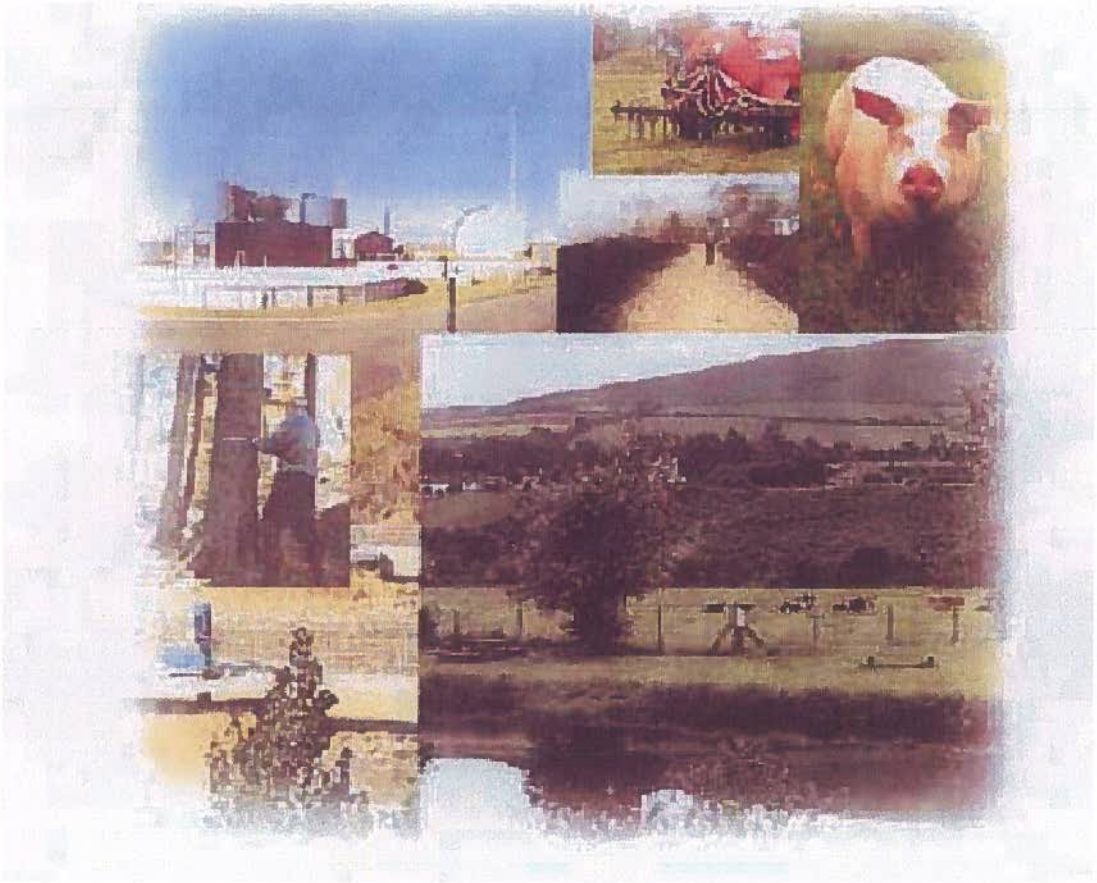
AN ROINN COMHSHAOIL AGUS RIALTAIS ÁITIÚIL
DEPARTMENT OF THE ENVIRONMENT AND LOCAL GOVERNMENT

CODES OF GOOD PRACTICE

FOR THE USE OF BIOSOLIDS IN AGRICULTURE

Guidelines for Farmers



FEHILY TIMONEY & COMPANY

CONSULTANTS IN ENGINEERING & ENVIRONMENTAL SCIENCE

contents

APPENDICES

part one

What you should know about the Code and the use of Biosolids in agriculture

What is Biosolids?

Biosolids is the organic by-product of urban wastewater treatment which, by being treated to an approved standard, can be used beneficially as a fertiliser/soil conditioner in agriculture.

Purpose of the Code

The objective of this Code of Good Practice for the Use of Biosolids in Agriculture is to set guidelines for the treatment and use of wastewater sludge. Use of wastewater sludge in agriculture is regarded as the most sustainable method of sludge management. The Code of Good Practice has been designed using the best scientific data available to ensure that the use of Biosolids in agriculture will:

- be compatible with good agricultural practice
- not pose a risk to human, animal or plant health
- maintain the integrity of the soil ecosystem
- avoid water pollution
- avoid air pollution
- minimise public inconvenience.

Background to preparation of the Code

Council Directive 91/271/EEC concerning urban wastewater treatment requires treatment of wastewater discharging from all major population centres by 31 December 2005 and places a ban on disposal of sludge to sea by 31 December, 1998. Because of this, the volume of sludge arising from wastewater treatment in Ireland is set to grow substantially. The Directive further encourages use of wastewater sludge wherever appropriate.

The recommendations in this Code of Good Practice are designed to reflect the requirements of relevant legislation at both European and Irish levels; a list of this legislation is provided in Appendix 2.

This Code of Good Practice will complement the *Code of Good Agricultural Practice to Protect Waters from Pollution by Nitrates*, published in July 1996 by the Department of Environment and the Department of Agriculture, Food and Forestry.

What is in the Code?

This Code advises farmers in relation to:

- liaising with the Biosolids producer
- guaranteeing treatment of Biosolids to achieve pasteurisation
- nutrients present in Biosolids
- suitability of spreadlands for Biosolids application
- storage of Biosolids
- best spreading practices in relation to Biosolids application
- nutrient management planning

Where does the Code apply?

The Code of Good Practice applies in all parts of the country and is intended to permit the safe and beneficial use of Biosolids in agriculture nationally.

Status of the Code

This is a mandatory Code, produced in response to Directive 86/278/EEC on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture. Its intention is to promote sustainable agricultural use of the organic matter and nutrients contained in Biosolids. It is designed specifically to assist farmers in understanding and facilitating the obligations of the Biosolids producer under Irish and European legislation.

Why should Biosolids be used in agriculture?

The chain of nutrient recycling is integral to all natural processes. That chain begins in the soil, when plants take up nutrients and transform them into tissue. Plant tissue is consumed by humans, either directly in the form of fruits, vegetables and cereals, or indirectly in the form of dairy and meat products. Not all the nutrient value contained in food is used by humans. The unused portion of nutrients enters the wastewater stream and most is transferred to the sludge which results from the process of wastewater treatment. The natural cycle is completed when the nutrients are returned to the soils, replenishing those removed by the plants. Returning the nutrients transferred via food from rural to urban areas to rural agricultural land also completes the urban/rural cycle. It is for this reason that use of Biosolids in agriculture is considered the most sustainable option of sludge management.

What are the benefits for farmers?

Biosolids is rich in both the macro and micro nutrients required for healthy plant and animal growth. It contains nitrogen, phosphorus and potassium. It can also provide magnesium, zinc, copper, calcium, nickel, boron, manganese and cobalt.

Because of its organic matter content, Biosolids can provide good tilth to heavy soils and improve the structure of sandy soils. By improving the relationship between soil microorganisms and the plant root, the addition of Biosolids to soil can assist plants to attain full health at optimal growth rates.

Potential constraints on agricultural use of Biosolids

The everyday activities of man in modern society result in the discharge of many substances to the wastewater stream. Untreated wastewater sludge may contain:

- bacteria, viruses, parasites and other potentially disease-causing microorganisms
- heavy metals, sources of which include pipework materials, storm water run-off from roads, industrial processes and cosmetics
- a variety of organic micropollutants, arising principally from industrial processes, detergent use and irresponsible waste disposal.

These potential contaminants can be either eliminated or substantially reduced by:

- environmental legislation
- prevention/limitation of discharges to sewer
- treatment of wastewater sludge.

Only wastewater sludge which has undergone one of the recommended treatment processes to attain an adequate standard can be classified as Biosolids (see Part 2, Paragraph 1.6). The precautionary principle is observed by limitation and control of Biosolids application to land.

Control of discharges to sewer is most desirable for the purposes of producing a quality Biosolids product. Maximisation of sewage effluent quality is regarded as central to the sustainability of the Biosolids use programme.

Who is the Biosolids producer?

A Local Authority, wastewater treatment plant operator and any other organisation involved in treating wastewater sludge to a standard sufficiently high for its safe and beneficial use, can be regarded as a Biosolids producer.

How does the farmer obtain Biosolids?

If you are interested in using Biosolids as a fertiliser and are not aware of Biosolids use programmes in your locality, contact your Local Authority.

Remember

- Biosolids is a valuable fertiliser. Every dry tonne of Biosolids is worth approximately £27 in terms of its nutrient content.

part two

Liaising with the Biosolids producer

1. Guarantee of quality product

General

1.1 You will want to feel confident that any product used on your farm will do its job efficiently, effectively and safely. You must therefore be satisfied that the Biosolids product is of a consistently high quality with a defined range of constituents.

1.2 The Biosolids producer will:

- guarantee that the Biosolids has been treated sufficiently to attain defined chemical, physical and microbiological standards
- provide a range of information pertaining to the Biosolids product whenever requested.

1.3 A Biosolids producer setting up a programme of use will survey the fertiliser requirements of farmers in his/her locality. The more contact you have with the Biosolids producer at this set-up stage, the greater will the Biosolids producer's ability be to choose a sludge treatment process to meet your fertiliser needs.

Treatment requirements

1.4 If sludge arising from wastewater treatment is to be used as a fertiliser in an agricultural setting, it must receive the appropriate treatment to ensure that it attains the standards necessary to be classified as Biosolids. The Biosolids product may be spread on agricultural land in accordance with the requirements of this Code of Good Practice.

1.5 Untreated wastewater sludge should not be landspread or injected into soil.

Microbial reduction

1.6 Treatment of sewage sludge by one or more of the processes described in Appendix 3 will produce Biosolids, a pasteurised product.

1.7 Treatment can have the added benefit of making the Biosolids product **easier** to handle, store, transport and spread.

1.8 Treatment by at least one of the approved processes will ensure that the Biosolids product attains the following microbial standards:

Faecal coliform < 1,000 MPN (Most Probable Number).g^{-1} dry solids
Salmonella sp. < 3 MPN.$4g^{-1}$ dry solids
The Biosolids can then be classified as a pasteurised product.

1.9 The microbial standards of the Biosolids product will be monitored by the Biosolids producer at least as frequently as is specified in Appendix 7, Table 2.

Heavy metals

1.10 Some soils are naturally high in heavy metals. But metals also enter soil from a variety of other sources, including the air, artificial fertilisers and animal slurries. Care must be taken that additional metal applied to soil by the landspreading of Biosolids will not prove adverse to soil, plant, animal or human health. This can be ensured by:

- observing planting, harvesting and grazing constraints (Part 3, Paragraphs 5.1 – 5.6);
- restricting rates of Biosolids application to land (Part 3, Paragraphs 6.1 – 6.10);
- controlling the annual average addition of metal to land over a 10-year period (Part 3, Paragraph 6.7);
- not applying Biosolids to land in which heavy metals are already present in high concentrations (Part 3, Paragraph 6.7).

1.11 The rates of metal addition resulting from the controls such as those outlined above can provide many of the micronutrient requirements essential for healthy plant and animal development (see Appendix 6, Table 3).

1.12 The Biosolids producer will carry out a complete analysis of the Biosolids product for the metal types specified in Appendix 7, Table 1 at least as frequently as is indicated in Appendix 7, Table 2.

Organic micropollutants

1.13 Levels of organic micropollutants in wastewater sludge are very low. The constraints outlined in Paragraph 1.11 on landspreading of Biosolids will ensure that applications of organic micropollutants are extremely low and will not be detrimental to soil, plant, animal or human health.

1.14 The concentration of a representative number of organic micropollutants in the Biosolids product will be measured by the Biosolids producer as frequently as is required in Appendix 7, Table 2. This will establish data against which a constant check on concentrations of these substances can be made.

Certificate of Analysis of the Biosolids product

1.15 The Biosolids producer will make a comprehensive analysis of the Biosolids product on a regular basis, taking account of all parameters identified in Appendix 7, Table 1. The results will be presented in a Certificate of Analysis.

1.16 Every farmer may obtain a Certificate of Analysis of the Biosolids which he/she is going to use.

2. Land suitable for application of Biosolids

Programme of Evaluation

2.1 Should you wish to receive Biosolids for use as a fertiliser, the Biosolids producer will undertake a strategic exercise to evaluate the suitability of your land for Biosolids application.

2.2 Factors which this Programme of Evaluation shall include are:

Type, quality and quantity of wastewater sludge generated in the locality
Availability of land in the locality
Crops grown in the locality and methods of fertilisation
Availability of other organic fertilisers
Suitability of area for landspreading of organic wastes
Soil type, quality, trafficability, nutrient status
Local climate
Local topography
Presence of nitrate in groundwater
Vulnerability of both ground and surface waters
Hydraulic capacity of the soil
Background concentration of heavy metals in soils
Accessibility by road

2.3 The soil on which you propose to spread Biosolids will be analysed by the Biosolids producer for nutrient and heavy metal concentrations. If soil metal levels are above those specified in Appendix 6, Table 1, your land is not suitable for application of Biosolids.

2.4 The Biosolids producer is obliged to walk all proposed spreadlands prior to deciding whether they are suitable for inclusion in the Biosolids use programme.

2.5 While use of Biosolids in agriculture is the best practice generally, it may be that the Programme of Evaluation will show that it is not practicable in a particular locality.

2.6 For further guidance on safe application of Biosolids, see also Part 3, Paragraphs 8.1 – 8.6.

3. The farmer's entitlements under the Biosolids use programme

General

3.1 Traceability of the Biosolids product is essential if confidence in its high quality as a fertiliser is to be maintained. The Biosolids producer recognises that a regulated programme of monitoring complemented by comprehensive record-keeping is an essential part of the Biosolids production process. A copy of all such records will be kept at the Biosolids production plant site office for at least a 10-year period and will be made available on request.

Certificate of Analysis

3.2 You may obtain a Certificate of Analysis of the Biosolids product as detailed in Paragraphs 1.16 – 1.17.

3.3 This Certificate should indicate the:

- date on which the sample was taken
- origin of the sludge from which the Biosolids was produced
- treatment process used to achieve the Biosolids product
- analysis of the parameters specified in Appendix 7, Table 1, using standard methods.

Soil monitoring

3.5 The Biosolids producer will ensure that soil samples are taken from your spreadlands for analysis of phosphorus and potassium levels at least once every 3 years.

3.4 The Biosolids producer will take a deep soil sample from your spreadlands at least once every 5 years. This sample must be of a depth of 25 cm, where practicable, representative of a maximum of 5 hectares and will be analysed for a range of metals and micropollutants by an approved laboratory (see Appendix 7, Table 3).

3.6 All soil test results for your spreadlands will be made available to you.

Nutrient Management Plans

3.7 Provision of sound and objective agronomic advice will be an integral part of the Biosolids use programme. The Biosolids producer will provide a full Nutrient Management Plan for all your spreadlands in accordance with Part 3, Paragraphs 7.1 – 7.8.

3.8 The Biosolids producer will arrange annual revision of the Nutrient Management Plan, taking account of the most recent Certificate of Analysis, soil testing results, crop type and any other relevant changes.

3.9 You will be provided with a copy of this Nutrient Management Plan, its associated maps and all details pertaining to its annual update.

4. The farmer's responsibilities under the Biosolids use programme

General

4.1 Biosolids is a beneficial fertiliser and soil conditioner and it is in the interests of the receiver as well as the producer to maintain the quality of the Biosolids product and the smooth operation of the Biosolids use programme. Farmers participating in the Biosolids use programme will be asked to assist the Biosolids producer in this regard by following Paragraphs 4.2 – 4.6 below.

Landspreading agreements

4.2 Should you wish to use Biosolids as a fertiliser and both your land and crop are suitable for Biosolids application, the Biosolids producer will ask you to sign a landspreading agreement.

4.3 The landspreading agreement indicates that the Programme of Evaluation has been completed and that both you and the Biosolids producer are in agreement that your land may be fertilised with Biosolids when spreading conditions permit.

4.4 The Biosolids producer is responsible for the proper landspreading of the Biosolids product.

Certificate of Acceptance/Certificate of Spreading

4.5 On delivery of the Biosolids product, the Biosolids producer will ask you to sign

- Receipt of Acceptance, where the Biosolids is stored on your farm, or
- Receipt of Spreading, where the Biosolids is applied to your land.

4.6 This Receipt will be kept at the Biosolids production plant as proof of delivery of the Biosolids product.

Code of Good Practice

4.7 This copy of the Code of Good Practice for the Use of Biosolids in Agriculture has been provided for your information. Read it carefully. All farmers participating in the Biosolids use programme are obliged to follow the requirements of Part 3 of the Code in relation to storage, transportation and landspreading.

part three

Code of Good Agricultural Practice

1. General

1.1 The Biosolids product may be in the form of a:

- liquid product of a low dry solids content (approximately 4% DS)
- dewatered product of a higher dry solids content (20 – 35% DS)
- alkaline product of a high dry solids content (approximately 60% DS)
- thermally dried granulated product of a very high dry solids content (approximately 92% DS)

2. Storage

2.1 Generally, the Biosolids producer will provide sufficient volume of storage to store Biosolids produced between the months of October and February, during which time conditions will generally not be suitable for landspreading (see Paragraph 8.2). However, your own on-farm storage facilities may be used for holding Biosolids prior to landspreading, should you so wish.

2.2 Storage facilities should not be readily accessible either to the public or livestock and secure fencing must be provided around any tank or hardstanding area in which Biosolids is stored.

3. Transportation

Transportation equipment

3.1 Liquid Biosolids will be delivered to your farm in a closed tanker, while Biosolids of a dry solids content > 25% may be delivered in a covered skip or trailer.

Management

3.2 The Biosolids producer must keep the transportation vehicle clean and avoid carrying mud from the farm or site of application onto the public road. Where possible, provide a hose or similar equipment with which the tanks and wheels of the vehicle can be washed before leaving the farm.

3.3 It is your responsibility to ensure that this washwater enters a conduit or storage tank and has no access to watercourses or wells.

4. Methodologies for landspreading of Biosolids

Landspreading equipment

4.1 The bandspreader is recommended as the most suitable equipment for landspreading of liquid Biosolids. Fitting of flow-meters, Global Positioning Systems and other recording and monitoring equipment is encouraged wherever feasible.

4.2 Shallow soil injection may be used for landspreading of Biosolids on land under permanent pasture in areas in which groundwater is not subject to elevated nitrate levels.

4.3 Biosolids of a dry solids content > 25% may be applied to land using a muck-spreader.

4.4 Thermally dried Biosolids, which is of a very high dry solids content and has the appearance of artificial fertiliser granules, may be applied with a conventional fertiliser spreader.

Responsibility for landspreading

4.5 In general, the Biosolids producer will be responsible for landspreading of the Biosolids product. However, it is quite acceptable that you carry out the landspreading operation on your own land, provided that it is done in full compliance with the requirements of the Code of Good Practice for the Use of Biosolids in Agriculture.

4.6 You may store Biosolids together with other organic slurries on your own farm. Where the volume of the other organic slurries exceeds 50% of the volume of the Biosolids, the landspreading operation is your responsibility and not that of the Biosolids producer.

4.7 Whoever carries out the landspreading operation will be provided with a map of the site where the Biosolids is to be applied. This map will indicate

- buffer zones and other prohibited areas;
- areas of rock outcrop;
- any hazards to be avoided;
- maximum permissible rates of application in accordance with the Nutrient Management Plan.

Use of contractors

4.8 Contractors may be employed to carry out the landspreading operation on your behalf or on behalf of the Biosolids producer on the understanding that they must operate in strict accordance with the Code of Good Practice for the Use of Biosolids in Agriculture.

5. Planting, harvesting and grazing constraints

General

5.1 The constraints on planting, harvesting and grazing when Biosolids is used in agriculture are outlined in Paragraphs 5.2 – 5.6 and are summarised in Appendix 5.

Crops to which Biosolids can be applied

5.2 Biosolids can be applied to soil prior to planting cereals, oil seed rape, grass (both permanent pasture and silage), fodder beet and forestry.

5.3 When used as a fertiliser on growing crops, it may be applied to cereals, oil seed rape, grass (both permanent pasture and silage) and forestry only.

5.4 Upland forestry is frequently characterised by artificially drained, thin, poor and acidic soils. For the purposes of preventing potential water pollution, Biosolids should not be applied to forestry plantations in upland areas. It may, however, be used to fertilise lowland forestry, provided all other landspreading considerations in this Paragraph and in Paragraphs 8.1 – 8.6 are satisfied.

Constraints on crop harvesting

5.5 No animal fodder, including kale, fodder beet or silage, may be harvested until at least 3 weeks after application of Biosolids.

Constraints on grazing

5.6 Cattle should not be turned out onto pasture which has been fertilised with Biosolids until 3 – 6 weeks after the date of application. The interval between application and commencement of grazing will depend on the level of incorporation of Biosolids into the soil.

6. Application rates for Biosolids

General

6.1 The target rate of application of Biosolids must be limited to that corresponding to the lowest of the following:

- the maximum permissible rate of application of nutrients
- the maximum permissible rate of application of metals
- the maximum permissible hydraulic loading.

This target rate, which must not exceed this lowest limit, will be determined by site-specific soil and crop conditions and by the quality of the Biosolids product.

6.2 Whatever target rate is found to be suitable should be applied uniformly over the landspreading site.

Nutrients

6.3 Integral to the use of all fertilisers is the balancing of crop nutrient requirements and available nutrients in the soil. Landspreading of Biosolids should always be done in accordance with the Nutrient Management Plan (see Paragraphs 7.1 – 7.8) drawn up for you by the Biosolids producer.

6.4 To protect both soil and water from pollution by nitrates, maximum rates of Biosolids application must be observed in accordance with the following extract from the Code of Good Agricultural Practice to Protect Waters from Pollution by Nitrates (Department of the Environment and Department of Agriculture, Food and Forestry, 1996).

> In areas supporting high stocking rates and, provided surface and groundwaters are in good condition, i.e. nitrate concentrations do not exceed 20 $mg.l^{-1}$ and there is no evidence of eutrophication caused by nitrates, the maximum quantity of slurry and other organic manure applied to land, including that deposited by the grazing animal, should be such as to ensure that the nitrogen contained therein does not exceed 250 kg per hectare per annum. In all other areas, the nitrogen applied from these organic fertilisers should not exceed 210 kg per hectare per annum. Lower application rates than those indicated should be observed in areas where the County Council indicates that this is necessary because of the nitrate level in waters, or because the phosphorus content of the slurry or other organic manure is causing, or is likely to cause, water pollution.
>
> (Department of the Environment and Department of Agriculture, Food and Forestry, 1996)

6.5 Recommended levels of soil phosphorus have been established by Teagasc for the agronomic requirements of individual crops. Any increase in soil phosphorus above these levels will not result in improved crop yield and may contribute to pollution of surface water. Biosolids should not be applied to land with soil phosphorus concentrations above these levels.

6.6 Biosolids should be applied in conjunction with agronomic levels of soil phosphorus as specified by Teagasc.

Heavy metals

6.7 The fertiliser benefits of Biosolids can best be optimised by restricting the potential application of metals to soils. Therefore limit values are set for

- the concentration of certain metals in soils (see Appendix 6, Table 1)
- the rates of addition of certain metals to soils (see Appendix 6, Table 2)
- the concentration of lead in Biosolids (see Paragraph 6.8).

These limits must be observed by all Biosolids use programmes.

6.8 The concentration of lead in Biosolids to be surface applied to permanent pasture for grazing should be no greater than 750 $mg.kg^{-1}$ dry solids.

6.9 Because soil pH and clay content are major factors in determining the availability of elements to plants, Biosolids may not be applied to any soil with a pH of less than 5.0 or a clay content of less than 10%. It is also desirable that the pH of soil to which Biosolids has been applied should be maintained above this level.

Hydraulic loading

6.10 Regardless of the Biosolids dilution factor, the maximum hydraulic loading per single application should not exceed the hydraulic capacity of the soil as determined by the Programme of Evaluation and, in general, should not exceed 50 m^3 per hectare.

7. Nutrient Management Planning

7.1 The objective of a Nutrient Management Plan is to balance the application of nutrients with crop requirements while taking account of nutrients already present and available in the soil so as to allow optimum crop growth without adverse environmental impact. Oversupply of nutrients may result in either soil or water pollution and may be detrimental to plant health. Balancing the nutrient requirements of the crop with nutrients in the soil is the key to good agricultural practice.

7.2 If Biosolids is spread on your land, it must be done in accordance with a Nutrient Management Plan prepared specifically for that land by the Biosolids producer.

7.3 Nutrient Management Plans must be designed to take account of all fertilisers being spread on your land, whether produced on or off the farm. If Biosolids is applied to grazing ground, account must be taken of the organic nitrogen load supplied by actively grazing livestock.

7.4 The nutrient content of Biosolids will be based on the most recent analysis of the Biosolids product identified in your Certificate of Analysis. Typical nutrients contained in Biosolids are provided in Appendix 4. The nutrient status of the soil will be evident from soil analysis and cropping and manuring history.

7.5 Crop nutrient requirements are as recommended by Teagasc. When the recommended nutrient requirements of a crop are not met by either Biosolids or other organic fertilisers, the additional nutrients may be obtained from artificial fertiliser.

7.6 Restrictions on the use of Biosolids as specified in Paragraphs 5.1 – 5.6 and 6.1 – 6.10 must be taken account of when drawing up the Nutrient Management Plan.

7.7 A set of Ordnance Survey maps should accompany the Nutrient Management Plan. These maps should be at least as detailed as those of a scale of 1:10,560 and should indicate the location of the landspreading areas and all sensitive features, including dwelling houses and sensitive buildings, watercourses, rock outcrops, buffer zones and sources of water supply on the lands or in their vicinity.

7.8 If you are accepting organic fertiliser from a party other than the Biosolids producer, the Biosolids producer must take responsibility for the preparation of a Nutrient Management Plan which takes account of the nutrients supplied by all organic fertilisers in question.

8. Best landspreading practices

8.1 The following guidelines for best landspreading practices have been taken into account in the preparation of this Code of Good Practice

- Code of Practice for Landspreading of Organic Wastes (Teagasc);
- Code of Good Agricultural Practice to Protect Waters from Pollution by Nitrates (Department of the Environment/Department of Agriculture, Food and Forestry, 1996);
- BATNEEC Guidance Note for the Pig Production Sector (EPA, 1996);
- Draft Code of Practice for Protection of Groundwater from the Landspreading of Organic Wastes (EPA/GSI, 1997).

These guidelines have been drawn up taking account of agronomic considerations, prevention of water pollution and minimisation of nuisance and should be followed at all times.

8.2 Landspreading of Biosolids should be carried out as early as practicable in the growing season so as to maximise the uptake of nutrients by crops and minimise pollution risks. As a general practice, Biosolids applications to land should be avoided during the non-growing season which varies throughout the country, depending on local climatic conditions, between the months of October and February.

Exceptions to this general rule are permitted where the Nutrient Management Plan (see Paragraph 6.1 above) establishes that landspreading of Biosolids can be carried out during this period in accordance with the Code of Good Practice without risk of causing water pollution or where exceptional weather conditions arise.

8.3 In general, Biosolids should not be spread on ground without an active crop cover. However, it may be spread on fallow land prior to sowing, provided the Biosolids is immediately incorporated into the soil.

8.4 In general, Biosolids should not be applied to land which:

- has a shallow depth to bedrock
- has gravel or cracked soil overlying pipe or mole drains
- has a surface gradient of greater than 11%
- is prone to flooding.

8.5 Spreading in unsuitable weather conditions can cause loss of nutrients to both surface and ground water. Avoid spreading Biosolids if heavy rain is forecast within 48 hours. Do not apply Biosolids to:

- waterlogged land
- frozen or snow-covered land
- free-draining sites where the water table is within 1 metre of the land surface at the time of application.

8.6 The following buffer strips must be observed when landspreading Biosolids:

	Buffer zone (m)
Sensitive buildings (hospitals, schools and churches)	200
Dwelling houses[1]	100
Lakes and main river channels[1]	20
Small watercourses[1]	10
Public roads[1]	10
Domestic wells[1]	50
Public water supplies[1, 2]	50 – 300

[1] Specified distances to be increased if the gradient is greater than 6%.
[2] The appropriate distance depends on vulnerability and direction of groundwater flow.

Remember

- Follow the Code – it is the passport to a cleaner environment and sustainable agriculture.
- If in doubt on any aspect, consult your farm adviser or Local Authority.

appendix 1

Glossary

Aerobic	In the presence of oxygen.
Anaerobic	In the absence of oxygen.
Heavy metal	A term used to describe metals with a high atomic mass, some of which can be harmful to ecological and human health.
MPN	Most Probable Number
Municipal	Pertaining to the urban situation.
Organic micropollutants	A term used to describe a huge number of compounds which are discharged into the sewerage system with wastewater from homes, industries, storm sewers, etc. Several of these have been singled out for monitoring and regulation in Biosolids on the basis of their rate of occurrence and potential hazard to human health and to the environment.
p.e.	Population equivalent 1 p.e. is the organic biodegradable load having a 5-day biochemical oxygen demand of 60 g of oxygen per day.
Precautionary principle	A principle enshrined in Agenda 21, the declaration of the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, 1992, which reflects our incomplete knowledge of ecosystems.
Wastewater sludge	Sludge arising from the process of wastewater treatment.

appendix 2

Relevant legislation

Legislation with which this Code of Good Practice complies

Council Directive 76/464/EEC on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community,
- adopted by the Local Government (Water Pollution) Act, 1977
  the Local Government (Water Pollution) Amendment Act, 1990
  Statutory Instrument No. 245 of 1994

Council Directive 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances
- adopted by the Local Government (Water Pollution) Act, 1977
  Statutory Instrument No. 108 of 1978
  Statutory Instrument No. 390 of 1979
  Statutory Instrument No. 33 of 1982
  the Local Government (Water Pollution) Amendment Act, 1990
  Statutory Instrument No. 245 of 1994
  the Waste Management Act, 1996

Council Directive 86/278/EEC on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture,
- adopted by Statutory Instrument No. 183 of 1991
  the Waste Management Act, 1996

Council Directive 91/271/EEC concerning urban waste water treatment,
- adopted by Statutory Instrument No. 419 of 1994

Council Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agriculture

Legislation taken into account in the preparation of this Code of Good Practice

Council Directive 78/659/EEC on the quality of fresh waters needing protection or improvement in order to support fish life,
- adopted by the Local Government (Water Pollution) Act, 1977
  Statutory Instrument No. 293 of 1988

Council Directive 83/513/EEC on cadmium discharges to the aquatic environment
- adopted by Statutory Instrument No. 294 of 1985

Council Resolution 88/C 30/01 on a community action programme to combat environmental pollution by cadmium

Council Resolution 97/C 321/01 on the drafting, implementation and enforcement of Community environmental law

appendix 3

Recommended treatment processes for Biosolids production

Table 1
Recommended Treatment Process Conditions for Production of Biosolids

Process	Description
Mesophilic anaerobic digestion with pre- or post- **pasteurisation**	Mean retention period of at least 12 days primary digestion in temperature range 35° +/- 3°C or of at least 20 days primary digestion in temperature range 25°C +/- 3°C. Pasteurisation phase must achieve a retention period of at least 1 hour at a temperature ≥ 70°C or 2 hours at a temperature ≥ 55°C.
Thermophilic anaerobic digestion	Mean retention period of at least 48 – 72 hours in temperature range 50 – 55°C. Must include a retention period of at least 1 hour at a temperature greater than 70°C followed by a minimum retention period of at least 2 hours at a temperature ≥ 55°C or of at least 4 hours at a temperature ≥ 50°C.
Thermophilic aerobic digestion	Mean retention period of at least 7 days. All sludge to be subject to a temperature ≥ 55°C for at least 4 hours. Must achieve a reduction in volatile solids of ≥ 38%.
Composting: 1. Windrows	To be held at 55°C for at least 15 days, during which time a temperature of ≥ 55°C must be maintained over 5 turnings of the windrow.
2. Static pile or in-vessel	A temperature of ≥ 55°C must be achieved and maintained uniformly for at least 3 days.
Alkaline stabilisation	1. Addition of lime to raise pH to greater than 12.0 with an accompanying rise in temperature to 70°C for 30 minutes. 2. Addition of lime to raise pH to greater than 12.0 and to maintain the pH above 12 for 72 hours and to achieve a temperature ≥ 52°C for at least 12 hours. At the end of the 72 hour period, air dry to a dry solid content of ≥ 50%.
Thermal drying	Drying by direct or indirect contact with hot gases. Moisture content of the dried Biosolids to be ≤ 10%. Either the temperature of the Biosolids > 80°C or the wet bulb temperature of the gas in contact with the Biosolids as the Biosolids leaves the drier > 80°C.

appendix 4

Composition and fertiliser value of Biosolids

Table 1
Composition of Irish Wastewater Sludges
(Note: These are untreated sludges. Nitrogen and phosphorus composition may change with treatment. Heavy metal content will remain unchanged.)

		Range	Mean	Number of samples
Dry solids[1]	%	1 – 65	22	20
Nitrogen[1]	mg/kg DS[3]	8.5 – 58100	27558	12
Phosphorus[1]	mg/kg DS	1.5 – 21100	10386	13
Potassium[1]	mg/kg DS	0.7 – 89,600	31467	3
Magnesium[1]	mg/kg DS	– –	0.4	2
Copper[1]	mg/kg DS	25 – 2,481	641	24
Nickel[1]	mg/kg DS	2.6 – 389	54	24
Iron[1]	mg/kg DS	1,200 – 96,075	20,190	7
Zinc[1]	mg/kg DS	32 – 2070	562	25
Cadmium[1]	mg/kg DS	0.1 – 13.6	2.8	22
Chromium[1]	mg/kg DS	28 – 509	165	4
Lead[1]	mg/kg DS	8.1 – 850	150	24
Mercury[1]	mg/kg DS	0.1 – 2.0	0.6	4
Manganese[2]	mg/kg DS	65 – 3,018	340	N/A
Boron[2]	mg/kg DS	19 - 236	72	N/A
Cobalt[2]	mg/kg DS	1 – 48	14	N/A

[1] Samples from 25 Irish wastewater treatment plants taken for the *Strategy Study on Options for the Treatment and Disposal of Sewage Sludge in Ireland* (Weston-FTA, 1993). The smallest wastewater treatment plant in this survey served a population of 350; the largest served a population of 29,527.

[2] 200 samples from 45 Irish wastewater treatment plants published in O'Riordan , E.G., Dodd, V.A., Tunney, H. and Fleming, G.A. (1986), "The chemical composition of Irish sewage sludges". In the *Irish Journal of Agricultural Research*, No. 25.

[3] DS = dry solids

Table 2
Total and Available Phosphorus in Biosolids produced by Various Recommended Treatment Processes

Biosolids type	% DS[1]	Total P applied	Available P (1st cropping year)
Digested low-solids	4	3% of DS = 1.2 kg/tonne	60% of total P = 0.7 kg/ tonne
Digested high-solids	25	3.5% of DS = 8.8 kg/tonne	35 – 50% of total P = 3.0 – 4.4 kg/tonne
Composted[2]	65	1.0% of DS = 6.5 kg/tonne	20% of total P = 1.3 kg/tonne
Lime stabilised	60	0.4% of DS = 2.4 kg/tonne	46% of total P = 0.6 kg/tonne
Thermally dried	94	3.7% of DS = 34.8 kg/tonne	9 – 50% of total P = 3.1 – 17.4 kg/tonne

[1] DS = dry solids

[2] Wood chips used as bulking agent

Table 3
Total and Available Nitrogen in Biosolids produced by Various Recommended Treatment Processes

Biosolids type	% DS[1]	Total N applied	Available N (1st cropping year)
Digested low-solids	4	5% of DS = 2.0 kg/tonne	60% of total N = 1.2 kg/ tonne
Digested high-solids	25	3.0% of DS = 7.5 kg/tonne	15% of total N = 1.1 kg/tonne
Composted[2]	65	1.6% of DS = 10.4 kg/tonne	10% of total N[3] = 1.0 kg/tonne
Lime stabilised	60	0.7% of DS = 4.2 kg/tonne	15% of total N = 0.6 kg/tonne
Thermally dried	94	3.7% of DS = 34.8 kg/tonne	20% of total N = 7.0 kg/tonne

[1] DS = dry solids

[2] Wood chips used as bulking agent

[3] Ammonium-N only

appendix 5

Planting, harvesting and grazing constraints

Table 1
Planting, harvesting and grazing constraints to be observed when using Biosolids as a fertiliser

Crops to which Biosolids can be applied while growing	Crops to which Biosolids can be applied prior to sowing/setting
Cereals	Cereals
Oil seed rape	Oil seed rape
Grass[1]	Grass
Forestry[2]	Sugar beet
	Animal fodder[1]
	Forestry[2]

1 No harvesting or grazing until at least 3 weeks after application.

2 Not to be applied to upland forestry.

appendix 6

Limits to heavy metal application

Table 1
Maximum permissible concentrations of certain heavy metals in soil

Metal	Maximum permissible concentration (mg/kg dry solids)	
	pH 5.0 – 6.0 and/or clay content 10 – 15%	pH > 6.0 and clay content > 15%
Zinc	100	150
Cadmium	1.0	1.5
Nickel	50	80
	For pH > 5.0 and clay content ≥ 15%	
Copper	80	
Lead	80	
Mercury	1	
Chromium	100	

Table 2
Maximum permissible annual average rates of addition of certain heavy metals to soils over a 10-year period

Metal	Maximum permissible average annual rate of addition of metal over a 10-year period (kg/hectare/year)
Zinc	7.5
Cadmium	0.05
Nickel	3.0
Copper	7.5
Lead	4.0
Mercury	0.1
Chromium	3.5

Table 3
Typical maximum permissible number of applications of Biosolids as determined by soil metal concentrations

		Cd	Cu	Ni	Pb	Zn	Cr
Case 1: Biosolids @ 2% DS; 2.8% N; 1% P							
Concentration in Biosolids	(mg/kg DS)	2.8	641	54	150	562	165
Background level in soil[1]	(mg/kg soil)	0.61	21	24.8	24.2	71.8	46.6
Amount in Biosolids application of 50 t/ha	(kg/ha)	0.003	0.64	0.05	0.15	0.56	0.17
Total concentration in 25 cm soil sample in year 1	(mg/kg soil)	0.61	21.2	24.8	24.2	72.0	46.7
Permissible number of applications at 50 t/ha[2]		452	299	1516	1209	163	1051
Case 2: Biosolids @ 6% DS; 2.8% N; 1% P							
Concentration in Biosolids	(mg/kg DS)	2.8	641	54	150	562	165
Background level in soil[1]	(mg/kg soil)	0.61	21	24.8	24.2	71.8	46.6
Amount in Biosolids application of 50 t/ha	(kg/ha)	0.008	1.9	0.16	0.45	1.69	0.5
Total concentration in 25 cm soil sample in year 1	(mg/kg soil)	0.61	21.6	24.9	24.3	72.3	46.8
Permissible number of applications at 50 t/ha[2]		150	99	505	403	54	350
Case 3: Biosolids @ 25% DS; 2.8% N; 1% P							
Concentration in Biosolids	(mg/kg DS)	2.8	641	54	150	562	165
Background level in soil[1]	(mg/kg soil)	0.61	21	24.8	24.2	71.8	46.6
Amount in Biosolids application of 50 t/ha	(kg/ha)	0.025	5.77	0.49	1.35	5.06	1.49
Total concentration in 25 cm soil sample in year 1	(mg/kg soil)	0.62	22.8	25.0	24.6	73.6	47.1
Permissible number of applications at 50 t/ha[2]		50	33	168	134	18	116

[1] Average background metal concentrations in Irish agricultural soils

[2] Assuming no loss or dissipation of metal during spreadland lifetime

appendix 7

Monitoring requirements

Table 1
Parameters to be included in Certificate of Analysis of Biosolids

Parameter	Units of measurement
Dry solids	(%)
Organic matter	(% of dry solids)
pH	
Total nitrogen	(% dry solids)
Ammonium-nitrogen	(% dry solids)
Total phosphorus	(% dry solids)
Total potassium	(% dry solids)
Faecal coliform	(MPN.g^{-1} dry solids)
Salmonella sp.	(MPN.g^{-1} dry solids)
Zinc	(mg.kg^{-1} dry solids)
Copper	(mg.kg^{-1} dry solids)
Nickel	(mg.kg^{-1} dry solids)
Cadmium	(mg.kg^{-1} dry solids)
Lead	(mg.kg^{-1} dry solids)
Mercury	(mg.kg^{-1} dry solids)
Chromium	(mg.kg^{-1} dry solids)
Polychlorinated biphenyls (PCB)	(mg.kg^{-1} dry solids)
Polychlorinated dibenzodioxins/dibenzofurans (PCDD/F)	(ng TEQ.kg^{-1} dry solids)
Polyaromatic Hydrocarbons (PAH)	(mg.kg^{-1} dry solids)
Nonylphenol	(mg.kg^{-1} dry solids)

Table 2
Minimum Frequency of Analysis of Certain Parameters required to be Monitored in Biosolids

Parameter	Frequency of analysis[1]		
	< 50,000 p.e.[2]	50,000 – 100,000 p.e.[2]	> 100,000 p.e.[2]
pH	Every 12 months[3]	Every 12 months	Every 6 months
Total nitrogen	Every 12 months[3]	Every 12 months	Every 6 months
Ammonium-nitrogen	Every 12 months[3]	Every 12 months	Every 6 months
Total phosphorus	Every 12 months[3]	Every 12 months	Every 6 months
Total potassium	Every 12 months[3]	Every 12 months	Every 6 months
Faecal coliform	Every week	Every week	Every week
Salmonella sp.	Every week	Every week	Every week
Zinc	Every 12 months[3]	Every 12 months	Every 6 months
Copper	Every 12 months[3]	Every 12 months	Every 6 months
Nickel	Every 12 months[3]	Every 12 months	Every 6 months
Cadmium	Every 12 months[3]	Every 12 months	Every 6 months
Lead	Every 12 months	Every 12 months	Every 6 months
Mercury	Every 12 months[3]	Every 12 months	Every 6 months
Chromium	Every 12 months[3]	Every 12 months	Every 6 months

continued ...

Table 2 ... continued
Minimum Frequency of Analysis of Certain Parameters required to be Monitored in Biosolids

Parameter	Frequency of analysis[1]		
	< 50,000 p.e.[2]	50,000 – 100,000 p.e.[2]	> 100,000 p.e.[2]
Polychlorinated biphenyls (PCB)	Every 5 years	Every 2 years[4]	Every 12 months
Polychlorinated dibenzodioxins/dibenzofurans (PCDD/F)	Every 5 years	Every 2 years[4]	Every 12 months
Polyaromatic Hydrocarbons (PAH)	Every 5 years	Every 2 years[4]	Every 12 months
Nonylphenol	Every 5 years	Every 2 years[4]	Every 12 months

[1] To be analysed more frequently if there is a significant change in the quality of the wastewater stream.

[2] p.e. = population equivalent, i.e. the number of people who would produce the organic load of the wastewater were that organic load arising only from the population contributin to the wastewater treatment plant. See Glossary, Appendix 1.

[3] Can be reduced to every 2 years for a wastewater treatment plant into which industry does not discharge and if no significant changes are observed in the parameter values over a period of 2 years.

[4] Can be reduced to every 5 years for a wastewater treatment plant into which industry does not discharge. Should be analysed more frequently if there is a significant change in the quality of the wastewater stream.

Table 3
Minimum Frequency of Soil Sampling and Analysis

Parameter	Depth of sample (cm)	Frequency
Organic matter	10	Every 2 years
pH	10	Every 2 years
Clay content	10	Every 2 years
Total phosphorus	10	Every 2 years
Total potassium	10	Every 2 years
Zinc	25	Every 5 years
Copper	25	Every 5 years
Nickel	25	Every 5 years
Cadmium	25	Every 5 years
Lead	25	Every 5 years
Mercury	25	Every 5 years
Chromium	25	Every 5 years
Polychlorinated biphenyls (PCB)	25	Every 5 years
Polychlorinated dibenzodioxins/dibenzofurans (PCDD/F)	25	Every 5 years
Polyaromatic Hydrocarbons (PAH)	25	Every 5 years