry and other animal litter

194 Because litter from poultry or other animals varies in its moisture content and composition, it is difficult to burn except under closely controlled conditions. Uncontrolled burning will produce dark smoke and odour. Therefore, do not burn poultry and animal litter in the open.

Burning in the Open

Good practice

195 Under the Clean Air Act 1968 it is an offence to burn any material in the open on trade premises if the burning produces dark smoke (paragraphs 14-16). Part III of the Environmental Protection Act 1990, which relates to statutory nuisances, also applies (paragraphs 7-10).

196 If burning in the open is the only practicable method of disposal, take the following precautions to prevent producing dark smoke or causing a nuisance:

- Do not burn plastics, rubber, tyres or other materials known to produce dark smoke.
- Avoid burning if it will cause a nuisance to nearby residential areas.
- Materials should be dry and have a low moisture content. Do not burn green vegetation.
- Keep fires small and continually add combustible material, minimising the depth of the combustion area. Do not pile material high on fires.
- Minimise the quantity of incombustible material which is added to the fire. Wherever possible keep incombustible materials separate from the materials to be burnt.
- For better combustion, agitate the base of the fire to improve the air supply.
- If a fire produces dark smoke, don't add any more material that burns slowly.

Safety precautions

197 Also take the following precautions to minimise fire hazard:

- Build fires well clear of houses, other buildings, overhead cables or flammable materials such as stacks of straw, trees, hedgerows, ripe cereals or stubble.
- Fires must not be lit near a public road. If the fire, or smoke from it, causes injury, interruption or dangers to road users, this may be an offence under the Highways Act 1980.
- Do not burn materials in the open, when it is very windy or in a period of drought.
- Only light fires downwind of public highways, houses, other buildings or inflammable materials, so that the wind will carry any sparks and smoke away from them.
- Tell the local authority Fire Service before starting any substantial burning operations.
- Have a fire extinguisher and a supply of water from a mains supply or bowser on hand in case of an emergency.
- Burning should be carried out under direct and continuous supervision of the occupier of the premises or a person authorised to act on their behalf. The only exception to this should be if there is an emergency elsewhere on the farm requiring immediate attention.
- Put out all fires before you leave them.

PART D.
GREENHOUSE GASES

Greenhouse Gases

Introduction

198 This Section describes the greenhouse gases emitted by agricultural systems and some steps which can help limit the amount of gases that are released.

199 Climate change is one of the biggest environmental problems now facing the world. The sun is the earth's source of heat. Some of the sun's energy is absorbed by the surface of the earth. In turn the earth radiates the energy back into space as infra-red radiation. Some of the gases in our atmosphere can absorb this infra-red radiation, and so prevent it leaving the earth and its atmosphere. This acts as a blanket and makes the earth warmer. This is similar to the effect of glass in a greenhouse, which lets the sunlight in but stops some of the radiated heat from escaping. The gases which cause this effect are therefore called greenhouse gases. Most of these occur naturally in the atmosphere, and produce a natural greenhouse effect which keeps the temperature of the earth about 30°C higher than it would otherwise be.

The greenhouse gases

200 Many gases can absorb infra-red radiation to some extent. The most important greenhouse gases are water vapour, carbon dioxide, methane, nitrous oxide, and chlorofluorocarbons (CFCs) (Figure 6). The natural greenhouse effect is essential to life but human activity causes the release of extra greenhouse gases. It is believed that these extra gases will increase the greenhouse effect, causing the earth's surface to warm up even more which could have major effects on the world. Changes in sea level could cover low-lying coasts, and changes in climate and

weather could damage agriculture and natural systems. Because some of the greenhouse gases last for a long time in the atmosphere, it is important that any action to reduce emissions of greenhouse gases is taken as early as possible. Negotiations are taking place between governments to reach an international agreement on targets and ways to reduce the amount of greenhouse gases that are being produced. In advance of any international agreements, it is best to take steps now to reduce emissions of greenhouse gases. The UK has set itself a target, if other countries take similar action, of returning UK emissions of carbon dioxide back to 1990 levels by 2000.

Figure 6: Contribution of the main greenhouse gases from UK agriculture to global warming potential

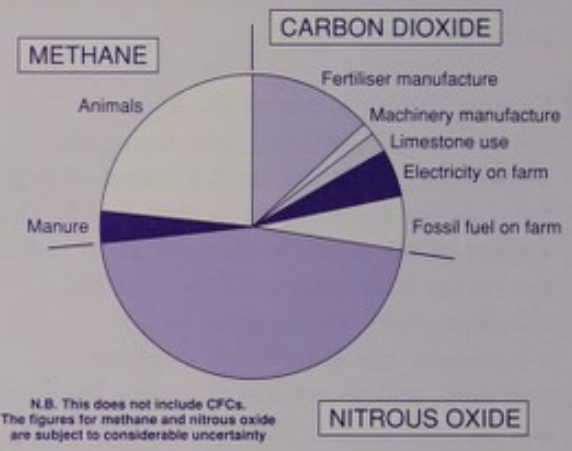


Figure 6 shows the relative importance of the three main greenhouse gases emitted by UK agriculture. In terms of global warming, methane is 11 times more powerful than carbon dioxide, and nitrous oxide is 290 times more powerful than carbon dioxide over a 100 year period. The amount of carbon dioxide produced during fertiliser and machinery manufacture is shown as a comparison, but this carbon dioxide is not produced by agriculture and, in the case of imported goods, it is produced outside the UK. Agriculture produces about 1% of the amount of carbon dioxide released in the UK (this does not include any contribution from emissions made during manufacture of fertilisers and machinery), 30% of the methane and 40 to 50% of the nitrous oxide emitted in the UK.

Reducing emissions

201 It is impossible to prevent all emissions of greenhouse gases from agriculture. There are, however, some methods that farmers can use to reduce the amount emitted, many of which will also save money.

Carbon dioxide

202 It is important not to confuse the carbon dioxide that is recycled within agriculture and the human and animal food cycle, with the permanent release into the atmosphere of fossilised carbon from fossil fuels and limestone. As crops grow, they absorb carbon dioxide from the atmosphere, but an equal amount is released to the atmosphere when the crop products are used as food for animals or people, so that agriculture cannot be considered a net consumer of carbon dioxide. However, if agricultural products are used as fuels instead of fossil fuels, there is a net reduction in the amount of carbon dioxide generated.

203 As well as by using fossil fuels, agriculture also contributes carbon dioxide from the breakdown of liming materials in the soil. Limestone is made from calcium carbonate which releases fossilised carbon dioxide into the atmosphere as it neutralises acidity in the soil.

204 The most effective way of reducing carbon dioxide emissions is to use energy more efficiently and to exploit alternative non-fossil fuels as sources of energy. Improvements in energy efficiency can reduce farm running costs. The following are important:

- Maintain engines by following the manufacturers recommendations. A 5 to 15% reduction in fuel consumption can be obtained by servicing air cleaners and fuel injectors regularly.
- Choose tractors and machinery that are suitable for the tasks they will be performing. Use the lowest powered tractor capable of doing the required job.
- Do not make unnecessary journeys and cultivation passes.
- Maintain fixed equipment such as grain driers, refrigerated stores and bulk milk tanks in good condition and operate them efficiently.
- Reduce heat loss from heated buildings. Unintentional ventilation of buildings can waste a lot of heat. Effective insulation of walls, roofs, and heating pipes can significantly reduce the amount of heat that is lost.
- Heated glasshouses, mushroom houses and polythene covered structures are major users of energy. Economise on fuel by precise control of the correct temperature regimes, using thermal screens and correct maintenance of boilers and burners.
- Consider the use of energy sources which are not fossil fuels. There are opportunities for using alternative energy sources, such as solar heating, heat pumps, straw burning boilers, biogas from manure digestion, wind and water power. These techniques may be cost effective especially when the amount of energy needed is consistent through the year. Each project needs firstly to be critically assessed for its capital, management and running costs. Further details of some of these possibilities are given in Section 15.

There are also potential commercial opportunities to sell the energy from such sources. Under the Non-Fossil Fuel Obligation, electricity supply companies are required to buy a proportion of their electricity from alternative energy sources.

- Large amounts of fossil fuel are needed to manufacture nitrogen fertilisers. Fertilisers should only be used at the rates suitable for the cropping situation. When calculating application rates, take into account any organic manures or sewage sludge applied to the land. Make sure that fertiliser spreaders are properly maintained and use suitable settings for different types of fertiliser.

Methane

205 The major source of methane loss in UK farming is from ruminant animals and stored slurry. Research is being done on modified diets for livestock that may minimise emissions, although in UK conditions it is unlikely that these will result in significant reductions. Installation of an anaerobic digestion system which makes use of methane produced from slurry (paragraphs 121 and 122) reduces methane losses to air.

Nitrous oxide

206 Nitrous oxide from farms comes from the reaction of nitrogen compounds in manures and soils especially in oxygen-free conditions. The most effective way for farmers to reduce releases of this gas is to avoid excess use of nitrogen fertiliser and manures and make sure that they are not applied to waterlogged soils.

Chlorofluorocarbons (CFCs)

207 Apart from their effect as greenhouse gases, CFCs may also cause the ozone layer around the earth to thin out. This allows more of the sun's ultraviolet-B radiation (UVB) to reach the earth's surface. This could have important economic and health effects as UVB radiation can lead to increased numbers of human eye disorders and skin cancer, as well as damaging crops, farm animals and wildlife.

208 CFCs are used in refrigeration equipment. Keep refrigeration equipment properly maintained to minimise the risk of leaks of refrigerant. Whenever such equipment is serviced, make sure that no refrigerant is lost. Do not allow unused equipment to deteriorate on site. Get a specialised contractor to take away the equipment and safely remove the refrigerant, so that it can be recycled or destroyed.

209 CFCs are also used in halon fire extinguishers which are often kept for use on electrical fires. When such extinguishers reach the expiry date marked on them or have been partly used, dispose of them through the manufacturer or a specialised contractor so that the halon can be recycled or destroyed.

APPENDIX

Further Reading

Odours

Environmental Protection Act 1990, Chapter 43. HMSO (ISBN 0-10-544390-5).

Town and Country Planning General Development Order 1988. SI 1988 No 1813. HMSO (ISBN 0-11-087813-2).

Town and Country Planning General Development (Amendment) (No 3) Order 1991. SI 1991 No 2805. HMSO (ISBN 0-11-015839-3).

Town and Country Planning (Assessment of Environmental Effects) Regulations 1988. SI 1988 No 1199. HMSO (ISBN 0-11-087199-5).

Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) Regulations 1991. SI 1991 No 324. HMSO (ISBN 0-11-013324-2).

The Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) Regulations 1991 - GUIDANCE NOTES FOR FARMERS. (Department of Environment, WOAD) February 1991.

Code of Good Agricultural Practice for the Protection of Water. MAFF 1991. PB0587. (Available free of charge from MAFF Publications, London SE99 7TP or telephone 081-694 8862).

Sludge (Use in Agriculture) Regulations 1989. SI 1989 No 1263. HMSO (ISBN 0-11-097263-5) as amended by the Sludge (Use in Agriculture) Regulations 1990. SI 1990 No 880. HMSO (ISBN 0-11-003880-0).

Code of Practice for Agricultural Use of Sewage Sludge. (Department of Environment) 1989 (£2.75).

British Standard 5502 Buildings and Structures for Agriculture, Part 50: 1989 Code of Practice for design, construction and use of reception pits and storage tanks for slurry. Part 33: 1991. Guide to the control of odour pollution. BSI.

Health and Safety at Work etc Act 1974, Chapter 37, HMSO (ISBN 0-10-543774-3).

Effluent Storage on Farms. Health and Safety Executive Guidance Note GS12 (May 81).

Slurry Storage Systems. Health and Safety Executive (Annex to AIC 1986/155).

Highways Act 1980. HMSO (ISBN 0-10-546680-8).

Planning Policy Guidance Note 7: The Countryside and the Rural Economy (PPG7) 1992. HMSO (ISBN 0-11-752585-5, £5.20)

Codes of Recommendations for the Welfare of Livestock - MAFF:

Pigs (1983)	PB0075
Cattle (1983)	PB0074
Domestic Fowls (1987)	PB0076

(Available free of charge from MAFF Publications, London SE99 7TP or telephone 081 694 8862).

Smoke Pollution

The Clean Air Act 1956. HMSO (ISBN 0-10-850282-1).

The Clean Air Act 1968 Chapter 62. HMSO (ISBN 0-10-546268-3), as amended by the Control of Smoke Pollution Act 1989 Chapter 17. HMSO (ISBN 0-10-541789-0).

The Clean Air (Emission of Dark Smoke) (Exemption) Regulations 1969. SI 1969 No 1263. HMSO.

The Environmental Protection (Prescribed Processes and Substances) Regulations 1991. SI 1991 No 472. HMSO (ISBN 0-11-013479-9, £3.85).

Secretary of State's Guidance Notes:

General waste incineration processes under 1 tonne an hour (PG 5/4 (91)). HMSO (ISBN 0-11-752397-6, £2.70).

Waste oil burners, less than 0.4 MW net rated thermal input (PG1/1 (91)). HMSO (ISBN 0-11-752407-7, £3.40).

Waste oil or recovered oil burners, less than 3MW net rated thermal input (PG 1/2 (91)). HMSO (ISBN 0-11-752405-0, £2.70).

Straw combustion processes between 0.4 and 3 MW net rated thermal input (PG 1/7 (91)). HMSO (ISBN 0-11-752401-8, £2.70).

Wood combustion processes between 0.4 and 3 MW net rated thermal input (PG 1/8 (91)). HMSO (ISBN 0-11-752406-9, £2.70).

Poultry litter combustion processes between 0.4 and 3MW net rated thermal input (PG 1/9 (91)). HMSO (ISBN 0-11-752399-2, £2.70).

Animal carcase incineration processes under 1 tonne an hour (PG 5/3 (91)). HMSO (ISBN 0-11-752383-6, £2.70).

Production of compost for mushrooms (PG 6/30(92)). HMSO (ISBN 0-11-752611-8, £2.75).

Code of Practice for the Safe Use of Pesticides on Farms and Holdings 1990. HMSO (ISBN 0-11-242892-4, £5.00).

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The Crop Residues (Restrictions on Burning) (No.2) Regulations 1991. SI 1991 No 1590. HMSO (ISBN 0-11-014590-9, £1.00).

Guidance Notes to Farmers When Burning Crop Residues. PB0575 MAFF 1991. (Available free of charge - MAFF Publications, London SE99 7TP or telephone 081 694 8862).

Greenhouse Gases

This Common Inheritance. Britain's Environmental Strategy. HMSO 1990 (ISBN 0-10-112002-8, £24.50)

Climate change - The IPCC Scientific Assessment, Edited by J.T. Houghton, G.J. Jenkins & J.J. Ephraums. Published for the Intergovernmental Panel on Climate Change by Cambridge University Press, Cambridge, 1990. (ISBN 0-521-40720-6)

The potential effects of climate change in the United Kingdom.
United Kingdom Impacts Review Group - Department of Environment
1991. HMSO. (ISBN 0-11-752359-3, £8.50)

The Ozone Layer. Booklet published by Department of Environment, 1991.

Notes:
1. Some of the literature under each main heading may also be relevant under other headings.
2. Only the main amendments to the legislation have been included.

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