A Review of Existing and Proposed Sludge Management Practices in Local Authorities in Ireland

by

Niall Gallagher

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Supervised by: Noel Connaughton

ABSTRACT

Local Authorities in Ireland have to treat and dispose of sewage sludge produced in wastewater treatment plants in their functional area which totalled 45,590 tonnes of dry solids in 2004. Eighty six per cent of this sludge is currently recycled to agriculture. This dissertation examines existing and proposed sludge management practices in Local Authorities and outlines weaknesses in the system and proposes measures to remedy these weaknesses.

A detailed questionnaire was carried out by telephone and found that twenty-nine Local Authorities were recycling some or all of their sludge to agriculture. Ten of these Local Authorities were applying raw untreated sewage sludge to agricultural land, which amounted to 9,724 tonnes of dry solids annually or 21.34% of the total sewage sludge production in the country. Some of these Local Authorities have no record of where this sludge was disposed. A further 4,780 tonnes of dry solids was sent to landfill of which 3,543 tonnes received no form of treatment.

A substantial number of Local Authorities are not complying with statutory obligations in relation to completion of sludge registers and composite sampling for reporting purposes.

Twenty four Local Authorities are proposing to install thermal drying for sludge treatment. Consultants have stated that this type of sludge product is the most versatile.

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INTRODUCTION

The management of sewage sludge from production to disposal is the responsibility of Local Authorities in Ireland. The types of sludge treatment and disposal currently operating in Local Authorities can vary depending on the management structure (past and present) and the history the Local Authority has of investment in wastewater infrastructure.

The future of sewage sludge treatment and disposal will depend on what direction Local Authorities take in the next five years. This direction will include the types of sludge treatments selected and disposal outlets that will pose no danger to human health.

The focus of this study is to ascertain the nature of sludge management currently in operation in Local Authorities and its compliance with statutory obligations. It also focuses on the proposed future sludge management practices in Local Authorities.

Section 1, the Literature Review outlines all aspects of sewage sludge including the debate on sludge use in agriculture in Europe, the types of treatment to give a pasteurised sludge, existing and proposed legislation governing sludge use, the role of the DoEHLG and the EPA and publications available to assist in the management of sludge.

Section 2, Objectives and Methodology, outlines the objectives of the study, the methods used and the questions asked.

Section 3 lists the results obtained after assimilating the information obtained during the survey of Local Authorities, consultants, the DoEHLG, the EPA and other agencies.

Section 4 includes a detailed discussion on the findings from the results section and outlines weaknesses in Sludge Management Practices in Local Authorities.

Section 5 concludes the study after assessing all the information.

Section 6 outlines recommendations to assist Local Authorities in Sludge Management Practices and emphasises a number of practices which should be adopted and those which should be abandoned.

1.0 LITERATURE REVIEW

1.1 Introduction

Local Authorities in Ireland are presently upgrading and building wastewater treatment plants to comply with existing EU Directives and subsequent regulations. The need for a parallel development of sludge treatment for the increasing amount of sludge produced, that is economic, ensures pasteurisation and provides sustainable disposal outlets has to be accelerated. The beneficial use of sewage sludge is advocated by the EU (Urban Waste Water Directive).

Local Authorities are presently required to treat and dispose of sludge under the Waste Management (Use of Sewage Sludge in Agriculture) Regulations, 1998 and the Waste Management (Use of Sewage Sludge in Agriculture) (Amendment) Regulations, 2001. Under these regulations, "treated sludge" means sludge which has undergone biological, chemical or heat treatment, long term storage or any other appropriate process so as to significantly reduce its fermentability and health hazards resulting from its use.

Local Authorities are required to monitor the disposal of this sludge for plants with a treatment capacity above 300kg of BOD per day (corresponding to a population equivalent (PE) of 5000), which includes testing of the sludge and soil and monitoring the quantities supplied for use in agriculture in their functional area.

The Environmental Protection Agency (EPA) are required to produce a report detailing the performance of urban waste water treatment plants throughout the country every two years. The Office of Environmental Enforcement exercises a supervisory role over Local Authorities through auditing their performance and has the power to prosecute Local Authorities in the event of environmental pollution.

This study concentrates on a critical review of existing management practices around the country in Local Authorities with regard to sludge treatment and disposal and other agencies involved. It also proposes to set up guidelines to help in the management of sewage sludge from production to disposal.

1.2 Nature of Sewage Sludge

Sludges from conventional sewage treatment plants originate from Primary, Secondary and Tertiary treatment processes.

1.2.1 Primary Sludge

The objective of primary treatment is to remove readily settelable solids and floating material and thus reduce the suspended solid content of the incoming wastewater. Sewage is passed through a specially constructed sedimentation tank at such a velocity that the fine solids settle out of suspension by gravity. The solids settle to the base of the tank, which can then be removed as primary sludge (IWPC, 1979).

A typical domestic primary sludge is normally greyish black, has an offensive odour and contains about five per cent dry solids of which seventy to eighty per cent is organic and volatile matter. The organic matter includes fats and grease, food residues, faeces, paper and detergents and the inorganic matter mainly consists of siliceous grit (IWPC, 1979).

1.2.2 Secondary Sludge

The objective of secondary treatment is to remove the dissolved and colloidal matter present in the incoming wastewater stream. There are two types of secondary sludge: Humus Sludge and Waste Activated Sludge (IWPC, 1979).

1.2.3 Humus Sludge

This is the product of the settlement of effluents from biological filters. These filters are circular or rectangular beds of course particulate media such as stones or plastic contained within vertical retaining walls. Fresh humus is brown in colour and has a characteristic earthy smell. A typical sludge contains 0.5 – 2.0 percent dry solids of which 65 – 75 per cent is organic matter (IWPC, 1979).

1.2.4 Waste Activated Sludge

This is the product of a biological process where sewage enters a specially designed reactor where under aerobic conditions, dissolved and colloidal organic matter is utilised by micro-organisms to produce further biomass. This biomass (activated sludge) is then settled out in a secondary settlement tank (clarifier) where most of it is returned to the reactor (as micro-organisms) and the rest removed as waste activated sludge (Gray, 1999). Activated sludge varies in colour from grey to dark brown and normally has an earthy smell. It normally contains less than one per cent dry solids of which 70-80 per cent is organic matter (IWPC, 1979).

1.2.5 Tertiary Sludge

Tertiary sludge is derived from a tertiary treatment or effluent polishing process. It comprises that fraction of the secondary sludge which remains in the effluent from the secondary settlement tank and is removed in the tertiary treatment stage (IWPC, 1979).

1.2.6 Sludge Production Rates

Studies have shown that sludge production rates per head of population for different types of treatment are reasonably predictable (Bruce and Evans, 2002). Table 1 shows the typical values (and normal ranges) of production for different types of sludge. The actual per capita output is dependant both on the degree of treatment provided (primary, secondary or tertiary), and the method of secondary treatment.

Table 1 Typical quantities (and range of values) of raw sludge produced per annum per head of population served by a sewage works (Bruce and Evans, 2002).

Treatment Stage	Annual quantity of dry solids (kgDS/head/year) Typical value and range
Primary	19 (16-21)
Secondary	11 (8-13)
Tertiary	2 (1-3)

In the case of tertiary treatment, the quantity of sludge produced may be significantly greater where phosphorus is removed by chemical means.

1.3 Nature of Biosolids

Biosolids are the organic by-product of urban wastewater treatment processes which by being treated to an approved standard, can be used beneficially as a fertiliser/soil conditioner. Biosolids are a complex mixture that may contain organic, inorganic and biological pollutants from the wastewater of household, commercial establishments and industrial facilities and compounds added or formed during various wastewater treatment processes (Anon, 2002a).

Biosolids go through a number of treatment processes to change their organic matter content, pH, moisture content or temperature. These treatment processes help to reduce odours, pathogens and vector attraction so that biosolids will be a safe and beneficial material when applied to land (Anon, 2002a).

1.3.1 Advantages of Biosolids

Biosolids contain organic matter and plant nutrients (nitrogen, phosphorus and potassium) separated from wastewater and concentrated during its treatment. Biosolids contain several other nutrients that crops need in smaller amounts such as calcium, magnesium, sulphur, zinc, copper and iron. Most commercial fertilisers do not contain these necessary micro-nutrients (Michigan Department of Agriculture).

The use of biosolids on land completes nutrient cycles and conserves organic matter. It feeds the soil and promotes better structure and increases the soil's ability to absorb and store water which helps sustain crops through dry spells and reduce runoff and soil erosion. When biosolids are used on land, they substitute for part of the mineral fertiliser needs of the crops, and because of the gradual release nature of the nutrients, the crops are frequently healthier and therefore need fewer applications of crop protection chemicals. It is thus a component of sustainable development (Michigan Department of Agriculture).

1.3.2 Disadvantages of Biosolids

Biosolids can include pathogens, (e.g. bacteria, viruses, fungi and yeast, parasitic worms and protozoa), inorganic contaminants (e.g. heavy metals and trace elements), organic contaminants (e.g. polychlorinated biphenyls (PCBs), dioxins, pharmaceuticals and surfactants) (Anon, 2002a).

1.3.3 Pathogens and Parasites

The reliability of biosolids treatment processes in reducing pathogens in sludge is essential for public-health protection. Even though biosolids must undergo a pathogen reduction treatment before being applied to land, health hazards associated with pathogens are still a valid concern. Protozoa, bacteria, viruses and parasitic worms may be present in biosolids and have the potential for causing a health hazard (Jacobs and Mc Creary, 2001).

Humans may be exposed to pathogens in biosolids from ingestion of contaminated food, water or soil, dermal contact and inhalation of bioaerosols (aerosolised biological particles) (Anon, 2002a).

Some of these pathogens will die as soon as biosolids are applied to the soil (e.g. salmonella spp.) (Jacobs and Mc Creary, 2001), but some can persist longer in the soil depending on the specific pathogens, biosolids application methods and rates, initial pathogen concentrations, soil composition and meteorology and geological conditions (Anon, 2002a). However, it is the length of time it takes to kill off these pathogens and whether animals are grazing on this soil in the intervening period that is of concern.

1.3.4 Heavy Metals and Trace Elements

Depending on the concentration in the soils, some heavy metals can be toxic to plant species and some potentially toxic elements may occur at increased levels in the food chain. Sewage sludge can contain heavy metals such as aluminium, cadmium, copper, chromium, iron, manganese, mercury, molybdenum, nickel, lead, zinc, arsenic and selenium. The trace elements in biosolids that are of greatest concern are

arsenic, cadmium, copper, mercury, molybdenum, nickel, selenium, zinc and lead (Jacobs and Mc Creary, 2001).

There are two concerns regarding heavy metal additions to soils (Jacobs and Mc Creary, 2001):

1. They could become toxic to crops.
2. They could become sufficiently concentrated in an edible crop to have harmful effects on animals or humans that consume that crop i.e. bioaccumulation.

Because metals are elements, they do not break down in the environment, the only possible change is transformation to a different form, often resulting in more toxic compounds. Tin, arsenic, selenium, tellunium, lead, gold, mercury, titanium, platinum and palladium have all been reported to undergo conversion into organic forms by micro-organisms in the environment and in organic form are bioaccumulative toxins, particularly to the central nervous system (Johnson, 2003).

Metals in soils repeatedly applied with biosolids will necessarily have increased metal concentrations. Any decreases must be due to uptake into plants, diffusion into ground water, runoff via surface water, or transformation into another form (Johnson, 2003).

1.3.5 Organic Contaminants

Along with beneficial organic matter, biosolids may also contain organic chemical contaminants. These include PCBs, dioxins, chlorinated organic pollutants and pesticides (Langenkamp *et al*, 2001). Though various types of organic contaminants may find their way into the sewer system from consumer or industrial use, many of these organics will be broken down or decomposed during wastewater treatment (Jacobs and Mc Creary, 2001). Those organics that do not decompose will likely be strongly adsorbed onto the organic matter particles present in biosolids (Jacobs and Mc Creary, 2001). When biosolids are applied to land, most of these organic chemicals will be decomposed in soil by soil micro-organisms (Jacobs and Mc Creary, 2001). Some of the compounds are persistent in the environment and they can

bioaccumulate in the food chain and thus are a health hazard to plants, animals and humans. A large number of studies have shown that livestock regularly ingest soils, and that soil ingestion is able to cause significant transfer of contaminants from soil to edible tissues of grazing livestock (Langenkamp *et al*, 2001).

1.4 Public Concerns

The debate on the use of sludge in agriculture originated mainly in Northern Europe at the beginning of the 1990s, before gaining intensity from 1995 onwards (European Commission, 2001). To add to this, the health scares in relation to Genetically Modified Organisms (GMOs), dioxins, and Bovine Spongiform Encephalopathy (BSE) i.e. "mad cow disease", have cast doubts on the safety of the food products on the market and on the ability of existing regulations and controls to minimise human exposure to potential risks in the use of sludge. Issues of importance in public acceptability include public health, food safety, neighbourhood nuisances, community land values, marketability of crops, sustainability of farmland and the reliability of safe farming practices (Jacobs and Mc Creary, 2001).

Odours are a common complaint about biosolids from exposed populations such as biosolids appliers, farmers who use biosolids on their fields, and communities near land application sites. There is also concern that crops or food grown with the aid of biosolids could in some way cause adverse health effects (Jacobs and Mc Creary, 2001).

1.5 The Debate on Sludge Use in Agriculture in Europe

1.5.1 Introduction

The main source of information in this section came from a European Commission report (Disposal and Recycling Routes for Sewage Sludge, Part 1 - Sludge use acceptance, October, 2001). This report outlined the main factors that limit the recycling and disposal of sludge in Member States.

1.5.2 Analysis of sludge use in Europe by country

1.5.2.1 Netherlands

In the Netherlands and Flanders, the debate on the use of sludge in agriculture is over, as the regulatory requirements have prevented almost all use of sewage sludge in agriculture since 1991 in the Netherlands and 1999 in Flanders (European Commision, 2001).

The Dutch Decree of November 20, 1991 established limit values so strict that the use of sludge in agriculture is only possible for four percent of the national production of sewage sludge. The strict restrictions on the use of sludge in agriculture are largely explained by the strong support of animal manure (pig slurry) in the Netherlands (Eurpoean Commission, 2001). Therefore limits were set that make the use of biosolids in agriculture virtually impossible in order that the maximum amount of land is available for animal manure (Bruce and Evans, 2002). Because of existing regulatory restrictions on landfill, the only viable option remaining for sludge appears to be incineration (European Commission, 2001).

1.5.2.2 Denmark and the United Kingdom

In countries such as Denmark and the United Kingdom, the debate is now mostly over. In Denmark, new regulations on the use of sludge in agriculture (Statutory Order No. 49 of January 20, 2000) have played a large part in ending the debate, as they are considered sufficiently strict to reduce risks to an acceptable level. Danish legislation is one of the strictest in the European Union regarding limit values for heavy metals in sludge (European Commission, 2001).

In the United Kingdom, the debate on sludge recycling was heated until an agreement was reached in September 1998 between Water UK, representing the 14 UK water and sewage operators and the British Retail Consortium (BRC), representing the major retailers. This agreement also involved the participation of the Environment Agency, the Department of the Environment, Transport and the Regions (DETR) and the Ministry of Agriculture, Fisheries and Food (MAFF). In addition, the National

Farmers Union (NFU) and the Country Landowners Association (CLA) also participated in discussions (European Commission, 2001).

The agreement in the UK led to the joint adoption of a "safe sludge matrix" by the UK water industry and the BRC. The "safe sludge matrix" provides for additional restrictions on the use of sewage sludge on agricultural land, as well as categories of crops on which sludge may not be used. The main impacts of the agreement are:-

- The phasing out of untreated sludge use on agricultural land;
- The surface spreading of conventionally treated sludge on grazed grassland is banned as of December 31, 1998; thereafter, conventionally treated sludge can only be applied to grazed grassland by deep injection into the soil;
- More stringent requirements apply to sludge spread on land for growing vegetable crops and, in particular, crops which can be eaten raw.

The CLA considers this agreement is non-binding, informal and subject to change in light of both future research and attitudes towards sludge recycling. The Soil Association, which certifies organic farming, has banned the use of sewage sludge on land. Farmers generally support the use of sludge but on condition that a reliable system of quality control is set up. The danger of soil pollution by pathogens is currently a growing concern in the farming community (European Commission, 2001).

1.5.2.3 Sweden

In Sweden, a voluntary agreement was signed in 1994 between the Swedish Environmental Protection Agency (SEPA), the Swedish Federation of Farmers (LRF) and the Swedish Water and Wastewater Association (VAV) concerning quality assurances relating to the use of sludge in agriculture. However, in October 1999 the LRF recommended that their members stop using sludge because of concerns about the quality of sludge (European Commission, 2001). Threats to the integrity of Sweden's farm produce from persistent compounds such as PCBs and Brominated Flame retardants are the main concern (Anon, 2002b).

1.5.2.4 Germany

In the 1970s and the 1980s, analysis carried out on cadmium and dioxin levels in sludge had a negative impact on the acceptance of sludge and as a result, its

agricultural use was reduced to 40% of total production. The German authorities introduced proposals in February 1999 to improve the acceptance of the use of sludge for land spreading such as:-

- Establishing approval procedures, particularly at regional level, in order to set common goals for all players;
- Modifying the regulatory framework in order to improve sludge recycling, for example by ensuring the transparency of the information on sludge disposal routes;
- Analysis of the performance of the waste water treatment plants with regard to sludge production and water quality;
- Improving the public image of sludge.

In 1999, the German authorities also made mandatory the guarantee fund, originally created in 1990 by the waste water operators in case of accidents related to sludge, in order to improve the acceptance of sludge use in agriculture. This guarantee fund seems to have improved the farmers' acceptance of sludge and opinion had swung in favour of agricultural land spreading because it is economically viable and it is considered that the potential risks are sufficiently reduced by the existing legislation. The German Union of Landowners also expressed concern regarding long-term liability and considered that the sludge supplier should be held liable should any problem occur. However, in 2001 the debate heated considerably with support for an increase in the regulatory constraints on sludge landspreading (European Commission, 2001).

1.5.2.5 Austria and France

In Austria and France, national agreements are currently under negotiation. In Austria, approximately twenty percent of the sludge produced is recycled to agricultural land. Working groups were set up in 1999, bringing together all players concerned with sludge management in Austria. The issues discussed were liability, legislation and a code of good practice. Liability related to some stakeholders wanting to establish clearly the liability for any accident caused by the agricultural use of sewage sludge, particularly in the long term. Farmers do not want to be held liable and want a compensation fund, based on the current fund in Germany. The current

uncertainty regarding risks related to the use of sewage sludge has also led several financial institutions to reduce the value of land on which sludge spreading is practised.

The situation is particularly tense in France where farmers' unions supported until recently, the development of the agricultural recycling of sewage sludge, on the condition that additional quality controls and an insurance fund system were set up. The situation has now changed, as farmers' unions have asked for a ban on the use of sewage sludge officially because the current methods used are not considered to be sufficient to address the risks related to the agricultural recycling of sludge. In general, many farmers believe that the factors which would increase the use of sludge, are the following:-

- The recognition that farmers are actually serving society by recycling sewage sludge;
- The establishment of an insurance system to cover against potential risks;
- The guarantee that no commercial consequences will arise from the use of sludge.

(European Commission, 2001).

1.5.2.6 Finland and Luxembourg

In Finland and Luxembourg, the farming community is generally hostile towards the use of sewage sludge for land spreading mainly because of the pressure to use animal manure for land spreading (European Commission, 2001).

In spring 1990, the Finnish Union of Agricultural Producers asked for a ban on the use of sewage sludge for land spreading. In 1991, the Finnish authorities introduced new guidelines to regulate the agricultural recycling of sewage sludge to satisfy farmers. In addition, despite new legislation introduced in 1994, which defines limit values for heavy metals in sludge among the strictest in European Union, farmers' perception of land spreading remains negative. The Central Union of Agricultural Producers and Forest Owners (MTK) has in 2001 renewed its stand against the use of sludge in agriculture. The use of land spreading should therefore fall in future, despite improvements in the quality of the sewage sludge. There is concern in agricultural circles that land spreading of sludge could tarnish the high quality image of Finnish

agriculture. Landowners' representatives have also expressed their hostility towards the agricultural use of sewage sludge, mainly due to the heavy metal content of sludge, as well as the risk of pathogens in the sludge (European Commission, 2001).

Consumers in Finland remain indifferent to the use of sewage sludge in agriculture and therefore the food industry has expressed little concern. However, some players in the food industry in western Finland insist on contracts with farmers, which exclude sewage sludge as a fertiliser (European Commission, 2001).

In Luxembourg, 65 – 70% of sewage sludge is recycled on land (Bruce and Evans, 2002). In most cases, farmers are reluctant to recycle sewage sludge to agriculture, as large quantities of animal manure are already used in agriculture. Some factors which limit the use of sludge in agriculture are:-

- Local subsidies for the preservation of the natural environment are not granted to farmers if sludge has been spread on pasture land;
- The national programme, which gives quality labels for food products, does not apply to potatoes and wheat (for bread-making) if they have been cultivated on sludge fertilised soil (European Commission, 2001).

1.5.2.7 Ireland and Portugal

In Ireland and Portugal, farmers support, in some cases, the agricultural use of sewage sludge, both for economic and for agronomic reasons. In Ireland, land spreading of sewage sludge is supported by national authorities and this recycling route appears to be the most likely long-term solution, given the public resistance to incineration and the restrictions on landfill. It is predicted that 75% of sewage sludge will be recycled to agriculture in 2005 (Bruce and Evans, 2002). A code of good practice has been introduced for the use of sewage sludge for land spreading, which sets out very strict requirements, although they are not compulsory. The majority of farmers are reported to be very positive about land spreading using thermally dried sludge originating from Dublin. The food industry has not expressed any concerns but some producers of dairy products are said to be particularly hostile towards land spreading (European Commission, 2001).

In Portugal, thirty percent of sewage sludge is predicted to be recycled to agriculture in 2005 (Bruce and Evans, 2002). Some players have commented that the quality of the sludge recycled for agricultural use could be an issue for concern, as the recommendations of the Portuguese Ministry for the Environment regarding good practices seem to have little influence on most farmers, who are more interested in obtaining cheap fertilisers than in the quality of these fertilisers. Some large foreign companies involved in the food industry are starting to ask farmers what fertilisers they use on their products and are proving to be more cautious when buying vegetables grown using sewage sludge (European Commission, 2001).

In both countries, the use of sludge seems to be too recent an issue to generate much public debate (European Commission, 2001a).

1.5.2.8 Spain, Italy and Greece

In Spain, Italy and Greece, the debate remains limited.

The national authorities in Spain are in favour of the development of the use of sewage sludge for land spreading. It is estimated that 54% of sewage sludge will be recycled to agricultural land by 2005 (Bruce and Evans, 2002). The Spanish plan for the purification and treatment of sludge considers composting to be a major recycling route for sewage sludge. As a result, large quantities of sludge are now composted and then sold. Often, farmers are not sufficiently informed of the composition of the compost they are purchasing. Cases of farmers complaining because of the bad quality of the compost (containing glass or plastics) have been reported. At the moment, no real debate has taken place in Spain on sludge recycling (European Commission, 2001).

The recycling route for sewage sludge to agriculture in Italy is as yet very limited as landfill is still the main disposal route (81% of treated sludge is placed in landfills) (Bruce and Evans, 2002). The increase of sludge recycling to agriculture is expected to be limited in the coming years due to the size of farms in Italy which, with an average area of 5.9 hectares (against 35 hectares in France), are rather small. Farmers are not opposed to the development of agricultural recycling of sludge (European Commission, 2001).

In Greece, the main regulation concerning the use of sludge in agriculture sets limit values identical to those provided by Directive 86/278/EEC. However, agricultural recycling accounts for only eight percent of the total sludge produced. In Greece, treated sludge is mostly disposed of by landfill (90%) (Bruce and Evans, 2002). As atmospheric pollution is already a serious problem in Greece, the authorities are not considering incineration as an option. Land spreading is the most likely viable alternative in the future (European Commission, 2001).

1.5.2.9 Limit Values in EU States.

By analysing the requirements contained in national regulations, countries can be divided into groups by the severity of existing legislation, taking Directive 86/278/EEC as a reference.

Table 2 National requirements compared to EU requirements (European Commission, 2002).

Much more stringent	Denmark, Finland, Sweden, Netherlands
More stringent	Austria, Belgium, France, Germany, Poland
Similar	Greece, Ireland, Italy, Luxembourg, Portugal, Spain, United Kingdom Estonia, Latvia

Appendix B details limit values for heavy metals in biosolids and soil in Member States. It also details limit values for organic compounds in biosolids in Member States.

1.5.3 Analysis by Stakeholder

1.5.3.1 Farmers

For farmers, the main motivation for the use of sludge in agriculture is the supply of organic fertiliser at low cost. Their main constraints come from their customers, either

food industries or retailers, who have specific quality requirements (European Commission, 2001).

1.5.3.2 Landowners

Landowners are generally hostile to the use of sludge. Their attitude is based on two major concerns: liability and land value (European Commission, 2001).

1.5.3.3 Agri-food industry

The main influences on the agri-food industry are marketing and public health concerns i.e. that the industries brand image is not tarnished (European Commission, 2001).

1.5.3.4 Food Retailers

The main motivation for food retailers is to be able to purchase agricultural products at low cost and to secure their market share by maintaining or improving the image of the quality and safety of their products (European Commission, 2001).

1.5.3.5 Wastewater Treatment Companies

The main motivation for wastewater treatment companies is to maintain long-term disposal and recycling routes for the sludge produced at the lowest possible cost (European Commission, 2001).

1.5.3.6 Communities

Communities are in most cases seeking to maintain the existing disposal and recycling routes for sewage sludge that are both economically viable and safe in terms of health. They are also concerned about limiting the "water bill" (European Commission, 2001).

1.5.3.7 National Authorities

In most cases, National Authorities have implemented policies supporting the use of sludge in agriculture, as it is considered to be the best economic and environmental option to deal with the increasing quantities of sludge produced (European Commission, 2001).

1.5.3.8 Consumer Associations/Environmental Groups

Consumer Associations and Environmental Groups have only played a minor role in national debates on sludge recycling. Consumer Associations are mainly concerned with food safety. The limited participation of consumer associations and the general public in the debate on sludge recycling can be explained by the lack of information made available to the public on these issues (European Commission, 2001).

1.6 The Pasteurisation of Sludge

1.6.1 Types of treatments to guarantee pasteurisation

The Irish Code of Good Practice for the Use of Biosolids in Agriculture lists treatment processes to achieve pasteurisation of sewage sludge. The recommended processes are (Fehily Timoney, 1999b):

1.6.1.1 Mesophilic Anaerobic Digestion with Pre or Post Pasteurisation.

In this process, the sludge requires an average retention time of at least twelve days primary digestion in a temperature range of 33^0-38^0C. During the pasteurisation phase, the sludge must achieve a retention period of at least one hour at a temperature greater than 70^0C or two hours at a temperature greater than 55^0C.

1.6.1.2 Thermophilic Anaerobic Digestion

In this process, the sludge requires an average retention period of 48-72 hours in a temperature range of 50^0-55^0C. This must include a retention period of at least one hour at a temperature greater than 70^0C, followed by a minimum retention period of at least two hours at a temperature greater than 55^0C.

1.6.1.3 Thermophilic Aerobic Digestion

In this process, the sludge requires an average retention period of at least seven days. During this period, all sludge must be subjected to a temperature of greater than 55^0C for at least four hours. The sludge must achieve a reduction in volatile solids of greater than 38%.

1.6.1.4 Composting – Windrows

In this process, the sludge must be held at 55^0C for at least fifteen days, during which time a temperature of greater than 55^0C must be maintained over five turnings of the windrow.

1.6.1.5 Composting – In-vessel

In this process, the sludge must achieve a temperature of greater than 55^0C, and this temperature must be maintained uniformly for three days.

1.6.1.6 Thermal Drying

In this process, the sludge is dried by direct or indirect contact with hot gases. The moisture content of the dried biosolids should be less than 10%.

1.6.1.7 Alkaline Stabilisation

In this process, lime is added to the sludge to raise the pH of the sludge to greater than twelve with an accompanying rise in temperature to 70^0C for thirty minutes.

1.7 Training and Staffing

It is essential that the operator of a waste management facility employs a competent person as manager of that facility and to employ suitably trained staff. There should be two levels, site supervisor/manager and site operator (Fehily Timoney,1999b). Training should address:-

- Waste management policy and legislation;
- Biological and thermal treatment;
- Management and operation of waste facilities/sites;
- Role of Local Authorities in enforcement;
- Communication and public consultation;
- Environmental management systems.

1.8 Quality Control

Quality control is of paramount importance in the case of biosolids production for land based management strategies. If agricultural markets are to be developed and maintained, biosolids must be recognised as a product of consistently high standard, which can be used safely and beneficially. Poor experience with one biosolid product will be quickly extrapolated to all similar products by many customers. Constant attention to high quality production and performance is therefore essential (Fehily Timoney, 1999b).

A number of key principles should always be observed in the wastewater treatment plant, in the process of treatment of the sewage and the subsequent generation of sludge (Guinan, 2002). These include:-

- Large particles, litter, plastic etc., which may be visible after the sludge is landspread should be removed, either by screening or by maceration;
- Operate equipment to within design specifications;
- Operate sludge treatment equipment within process parameters recommended to achieve pasteurisation;
- Maintain equipment in proper working order;
- Keep the site of sludge production or treatment clean and presentable to visitors at all times;
- Keep odour emissions generated by sludge feeding, aeration, treatment and storage to a minimum;
- Use treatment processes which maximise plant nutrient availability;
- Follow the Code of Good Practice, if biosolids are to be used in agriculture, with regard to presenting a certificate of analysis to the receiving farmer and checking pathogen concentrations before and after treatment;
- Adequate storage should be provided, to allow biosolids to be stored over winter months, when sludge application to land will not be possible.

1.9 Legislation governing Sewage Sludge

1.9.1 Directive 86/278/EEC

Council Directive of 12th of June, 1986 on the protection of the environment and in particular of the soil, when sewage sludge is used in agriculture (86/278/EEC) aimed to regulate the use of sewage sludge in agriculture in such a way as to prevent harmful effects on soil, vegetation, animals and man, while ensuring its correct use (European Commission, 1986).

The main provisions of the Directive can be summarised as follows (European Commission, 1986):-

1.9.1.1 Sludges and soils

1. Residual sludge from sewage plants treating domestic or urban wastewater may only be used in agriculture in accordance with this Directive.
2. Residual sludge from septic tanks and other similar installations may be used in agriculture subject to any conditions that a Member State may deem necessary for the protection of human health and the environment.
3. Residual sludges from other wastewater treatment plants may be used in agriculture only if its use is regulated by the Member State concerned.
4. Limit values (within a range) are set for the concentration of heavy metals in sludge.
5. Limit values (within a range) are set for the concentration of heavy metals in soil to which sludge is applied.
6. Limit values (within a range) are set to prevent the accumulation of metals in the soil exceeding the above limits by limiting: (a) sludge application rate in association with concentration limits or (b) observing metal quantities which may be added annually over a ten year period.

1.9.1.2 Treatment

1. Sludges should be treated before being used in agriculture.
2. However Member States may authorise conditions under which untreated sludge may be used if it is injected or worked into the soil.
3. Sewage sludge producers should provide sludge analysis to users regularly.

1.9.1.3 Prohibitions/Restrictions

1. Sludge shall not be used on grassland or forage crops if the grassland is to be grazed or the forage crops to be harvested, before a certain period has elapsed. This period is to be set by the Member States, but in any event, no less than three weeks.
2. Sludge is prohibited in soil in which fruit and vegetable crops are growing, with the exception of fruit trees.
3. Sludge is prohibited in ground intended for the cultivation of fruit and vegetable crops which are normally in direct contact with the soil and normally eaten raw, for a period of ten months preceeding the harvest of the crops and during the harvest itself.

1.9.1.4 Rules for Sludge Use

1. Sludge should be used so that the nutrient needs of the plants and the quality of the soil and of the surface and ground water are not impaired.
2. Where soil pH is below six, Member States should take into account the increased mobility and availability to the crops of heavy metals and reduce the metal limits to the soil.

1.9.1.5 Sampling, Analysis and Monitoring

1. Sludge and soil shall be analysed as outlined in the Directive.
2. Member States shall keep up-to-date records which must include:
   - Quantities of sludge produced and quantities supplied for use in agriculture
   - The composition and properties of the sludge as outlined
   - The type of treatment the sludge has received
   - The name and address of the recipients of the sludge and the place where the sludge is used
3. This information is to be available to the public upon request.

1.9.1.6 Exemptions

Sludge from sewage treatment plants with a treatment capacity below 300kg of BOD per day, corresponding to a population equivalent (PE) of 5000, may be exempted by Member States from some of the above record keeping.

1.9.2. S.I. No.148 of 1998

Council Directive 86/278/EEC on the protection of the environment and in particular, the soil when sewage sludge is used in agriculture was implemented in Ireland under the Waste Management Act (Use of Sewage Sludge in Agriculture) Regulations, 1998, S.I. No. 148 of 1998. These regulations implement the sewage sludge Directive and the following are the main points (Government of Ireland, 1998):-

1. The lowest of the ranges of limit values for heavy metal concentrations in soil were adopted.
2. To limit metal addition to soil, an application rate of two tonnes (dry matter) per hectare per year was set.
3. The lowest ranges of limit values for heavy metals concentrations in sludge were adopted.
4. The regulations did not specify any detailed technical requirements for the treatment of sludge.
5. "Treated sludge" was defined as sludge which has undergone biological, chemical or heat treatment, long term storage or any other appropriate process, so as to significantly reduce its fermentability and the health hazards resulting from its use.
6. Untreated sludge may be used in agriculture provided that it is previously injected or otherwise worked into the land.
7. Under Article 3(4), residual sludge from septic tanks may be used on grassland provided that the grassland is not grazed within six months following such use.
8. Article 8(2). Each Local Authority shall establish and maintain a register known as the "sludge register" and record details as laid out in the Directive.
9. Sludges from septic tanks or from sewage treatment plants less than 5000 PE designed primarily for the treatment of domestic wastewater shall under Article 9 of the regulations, be exempted from the reporting requirements of Articles 8(1), 8(2)(b), 8(2)(c), and 8(2)(d).
10. The regulations also set requirements for the sampling and analysis of soils and sludges, which apply also in the cases of septic tanks and treatment works. The regulations also specified the frequency of analysis for such sludge.

1.9.3 S.I. No. 267 of 2001

1. The Waste Management (Use of Sewage Sludge in Agriculture)(Amendment) Regulations, 2001, S.I. No. 267 of 2001, amends article 4 of S.I. 148 of 1998, to ensure that sludge is not used in agriculture except in accordance with a nutrient management plan.
2. It also introduced limit values for amounts of heavy metals, which may be added annually to agricultural land, based on a ten-year average.

(Government of Ireland, 2001).

1.9.4 Revision of the Sewage Sludge Directive – Working Document, Third Draft

1.9.4.1 Introduction

The working document - third draft is a publication of the European Commission. The Commission decided to review the 1986 sewage sludge directive. They set up a working group that included experts from individual Member States. These experts met several times and produced a first and second draft of a working document on a new sewage sludge directive. The latest draft is the third draft of the working document. The working group will produce a proposal for a new directive on sewage sludge, which will then go before the Council.

1.9.4.2 Background to Working Document

Commission Report to the Council and the European Parliament on the implementation of Community waste legislation (COM (1999) 752 of 10:1:2000) (O'Donoghue, 2002) contained the following important statements:

1. "it is crucial that the legislative framework put in place at community level for sludge management is effective in protecting the environment, and in particular the soil from long term pollution".
2. "the commission plans to undertake a comprehensive review of the provisions contained in the Directive. These provisions will be assessed in the light of sensitive research carried out since the adoption of the Directive. This review will aim at ensuring a high level of environmental protection".

In order to fulfil the above commitments, DG Environment consulted government experts from Member States, environmental NGOs, industry and stakeholders in

general. The result is a Working Document, the latest version dating from 27th April 2000 "Working Document on Sludge, Third Draft".

The main items in the Working Document are:-

a) Definition of sludges to which the Directive applies.
b) Nutrient application not to exceed the demand and uptake of crops.
c) Adjustment of limits for heavy metals in soil and sludge, with regard to pH of soil (See Appendix D for comparisons of heavy metals in soils and sludges between Directive 86/278/EEC, S.I. 148 of 1998, Code of Good Practice and Working Document Third Draft).
d) Limit values for concentration of organic compounds and dioxins in sludge for use on land (See Appendix B for limits on organic compounds in sludge).
e) A specified list of treatment processes through which sludge must undergo to achieve a certain standard. It is likely that there will be two standards, one for unrestricted use of high quality treated sludge and one for a restricted use of lower quality sludge.
f) Producer responsibility and certification
g) Proposals for codes of good practice.

Measures to prevent the amount of potentially hazardous substances entering the sewer and thus the sludge, with a view to achieving in the community these medium and long-term targets for the 90-percentile of sewage sludge (see Appendix C for medium and long-term targets) (O'Donoghue, 2002).

1.9.5 Present European Regulatory position on Sludge

1.9.5.1 Introduction

Presently, the limit values for the concentration of heavy metals in sludge are lower than the limit values specified in the Directive in a number of countries (see Appendix B). In five countries (Belgium-Flanders, Denmark, Finland, the Netherlands and Sweden), the limit values for heavy metals in sludge are lower than those specified in the Directive. However, six Member States (Greece, Ireland, Italy, Luxembourg, Portugal and Spain) have implemented limit values, which are identical to those specified in Annex 1B of Directive 86/278/EEC (European Commission, 2002).

In addition, the regulations on sludge use include limit values for pathogens in France, Italy and Luxembourg and in a larger number of cases for organic compounds (Austria, Belgium-Flanders, Denmark, France, Germany and Sweden, both of which are not included in the Directive (European Commission, 2002).

Regulations in Estonia, Latvia and Poland are comparable or even more stringent than the Directive's current requirements on limit values for heavy metals. In the other accession countries, sludge use and disposal usually falls under more general laws on waste or on environmental protection (European Commission, 2002).

In terms of obligations for treatment, France, Ireland, Luxembourg and Sweden permit the use of untreated sludge under certain conditions, while Denmark, Finland. Germany, Italy, the Netherlands and Spain have prohibited the use of untreated sludge (European Commission, 2002).

No major changes in relation to information requirements have been implemented in national regulations compared to the Directive, although Danish regulations requires analysis of organic compounds content at least once a year (European Commission, 2002).

The review of relevant legislation reveals that very few elements in the regulations specifically address the use of sludge in routes other than recycling in agriculture (e.g. use in silviculture, on natural forest, green areas and in land reclamation). However, use of sludge on forest soil is mentioned by the regulation on sludge use in Belgium-Flanders, Denmark, France, and Luxembourg. In addition, some national regulations have prohibited the use of sludge on silviculture (Germany, the Netherlands) on natural forest (Walloon region, Germany) and in green areas (Germany, the Netherlands). Significantly, the regulation in Poland includes limit values for heavy metal concentrations in sludge for use in land reclamation and on "non-agriculture soil" (European Commission, 2002).

1.10 The role of the Irish Environmental Protection Agency (EPA) - in relation to Sewage Sludge Management

1.10.1 The role of the EPA

The EPA's mission statement is "to protect and improve the natural environment for present and future generations taking into account the environmental, social and economic principles of sustainable development (Irish EPA Website).

The EPA is required to produce a report detailing the performance of urban wastewater treatment plants throughout the country every two years. This is carried out under Section 61 of the Environmental Protection Agency Act, 1992 and Section 51 of the Waste Management Act, 1996. The report (Urban Waste Water Discharges in Ireland with population equivalent greater than 500 persons) is prepared from data submitted by Local Authorities and audits conducted by the EPA. The auditing of Local Authorities and urban wastewater treatment plants commenced in 1998. These audits highlight examples of good practice as well as deficiencies that require correction (Irish EPA Website).

The EPA report gives the yearly tonnage (dry solids) of sewage sludge produced from each Local Authority and how it was disposed of (e.g. agriculture, landfill etc).

1.10.2 Recommendations of EPA in relation to Sewage Sludge

Based on an analysis of the urban wastewater returns for the year 2002/2003 and audits carried out by the agency on Local Authorities during the 2003 and 2004 period, the EPA made the following recommendations in relation to sewage sludge (Irish EPA, 2004):-

a) An environmental management system approach should be taken to the application of treated sewage sludge in agriculture, forestry, peatland and other similar outlets. The management system should address as a minimum:-
    - Organisation and responsibilities of personnel involved in producing and reusing the treated sludge;

- Quantification of the effects of the sludge on the environment (including the soil) where the sludge is used;
- Control of sludge storage, holding and spreading operations;
- Documentation and maintenance of records;
- Documentation to ensure compliance with recognised standards;
- Preventative maintenance;
- Emergency response;
- A monitoring programme.

b) The quantities of sludge generated at urban wastewater treatment plants should be recorded and this data used in the preparation of waste management plans. Where a Local Authority intends to reuse sludge in agriculture, it should comply with S.I. No. 148 of 1998 and S.I. No. 267 of 2001.

c) The sludge disposal route should be recorded and where sewage sludge is reused in agriculture (and is not injected or otherwise worked into the land), the Local Authority should ensure that the sludge is treated prior to use.

d) Where sludge is reused in agriculture, the sludge from each wastewater treatment plant should be analysed according to the regulations.

e) Detailed analysis of the soil should be carried out and if the limit values are exceeded, the practice of reusing sludge in that area should cease.

The EPA notes that the sampling programmes at some Local Authorities where sewage sludge is reused in agriculture are either non-existent or in need of improvement. It adds that sampling regimes exist at most secondary wastewater treatment plants. However the reference methods for monitoring, as set out in the schedules to the regulations, are not being rigidly adhered to, particularly the use of grab sampling instead of flow proportional sampling (Irish EPA, 2004).

The report noted that results for soils used to spread the sludge from the Ringsend treatment plant have been exceeded for all but one metal during the reporting period. They recommended that Dublin City Council review current practice and cease using these lands (Irish EPA, 2004).

It should be noted here that the EPA does not conduct any audits on the storage and spreading of sewage sludge for use in agriculture.

1.10.3 Office of Environmental Enforcement

The Office of Environmental Enforcement (OEE) exercises a supervisory role in respect of the environmental protection activities of Local Authorities through auditing their performance, providing advice and guidance and in appropriate cases, giving binding directions (Section 63 of the EPA Act empower the EPA to serve notice on Local Authorities to take action to prevent pollution. Section 63 of the EPA Act was amended by Section 13 of the Protection of the Environment Act, 2003 and gives the EPA even greater powers).

In undertaking this function, the OEE (Irish EPA Website):-

a) May request information from the Local Authority;
b) Carry out broader assessments e.g. audits;
c) On information obtained, may provide advice or recommendations;
d) May issue a proposed direction to the authority. (The Local Authority can make observations);
e) Where significant environmental pollution has occurred as a result of failure by a Local Authority, the OEE may issue a binding direction to the Local Authority. If the Local Authority fails to comply, then it will be liable to prosecution by the OEE.

The circumstances in which the OEE will consider issuing a directive include where:-

- A Local Authority has failed to follow advice or recommendations made by OEE.
- Significant environmental pollution or a real and imminent risk of such pollution is resulting from a failure by a Local Authority to carry out its statutory environmental protection functions.

The OEE is also a resource for members of the public who have exhausted all other areas of complaint (Irish EPA Website).

1.11 The role of the Department of the Environment, Heritage and Local Government (DoEHLG)

1.11.1 Introduction

The DoEHLG has commissioned several papers on sludge treatment and disposal. The objective of these papers is to identify appropriate solutions for the treatment and disposal of sewage sludge in Ireland, which will meet legislative, technical and environmental requirements.

1.11.2 The Strategy Study into Treatment and Disposal of Sewage Sludge, Weston-FTA Ltd.

In the early nineties, the DoEHLG commissioned a study of the countrywide situation with regard to sludge production and treatment. The main points can be summarised as follows (Weston, 1993):-

a) An existing sludge inventory on a countrywide basis was produced and future sludge production was predicted on a county, regional and national basis.
b) It carried out a comprehensive survey of sludge treatment technologies (11 No.)
c) It outlined and described five disposal options for sludge.
d) It proposed a regional sludge management system based on 48 regions with hub centres (excluding Dublin)
e) It proposed to set up educational programmes to educate the community on the beneficial reuse of sewage sludge thereby allaying misconceptions and irrational fears.
f) It recommended that the definition, "treated sludge" under the directive should be made more precise and that levels of micro-pollutants such as dioxins and PCBs be regulated.
g) It proposed regulation of industrial discharges to ensure that the heavy metal content of sewage sludge would not affect agricultural disposal.
h) It recommended setting up a Code of Good Practice for disposal of sewage sludge to agriculture and a similar one for forestry.
i) It also recommended that a national inventory of industrial sludges be undertaken to determine their overall impact on sludge management.

Sludge production in 1993 was 37,685 tonnes (dry solids) of which over 40% was produced in Dublin. Predictions of future sludge quantities were (Weston, 1993):-

2000 – 102,729tds

2005 – 112,133tds

2013 – 129,795tds

The Weston report (1993) emphasised that the report was only a starting point from which a detailed sludge management plan would emerge for each nominated region.

The Irish EPA has reported a figure for sludge production country wide of 42,298 tds, with 63% used in agriculture and 35% landfilled for 2003 (Irish EPA, 2004).

1.11.3 Inventory of Non-Hazardous Sludges

A study was commissioned by the DoEHLG in 1997 to carry out a study of non-hazardous sludges in Ireland (Fehily Timoney, 1998) in response to the concern of some Local Authorities regarding industrial sludge. Some of the points it outlined are as follows:

- Typical values for nutrient and heavy metal content in sewage sludge were given (pg.15).
- The quantities of sewage sludge produced by county (1997) were given which came to a total figure of 38,290tds. (pg16)
- Quantities of sewage sludge disposed to agriculture, landfill, sea, etc. were given.
- It outlined what sludge or biosolids should be tested for before deciding on a disposal route
- It pointed out that agriculture was the single largest disposal outlet for the beneficial reuse of sludge
- It outlined types of treatment, modes of transport and disposal techniques and outlets
- Agricultural disposal is always less expensive than landfill disposal, and also produces less greenhouse gases
- A producer of waste must make the product more desirable to a farmer, in particular its consistency, handleability, nutrient concentration and availability, odour, and pathogen count

- In a review of the 1993 Sewage Sludge Strategy Study where hub centres were not inhibited by county boundaries, redefinition of these regions incorporating county boundaries was recommended
- A detailed sludge management plan for each region would address among others, critical issues such as nitrate and phosphate enrichment and would have regard to Best Available Technology Not Entailing Excessive Cost (BATNEEC) and Nutrient Management Planning.

It pointed out that the proposed Landfill Directive was likely to have implications for the co-disposal of waste and the landfilling of organic waste.

1.11.4 Sludge Management Planning

The DoEHLG issued a document "Sludge Management Plans, A Guide to their Presentation and Implementation" in 1998. It was initiated as Local Authorities under Section 22 of the Waste Management Act,1996, were required to prepare Waste Management Plans for their functional areas and non-hazardous sludges would form part of this waste. The Guidance Document outlines the following steps (Fehily Timoney, 1999c):

a) Validation of sludge inventory
b) Identification of potential synergies in sludge treatment
c) Selection of treatment centres and satellites
d) Transportation study
e) Evaluating spreadlands for the use of biosolids
f) Other alternatives to agriculture use
g) Selection of treatment processes
h) Training and staffing
i) Quality control
j) Public information strategy

It also noted that sludges which Local Authorities are directly responsible for constitute just over one per cent of the total volume of non-hazardous sludges nationally with

livestock slurries (constituting 90%), agri-industrial and industrial accounting for the rest.

1.11.5 Model Sludge Management Plan

The sludge management plan for Tipperary South Riding County Council was prepared as a model plan in accordance with the guidelines laid down in "Sludge Management Plans: A Guide to their Preparation and Implementation" (Fehily Timoney, 1999d).

Department Circular L9/99 of 25th June,1999, (O'Donoghue, 2002) circulated copies of "Sludge Management Plans" and "A Model Sludge Management Plan" to each Local Authority and advised that these documents were to be used in the development of sludge management plans which Local Authorities were to proceed with.

1.11.6 Codes of Practice

In 1999 the DoEHLG issued two Codes of Good Practice:-

- The Code of Good Practice for the Use of Biosolids in Agriculture: Guidelines for Farmers.
- The Code of Good Practice for the Use of Biosolids in Agriculture: Guidelines for Local Authorities and Wastewater Treatment Plant Operators.

These documents are intended to compliment the Guidance Document and Model Plan.

The Code advises farmers in relation to:

- Liasing 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

(Fehily Timoney, 1999a).

The Code of Good Practice advises biosolids producers in relation to:

- Treatment of biosolids to achieve pasteurisation
- Evaluating spreadlands for use of biosolids
- Transportation and spreading of biosolids
- Nutrient Management Planning
- Quality Control
- Liasing with the customer

(Fehily Timoney, 1999b).

Brief summary of code contents:

The objective of the Code of Good Practice for the use of Biosolids in Agriculture is to set guidelines for the treatment and use of wastewater sludges and it includes:

- Lists the recommended processes to achieve a biosolids product
- Requires a certificate of analysis of the biosolids
- Requires the biosolids producer to walk all spreadlands
- Requires the biosolids producer to provide a full nutrient management plan for all spread lands
- Sets standards for storage of biosolids (October – February)
- Lists constraints on planting, harvesting and grazing
- Sets the concentration of heavy metals in soils
- Sets the rates of addition of heavy metals to soils
- Sets the limits for hydraulic loading of biosolids to spread lands taking into account metals and nutrients
- Gives advice on best land spreading practices
- Requires analysis for micro-pollutants
- Lists standards for soil monitoring and analysis
- Gives guidance on the monitoring and control of industrial discharges which may adversely affect biosolids quality

(Fehily Timoney, 1999b).

1.12 The Performance Management System (PMS)

1.12.1 Introduction

The PMS has been developed by the Water Services National Training Group (WSNTG) to assist Local Authorities in fulfilling their role as "Employer" in managing the performance of private service providers (PSP) in design, build and operate (DBO) type operational contracts. The PMS will provide Local Authorities with a consistent approach to dealing with all relevant performance management issues in relation to wastewater and sludge treatment (WSNTG, 2003). The PMS can also be implemented in wastewater treatment plants that the Local Authority currently operate themselves as it does not solely apply to DBO type contracts.

1.12.2 Brief summary of reporting procedures in PMS relating to sludge treatment and disposal

In volume two, section two of the PMS, the following reporting procedures are outlined:

- Procedure for reporting complaints
- Procedure for reporting odour equipment maintenance records
- Procedure for reporting incoming sludge records
- Procedure for reporting imported sludge reject records
- Procedure for reporting outgoing product record
- Procedure for reporting product disposal / reuse trace records
- Procedure for reporting volume/content records of incoming sludge and final product
- Procedure for compiling analysis results for incoming sludge
- Procedure for compiling analysis results of final product
- Procedure for reporting analysis results for soil samples

(WSNTG, 2003)

1.13 Sludge Quality Control

1.13.1 Sludge Management Planning

Sludge Management Plans are regarded as operational plans implemented as part of the overall Waste Management Plan for a county or region. They are recommended by the DoEHLG as being an effective tool which Local Authorities can use to assess their sludge situation and to plan for future sludge recovery and use, while taking account of current and proposed legislation (Guinan, 2002).

A Sludge Management Plan is a stepwise process undertaken to find the most appropriate sludge use or disposal option. All the constituent elements of a sludge management plan serve only one aim i.e., the successful recovery of sludge (Guinan, 2002).

1.13.2 Quality Control Upstream of Sludge Production

1.13.2.1 Commercial and Industrial Wastewater

European law requires any industry connected to the municipal sewerage system to pre-treat its wastewater discharge to achieve the characteristics of urban wastewater. All commercial and industrial discharges to the municipal sewerage system should be subject to the polluter pays principle, implemented through regulation. Licences issued for discharges to the sewer need to be reviewed and updated on a regular basis and specified discharge limits enforced (Guinan, 2002).

1.13.2.2 Domestic Sewage

In relation to domestic sewage, Local Authorities should encourage the use of alternatives to products that contain potentially toxic elements. Frequently, householders are unaware of the impact that their discharges may have downstream. Informational programmes may help to instil the domestic sewerage system user with a sense of ownership (Guinan, 2002).

1.13.2.3 Collection Systems

All surface water should be removed where possible from foul sewerage systems. This includes rainfall run-off from roads, rooftops and hard areas. The costs that are incurred by doing this will be compensated for by the optimisation of downstream wastewater and sludge management facilities (Guinan, 2002).

1.13.3 Quality Control Downstream of Sludge Production

The biosolids producer is responsible for quality control of the biosolids after pasteurisation (Guinan, 2002). Quality control down stream relates to:-

- Transportation
- Choice of land spreading area
- Sludge application
- Nutrient Management Planning

1.13.3.1 Transportation

Biosolids being transported from a site of production to the site of disposal should never be evident to the unaware passer-by. Tankers and other transportation equipment should be cleaned regularly and should always be maintained in good working order so that no liquid is permitted to fall on to the road when travelling. Entrances and exits to the site of biosolids production facilities should be cleaned regularly (Guinan, 2002).

1.13.3.2 Choice of land spreading area

A sludge management plan will identify catchment areas generally not suitable for biosolids application in the county (Guinan, 2002). These catchments will be excluded because of:

- Nutrient overloading arising from current application in the county
- High soil test phosphorus concentrations
- Vulnerable groundwater
- Unsuitable topography or soil types
- Extensive agriculture

1.13.3.3 Sludge Application

In spreading manure on land, it is essential that nutrient applications are reasonably accurate and in line with crop needs. Equipment, which is well maintained and suitable for its purpose, is essential in the efficient recycling of nutrients. There are several recognised methods of land spreading slurries:

- Vacuum tanker with splash plate.
- Bandspreader.
- Injection to soil.

For solid sludge, the rear discharge or the "side flinger" spreaders are the two most common types of spreading equipment (FAS, 2004).

1.13.3.4 Nutrient Management Planning

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 (Guinan, 2002). The following points should be noted in preparing a nutrient management plan for the use of biosolids in agriculture:

- As well as biosolids, the nutrient management plan should take into account nutrients from any other sludge being received by the farmer.
- The nutrient content of sludge should be based on analysis of the sludge as it is applied.
- A set of ordnance survey maps should accompany the nutrient management plan and they should indicate all buffer zones as recommended by the code of good practice.
- A nutrient management plan is a snap shot of what is happening on the land. Consequently, nutrient management plans need to be revised every two to three years.

1.14 Monitoring and Recording

1.14.1 Introduction

A comprehensive programme of record keeping and monitoring is essential in guaranteeing the traceability and maintaining the quality of the biosolids product.

1.14.2 Evaluation of spread lands

The biosolids producer should evaluate spreadlands to ascertain if they are suitable for biosolids application. This evaluation (Fehily Timoney, 1999b) should include:

- Availability of land in the locality
- Local topography
- Type of crops grown
- The type, quality and quantity of wastewater sludge
- The presence of other organic fertilisers
- The suitability of the land for landspreading of biosolids
- Soil type, quality, trafficability, nutrient status
- Vulnerability of ground and surface waters
- Existing concentration of heavy metals in the soils
- Hydraulic capacity of the soil
- Presence of nitrate in ground water
- Local climate
- Access to lands by road

1.14.3 Evaluation of Biosolids

The responsibility of evaluating the biosolids lies with the producer. Regular monitoring will ensure the biosolid is receiving a consistently adequate standard of treatment. Biosolids should be analysed for:

- Nutrients
- Heavy metals
- Organic contaminants
- Micro-organisms

(Fehily Timoney, 1999b)

1.14.4 Certificate of Analysis

The code of good practice states that a certificate of analysis of the biosolids product must be produced on a regular basis. This certificate should provide:

- The date the sample was taken
- The origin of the biosolid

- The treatment used to achieve the biosolid
- The presence of faecal coliform or Salmonella sp.
- The nutrient status of the biosolid
- Heavy metal content
- Concentration of organic micropollutants in the biosolid

(Fehily Timoney, 1999b)

1.14.5 Quality Assurance Scheme

The Working Document on Sludge, third draft prepared by the European Commission, advocates the implementation of a quality assurance system by the sludge producer. This system would include:

- Control of pollutants at source
- Sludge treatment
- How work is planned and land evaluated
- Sludge delivery
- Sludge application
- Communication of information to the receiver

This assurance scheme should be independently audited by auditors appointed by the competent authority (In this case the EPA)(European Commission, 2000).

1.14.6 Movement of Biosolids

The code of good practice recommends the logging of all movement of biosolids to include:

- Date of drawing
- Volume drawn
- Name of biosolid transporter
- Name and address of receiving customer
- Site to where biosolids is applied
- Name of biosolid spreader
- Where biosolid is stored if not spread (Fehily Timoney, 1999b)

1.14.7 Working Document Third Draft – Information required

Information from the producer of sludge to the receiver should include:

- The name and address of the producer
- Name and address of treatment plant
- Quality assurance on the sludge/Copy of auditor's certificate
- The type of treatment the sludge has received
- The agronomic composition and properties of the sludge
- The heavy metal and organic compound content of the sludge

(European Commission, 2000).

1.15 Nitrates Directive 91/676/EEC

1.15.1 Introduction

The Nitrates Directive (91/676/EEC) has the objective of protecting water bodies from pollution caused by nitrates from agricultural sources i.e. livestock manure and other fertilisers.

1.15.2 Action Programme

A National Nitrates Action Programme was submitted by the Government to the European Commission in July 2005. This programme will be implemented on a phased basis over a four-year period commencing 1st January 2006 (DoEHLG, 2005).

1.15.3 Conditions in Action Programme affecting Sewage Sludge

The main conditions in the action programme which affect the spreading of sewage sludge on agricultural land are (DoEHLG, 2005):

- Periods when the land application of certain types of fertiliser is prohibited (these periods are tabulated in Appendix E).
- The capacity of the storage vessels for livestock manure must exceed that required to store manure for the full length of the "prohibited period".

- For the purpose of manure storage and prohibited periods, it is proposed to sub-divide the national territory into three zones (groups of counties) by reference mainly to soil type, rainfall and length of growing season (these zones are tabulated in Appendix F).
- Limitations on the land application of fertilisers consistent with good agricultural practice (170kg of organic nitrogen per hectare). The government hopes to receive a derogation for 250kg of organic nitrogen per hectare.

2.0 OBJECTIVES AND METHODOLOGY

2.1 Objectives of this study

This study concentrates on existing and proposed sludge management practices in Local Authorities and aims to:-

1. Review the situation in Europe, existing and proposed legislation, the role of the Environmental Protection Agency (EPA), the role of the Department of the Environment, Heritage and Local Government (DoEHLG) and associated publications;

2. Obtain information by means of a questionnaire to each Local Authority to ascertain current and proposed sludge management practices and also obtain information from consultants, the EPA and the DoEHLG in relation to sludge treatment and disposal;

3. Ascertain if the statutory regulations are being complied with and to identify weaknesses in the management system and propose solutions.

4. To set up guidelines to help in the management of sewage sludge.

2.2 Methodology

2.2.1 Introduction

In order to investigate how Local Authorities in Ireland are managing their sludge (existing and proposed), a questionnaire was formulated with a view to carrying out a telephone survey. This questionnaire was of the format shown in Table 3. Question No. 4 in the questionnaire does not take into account liquid sludge that is removed directly from sewage treatment plants in each Local Authority and applied directly or indirectly on land. The reason for omitting this liquid sludge was that it was difficult enough to get sludge quantities from de-watering plants and inputting unreliable liquid sludge quantities would have compromised the survey.

2.2.2 Telephone Survey

It was decided at an early stage not to email the questionnaire as the author felt that no single person or persons in a Local Authority would have the necessary information to complete the questionnaire and that there was a strong possibility of it being returned only partially complete or completed incorrectly or not being returned at all. As a result, a telephone survey was selected as the most appropriate way to acquire information countrywide.

2.2.3 Rationale behind the Telephone Survey

Conducting a conversation with an individual on a one to one basis is much more rewarding in terms of information received for the following reasons:

- Once an initial contact was established in a Local Authority, it became easier to locate and converse with personnel who were dealing with sludge treatment and disposal on the ground and therefore the survey became more focussed.
- It was also felt that by conversing with personnel on the telephone, a relationship could be developed with the individual, thus ensuring more accurate information. Also by speaking to people, it could be determined if the information they were giving was credible.
- The other advantage of speaking to people directly was that the author also worked in a Local Authority and therefore individuals in other Local Authorities would be more likely to give information even if it did not reflect well on the authority in question.
- The Local Authority where the author works also had the same problems with sludge management as other Local Authorities and by sharing this, it was easier to get information.

2.2.4 How the research was carried out

The telephone survey was based on 31 Local Authorities and five city councils. It initially concentrated on identifying the most appropriate person to talk to in each Local Authority, who invariably were senior and junior engineers. This information was cross referenced with information from other personnel such as technicians in the county or city laboratory (if there was one), technicians on the ground operating the wastewater treatment plants, caretakers involved in operations and in some

cases, administrative personnel. As the information was accrued, it necessitated returning to individuals to clarify information submitted or request additional information.

Confidentiality was given on any information of a sensitive nature i.e. where non-compliance occurred or where operational practices were less than desired.

During the survey, personnel gave unsolicited information and opinions and spoke frankly in relation to the management of sludge treatment and disposal.

2.2.5 Focus on sludge generated by de-watering equipment

It was decided that the question on sludge production in the questionnaire would only concentrate on sludge generated by wastewater treatment plants in Local Authorities that contained sludge de-watering equipment. As a result, quantities of all liquid sludge removed from wastewater treatment plants and spread directly or indirectly on land were not taken into account. The reasons for this were two fold:

1. It was difficult to get sludge production figures for wastewater treatment plants with sludge de-watering equipment from Local Authorities and with time constraints in mind, it was felt that liquid sludge production figures would be too hard to obtain and this would leave the survey in an unfinished state.
2. It was felt that vague or estimated figures obtained for liquid sludge production would reduce the credibility of the survey.

2.2.6 Information/Personnel not readily available

Initially in most Local Authorities, the information requested was not readily available. Personnel were unsure of sludge production figures, type of de-watering equipment, state of the sludge management plan etc. As a result, obtaining some of the information became very frustrating and a diplomatic approach had to be taken at all times.

In all Local Authorities, some personnel were not readily available due in part to sick/annual leave but also due to the fact that they were under pressure themselves due to their own work load or were on site or attending meetings. This led to delays in receiving information.

Patience and determination were the driving force behind the successful outcome of the survey.

2.2.7 Questionnaire to Local Authorities

The Questionnaire to Local Authorities contained twenty questions as set out in Table 3 below.

Table 3 Copy of first questionnaire for Local Authorities

Number	Question
1.	How many wastewater treatment plants are de-watering sludge - Names and location?
2.	What type of de-watering facilities?
3.	What dry solids content of the sludge is being achieved?
4.	How much sludge is being produced at the plant?
5.	Is the sludge treated?
6.	If yes, what type of treatment?
7.	What is the sludge disposal outlet
8.	Does the Local Authority have sludge storage facilities?
9.	Can sludge be spread on agricultural land in the county and if not, why?
10.	Who is disposing of the sludge (Local Authority or contractor)?
11.	If it is a contractor, name of contractor?
12.	Where is the contractor treating and disposing the sludge?
13.	Does the contractor have sludge storage facilities?
14.	Is there a sludge register being kept?
15.	Who is keeping the sludge register?
16.	Is the sludge management plan implemented or adopted?
17.	If not, why?
18.	Are there changes to the original sludge management plan or is it being reviewed?
19.	What type of sludge treatment is proposed under the plan?
20.	What does the plan propose?

2.2.8 Further Questionnaire to Local Authorities

When the information had been collected from the initial survey of Local Authorities, the results were collated and summarised. However, this led to the need for an additional questionnaire as the initial survey highlighted a number of additional questions that needed to be asked. The second questionnaire was conducted in the same manner to the initial survey i.e. a telephone survey and contained six questions as set out in Table 4 below.

Table 4 Copy of additional questionnaire for Local Authorities

Number	Question
1.	Is there influent flow measurement on wastewater treatment plants in the county?
2.	How often is the flow meter calibrated?
3.	Are flow proportional/timer samples taken?
4.	How often are samples taken?
5.	How is population equivalent (PE) estimated?
6.	How are wastewater treatment plants managed in the county?

2.2.9 Questionnaire to Engineering Consultants

To get a perspective of where consultants stood in relation to sludge management, a further questionnaire was formulated. This survey was confined to consultants who were involved in the production of sludge management plans for Local Authorities. Again the survey was carried out by telephone, and contained six questions as set out in Table 5 below.

Table 5 Copy of questionnaire for Engineering Consultants.

Number	Question
1.	Could you rate different technologies for sludge treatment on a scale of one to five?
2.	Why is thermal drying selected over other sludge treatments?
3.	Is it economic to install thermal drying in smaller Local Authorities that produce small quantities of sludge?
4.	Should Local Authorities have alternative sludge treatment options installed as contingency plans in the event of dryer breakdown?
5.	Will the agricultural outlet for sewage sludge be sustainable in the long term?
6.	If the agricultural outlet is closed, what is the alternative outlet for sludge?

2.2.10 Other sources of Information

To include all stakeholders in the survey, a number of other agencies were contacted to ascertain their views on sludge treatment and disposal. These agencies included the DoEHLG, EPA, The Food Safety Authority and The Department of Agriculture (primary food production). These agencies were all contacted by telephone and the survey contained questions as set out in the tables 6-9 below.

Table 6 Questionnaire for Inspectors in the DoEHLG.

Number	Question
1.	Do you recommend a particular type of sludge treatment?
2.	Why are all new wastewater treatment plants being constructed under Design, Build and Operate (DBO) type contracts.

Table 7 Questionnaire for Inspectors in the EPA.

Number	Question
1.	Have all Local Authorities complete sludge registers?
2.	Are Local Authorities complying with regulations concerning sewage sludge?
3.	Are you satisfied that Local Authorities are monitoring sludge disposal contractors?
4.	Do you audit sludge storage in Local Authorities?
5.	What sampling regime do you require for plants between 500 PE and 2000 PE?
6.	Are Local Authorities complying with statutory obligations in regard to sampling plants over 2000 PE?

Table 8 Question for Inspector in Food Safety Authority

Number	Question
1.	Have you any issue with sewage sludge being used for food production?

Table 9 Question for Inspector in the Department of Agriculture and Food (Primary Food Production)

Number	Question
1.	Have you any issue with sewage sludge being used for food production?

3.0 RESULTS

3.1 Introduction

The following survey was carried out by contacting every Local Authority in the country to ascertain how they were managing the sewage sludge that was generated, how they treated this sludge and where this sludge was disposed to. In the process of collecting this information, an effort was also made to ascertain if Local Authorities were complying with their statutory duties in relation to sludge treatment and disposal. The survey also set out to determine in what direction Local Authorities were going in the future in regard to sludge management.

3.2 Survey Results

A questionnaire (see Tables 3 and 4) was used when carrying out the telephone survey which encompassed thirty-one Local Authorities and five city councils. The thirty-one Local Authorities included:

- Carlow County Council
- Cavan County council
- Clare County Council
- Cork City Council
- Cork County Council (Northern Division)
- Cork County Council (Southern Division)
- Cork County Council (Western Division)
- Donegal County Council
- Dublin City Council
- Dun Laoghaire-Rathdown County Council
- Fingal County Council
- Galway City Council
- Galway County Council
- Kerry County Council
- Kildare County Council
- Kilkenny County Council
- Laois County Council
- Leitrim County Council

- Limerick City Council
- Limerick County Council
- Longford County Council
- Louth County Council
- Mayo County Council
- Meath County Council
- Monaghan County Council
- Offaly County Council
- Roscommon County Council
- Sligo County Council
- South Dublin County Council
- Tipperary North Riding County Council
- Tipperary South Riding County Council
- Waterford City Council
- Waterford County Council
- Westmeath County Council
- Wexford County Council
- Wicklow County Council

Note 1 - One Local Authority (South Dublin County Council) was excluded from the survey as it had no wastewater treatment plants and did not generate any sludge in the county. All of the sewage in the county flows to Dublin City Council's wastewater treatment plant in Ringsend to be treated.

Note 2 - The calculation of sludge quantities in this survey (which covers over 95% of total estimated quantity of sewage sludge generated in Ireland) do not take into account liquid sludge that is removed from wastewater treatment plants and spread directly or indirectly on land. It was felt that any figures given for this type of sludge (less than 5% of total produced) would be vague or unreliable and therefore would undermine the credibility of the survey.

Note 3 - Details of the results obtained from the telephone survey with Local Authorities are included in Appendix A.

Table 10 **The number of wastewater treatment plants in each county that have sludge de-watering equipment and the quantity of sludge generated.**

County/City Council	No. of Wastewater Treatment Plants De-watering Sludge	% of sludge being Treated		Quantity generated (tonnes of Dry Solids per year)
		Treated (%)	Untreated (%)	
Carlow	3	100	--	472
Cavan	6	--	100	797
Clare	10	100	--	401
Cork City	1	100	--	2,190
Cork North	5	--	100	482
Cork South	6	--	100	1,210
Cork West	1	--	100	600
Donegal	4	--	100	654*
Dublin City	1	100	--	14,600
Dun Laoghaire	None	No sludge generated yet		--
Fingal	4	59	41	1,015
Galway City	1	100	--	1,615
Galway County	7	59	41	1,116
Kerry	10	50	50	927
Kildare	4	100	--	2,480
Kilkenny	1	100	--	1,913
Laois	4	--	100	394
Leitrim	3	--	100	89
Limerick City	1	100	--	1,800
Limerick County	5	92	8	621
Longford	4	--	100	1,056
Louth	2	100	--	1,948
Mayo	11	--	100	1,501
Meath	7	100	--	1,448
Monaghan	5	37	63	846
Offaly	5	47	53	814
Roscommon	4	--	100	295*
Sligo	None	--	100	45
Tipperary North	2	45	55	461
Tipperary South	4	100	--	911
Waterford City	None	No sludge generated yet		--
Waterford County	2	No sludge production records available		--
Westmeath	5	100	--	1,024
Wexford	8	100	--	1,278
Wicklow	6	100	--	587
Total	**142**	**78.66%**	**21.34%**	**45,590**

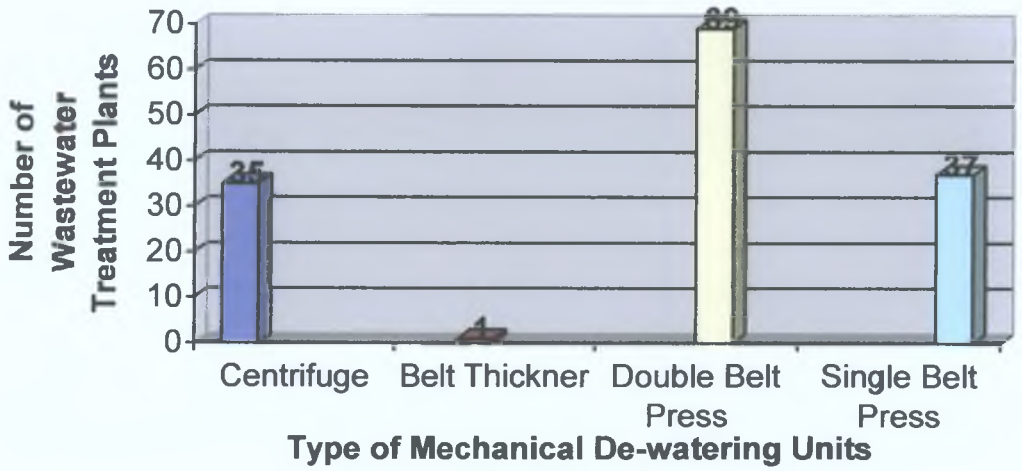
* Sludge quantities in tonnes of dry solids per annum generated in 2003. Sludge quantities for 2004 were not available.

3.3 Sludge De-watering Facilities.

All Local Authorities have their own mechanical sludge de-watering facilities with the exception of Dun Laoghaire-Rathdown County Council, Waterford City Council and Sligo County Council. Dun Laoghaire-Rathdown County Council and Waterford City Council do not generate sludge yet, as they are waiting for wastewater treatment plants to be built under DBO type contracts i.e. implementation of their sludge management plans. The sewage from both of these Local Authorities is presently discharged to coastal waters.

Sligo County Council does not have any mechanical sludge de-watering facilities but have sludge drying beds at a number of their wastewater treatment plants. These drying beds rely on evaporation and some gravity settlement of the sludge over an extended period of time to de-water the sludge.

Figure 1 **Number of wastewater treatment plants dewatering sludge and type of mechanical de-watering unit present.**



3.4 Type of Sludge Treatment

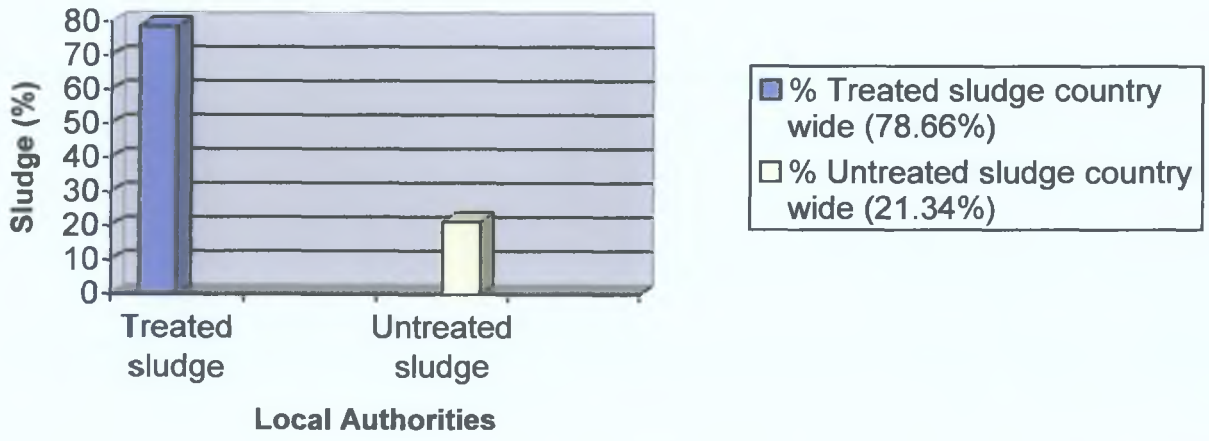
The sludge treatment in Local Authorities is broken down into seven main treatment types. These include:

- Thermal drying
- Lime stabilisation
- Composting

- Thermophilic aerobic digestion
- Mesophilic anaerobic digestion with pre or post pasteurisation
- Mesophilic anaerobic digestion
- Long term storage/deep injection

All of these sludge treatments potentially comply with the current regulations (S.I. 148 of 1998) which defines "treated sludge" as sludge which has under gone biological, chemical or heat treatment, long term storage or any other appropriate process so as to significantly reduce its fermentability and health hazards resulting from its use.

Figure 2 Percentage of total sludge in Local Authorities that is treated/untreated



3.5 Untreated Sludge

Untreated sewage sludge in Local Authorities accounts for 21.34% (9724.5 tds) of total sludge production. This figure is broken down into 6181.5 tds (63.6%) which is reycled to agriculture and 3543 tds (36.4%) which is disposed of to landfill.

Table 11 Quantity of untreated sewage sludge disposed of to Agriculture / Landfill for year ending 2004.

Disposal Outlet	Quantity of Untreated Sludge (tds) Country wide
Agriculture	6181.5 (63.6%)
Landfill	3543 (36.4%)
Total	**9724.5 (100%)**

3.6 Treated Sludge

Treated sewage sludge in Local Authorities accounts for 78.66% (35,865.5 tds) of total sludge production. This figure is broken down into 33,328.5 tds (93%) which is recycled to agriculture, 1,237 tds (3.4%) which is disposed of to landfill and 1,300 tds (3.6%) which is recycled to short rotation coppicing.

Table 12 Quantity of treated sewage sludge and the disposal outlets for year ending 2004.

Disposal Outlet	Quantity of treated Sludge (tds) Country wide
Agriculture	33,328.5 (93%)
Landfill	1,237 (3.4%)
Short Rotation Coppicing	1,300 (3.6%)
Total	**35,865.5 (100%)**

3.7 Total Sludge Quantity

Total sewage sludge produced by Local Authorities amounted to 45,590 tds for year ending 2004. This figure is broken down into 39,510 tds (86.7%) which is recycled to agriculture, 4,780 tds (10.5%) which is disposed of to landfill and 1,300 tds which is recycled to short rotation coppicing.

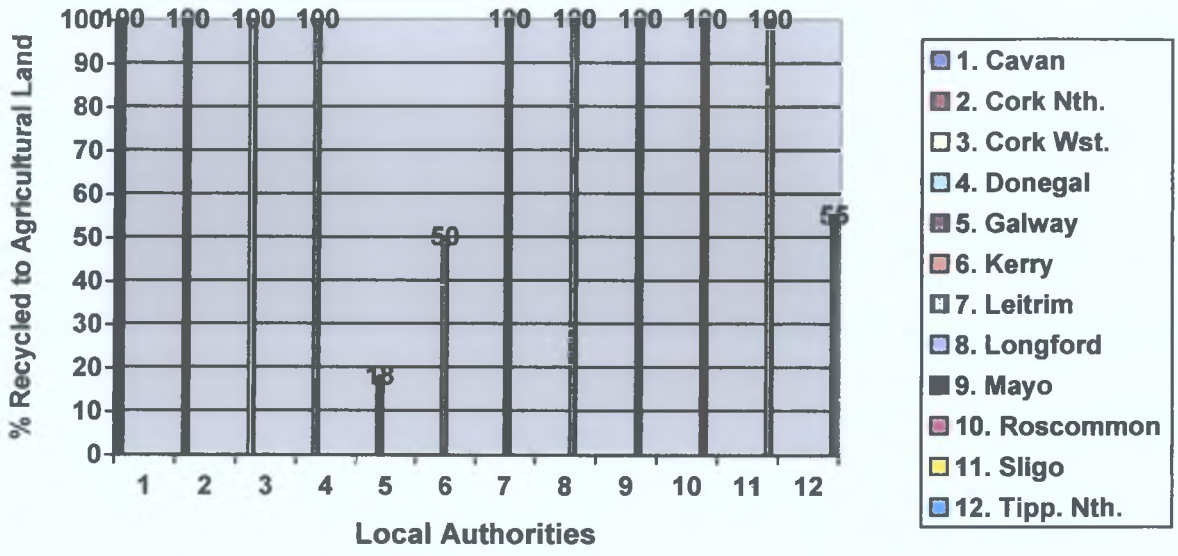
Table 13 **Total quantity of sewage sludge and the disposal outlets for year ending 2004. Sludge figures for 2003 in brackets (EPA, 2004).**

Disposal Outlet	Total Quantity of Sludge (tds) Country wide	
	tds	%
Agriculture	39,510 (26,743)	86.7 (63.0)
Landfill	4,780 (14,909)	10.5 (35.0)
Short Rotation Coppicing (Other or unspecified)	1,300 (646)	2.8 (2.0)
Total	**45,590** **(42,298)**	**100** **(100)**
Increase in sludge production from 2003 to 2004	**3,292**	**7.2**

3.8 Long-Term Storage

Twelve Local Authorities are using long-term storage to some extent, as a form of treatment for sludge before it is land spread. In some cases this raw sludge is being directly injected into land and this also complies with the regulations (S.I. 148 of 1998) which state that "untreated sludge may be used in agriculture provided that it is previously injected or otherwise worked into land". This untreated sludge which is stored long term or injected into land accounts for fourteen per cent (6,181.5 tons) of the total sludge production in the survey (see Figure 3).

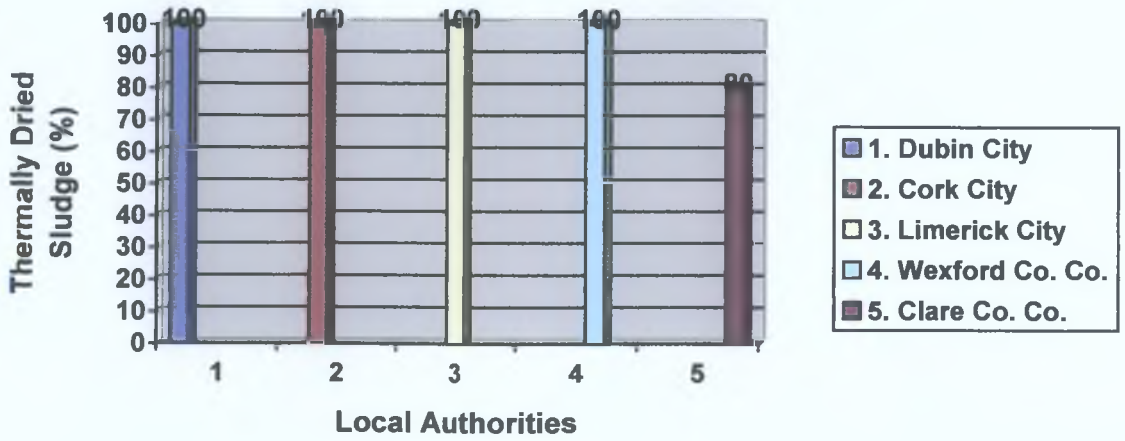
Figure 3 **Percentage of untreated sludge being recycled to agriculture and the number of Local Authorities carrying out this practice**



3.9 Thermal Drying

Dublin City Council, Cork City Council, Limerick City Council and Wexford County Council are using thermal drying to treat all of their sludge. Limerick County Council does not have a thermal dryer but send approximately ninety two per cent of their sludge to the wastewater treatment plant in Bunlickey in Limerick City for thermal drying. Clare County Council has a temporary dryer at its wastewater treatment plant in Ennis and eighty per cent of the sludge generated in the county is dried there. This thermally treated sludge is classed as a pasteurised sludge and therefore conforms to the "Code of Good Practice for the Use of Biosolids in Agriculture".

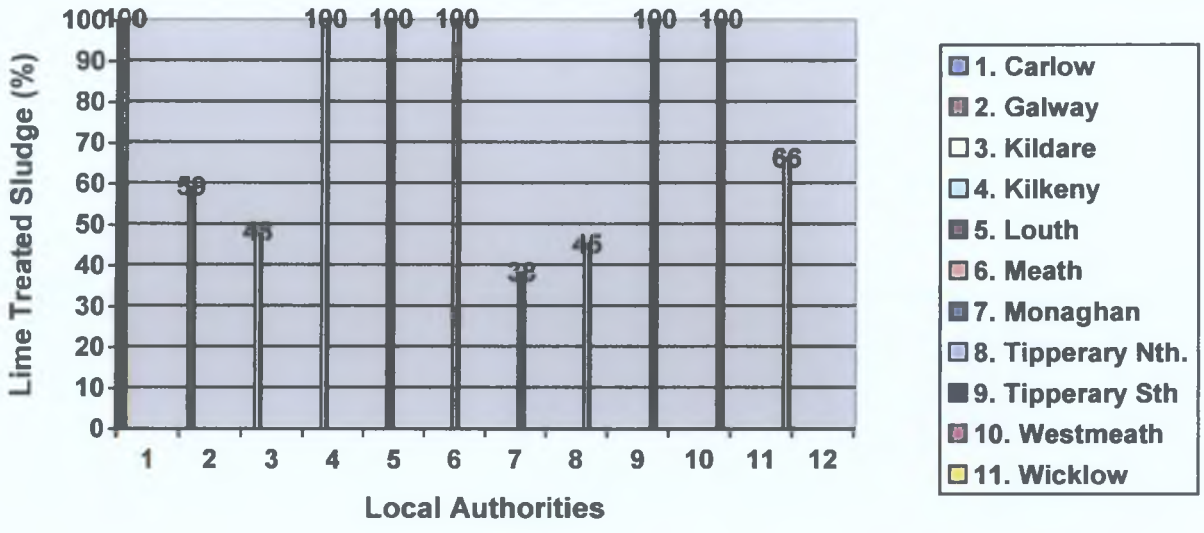
Figure 4 **Percentage of sludge that is thermally dried in the Local Authorities that are carrying out this type of treatment.**



3.10 Lime Stabilisation

Eleven Local Authorities are currently treating some or all of their sludge by lime stabilisation. The resultant treated sludge complies with the regulations (S.I. 148 of 1998), but does not comply with the requirements of treated sludge under the Code of Good Practice. The reason for this is that sludge is not reaching the desired temperature of 70°C for thirty minutes.

Figure 5 Percentage of total quantity of sludge treated by lime stabilisation in the Local Authorities using this process.



3.11 Composting

Only one Local Authority is currently treating sludge by composting. Clare County Council send approximately twenty per cent of the sludge generated in the county to Mc Gill Environmental in Cork for composting. Meath County Council and Tipperary South Riding County Council were composting a small amount of their sludge but these composting facilities had to be shut down because operations were not complying with planning permission.

3.12 Thermophilic Aerobic Digestion

There is only one Local Authority in the country using a Thermophilic aerobic digestion system. Kerry County Council has installed this process at their wastewater treatment plant in Killarney. The resultant sludge (330 tonnes per annum at three per cent solids content) is recycled to agriculture. This type of sludge

treatment produces a pasteurised sludge and therefore complies with the Code of Good Practice.

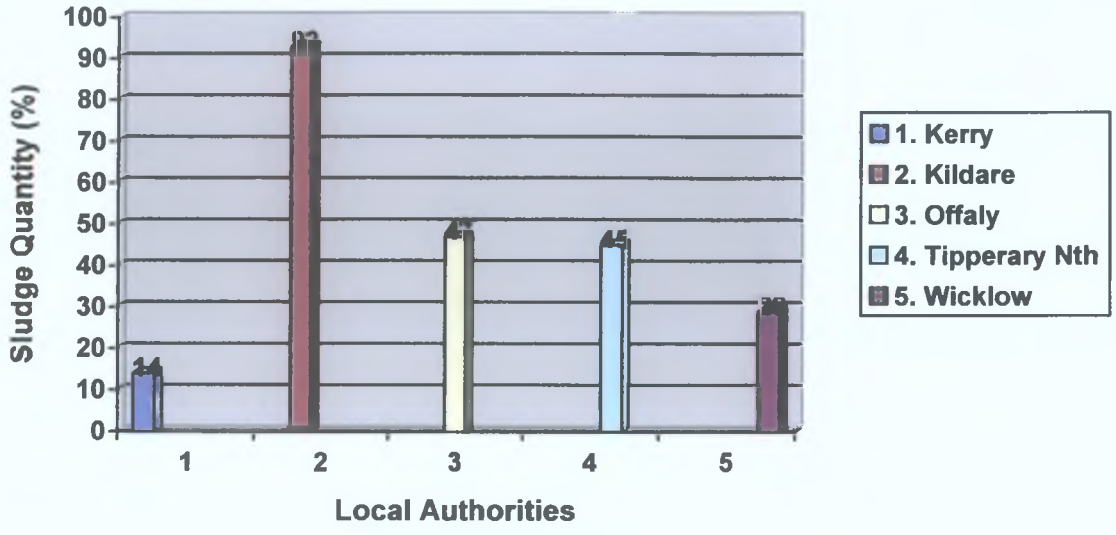
3.13 Mesophilic Anaerobic Digestion with Pasteurisation

Two Local Authorities (Galway City Council and Fingal County Council) are treating sludge using this process. The wastewater treatment plant in Mutton Island in Galway City is being operated by a contractor called Earth Tech on a two-year contract and a cake sludge (23% solids content) is produced and is recycled to agriculture. Swords wastewater treatment plant also produces the same type of sludge (25% solids content) but this sludge is disposed of to Balleally landfill in Lusk. This type of sludge treatment produces a pasteurised sludge, which complies with the Code of Good Practice.

3.14 Mesophilic Anaerobic Digestion

Mesophilic anaerobic digestion of sludge is installed in five Local Authorities. Kerry County Council treat the sludge in this way at their wastewater treatment plant in Tralee and the sludge generated is recycled to agriculture. Kildare County Council use this process at their wastewater treatment plant in Osberstown, Naas, and the sludge is recycled to willow and christmas tree plantation. Offaly County council have mesophilic anaerobic digestion installed at their Tullamore wastewater treatment plant and this sludge is recycled to agriculture for nine months of the year and disposed of to landfill for the other three months. Tipperary North Riding County Council have this type of sludge treatment installed at their Roscrea wastewater treatment plant but they employ a contractor to lime stabilise the sludge before it is recycled to agriculture. Wicklow County Council have this type of sludge treatment installed at their wastewater treatment plant in Greystones and the sludge generated is recycled to agriculture. This type of sludge treatment while complying with the regulations (S.I. 148 of 1998) does not comply with the Code of Good Practice as the sludge is not pasteurised. Sludge treated by this process will only reach temperatures of 33^0C-38^0C which will kill 50-70% of pathogens in the sludge. In order for it to be pasteurised, the sludge must reach a temperature of 70^0C for one hour or a temperature of greater than 55^0C for two hours.

Figure 6 **Percentage of sludge treated by Mesophilic Anaerobic Digestion in the Local Authorities using this process.**



Question eight of the questionnaire asked Local Authorities whether or not they had sludge storage facilities of their own. This is a very relevant question, as there is a proposal to implement the Nitrates Directive in January 2006, which would require some Local Authorities to have up to six months storage for sludge.

Figure 7 **Number of Local Authorities with or without storage facilities of their own.**

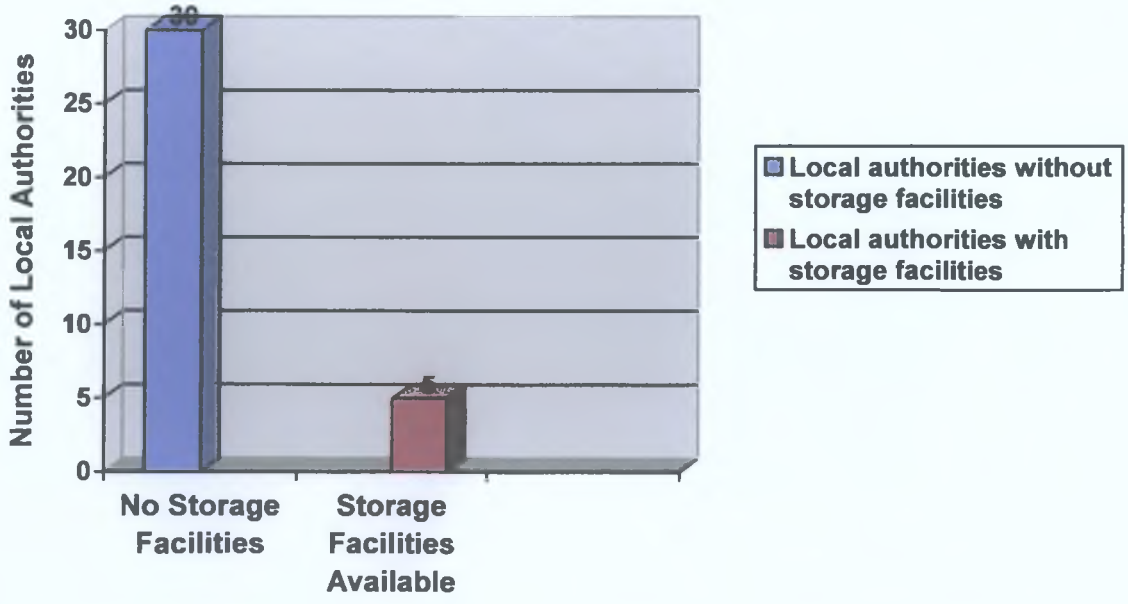


Figure 8 **Local Authorities means of disposing of sewage sludge to agriculture**

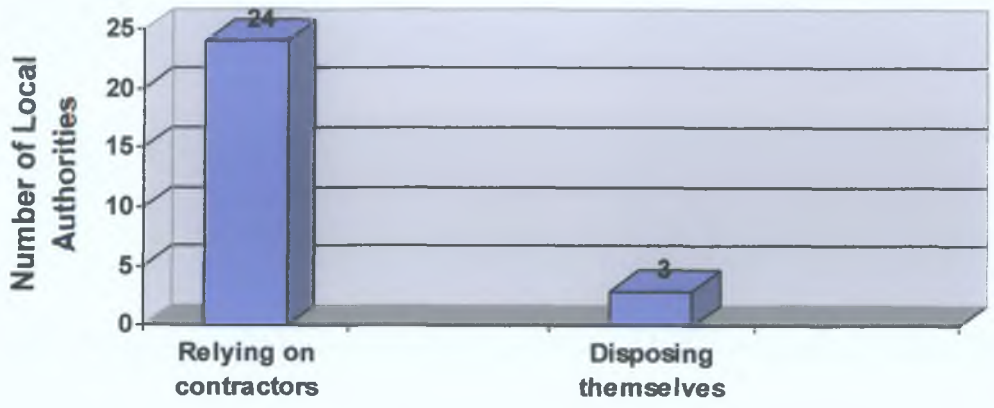


Table 14 **Type of sludge treatment that Local Authorities are currently using.**

County/City Council	Thermal Drying	Lime Stabilisation	Composting	Thermophilic Aerobic Digestion	Mesophilic Anaerobic Digestion With Pasteurisation	Mesophilic Anaerobic Digestion	Long Term Storage/ Deep Injection (Untreated)
Carlow		X					
Cavan							X
Clare	X	X	X				
Cork City	X						
Cork North							X
Cork South							X
Cork West							X
Donegal							X
Dublin City	X						
Dun Laoghaire	No sludge generated yet						
Fingal					X		X
Galway City					X		
Galway Co.		X					X
Kerry				X		X	X
Kildare		X				X	
Kilkenny		X					
Laois							X
Leitrim							X
Limerick City	X						
Limerick Co.	X						X
Longford							X
Louth		X					
Mayo							X
Meath		X					

County/City Council	Thermal Drying	Lime Stabilisation	Composting	Thermophilic Aerobic Digestion	Mesophilic Anaerobic Digestion With Pasteurisation	Mesophilic Anaerobic Digestion	Long Term Storage/ Deep Injection (Untreated)
Monaghan		X					
Offaly						X	
Roscommon							X
Sligo							X
Tipperary North		X				X	X
Tipperary South		X					X
Waterford City	No sludge generated yet						
Waterford Co.							
Westmeath		X					
Wexford	X						
Wicklow		X				X	

3.15 Sludge Disposal

The main disposal outlets for sewage sludge are agriculture, landfill and short rotation coppicing. Twenty-nine Local Authorities are recycling sludge to agriculture. Nine Local Authorities are landfilling some or all of their sludge while one Local Authority is recycling some of their sludge to short rotation coppicing.

Figure 9 Current sludge disposal routes being used by Local Authorities.

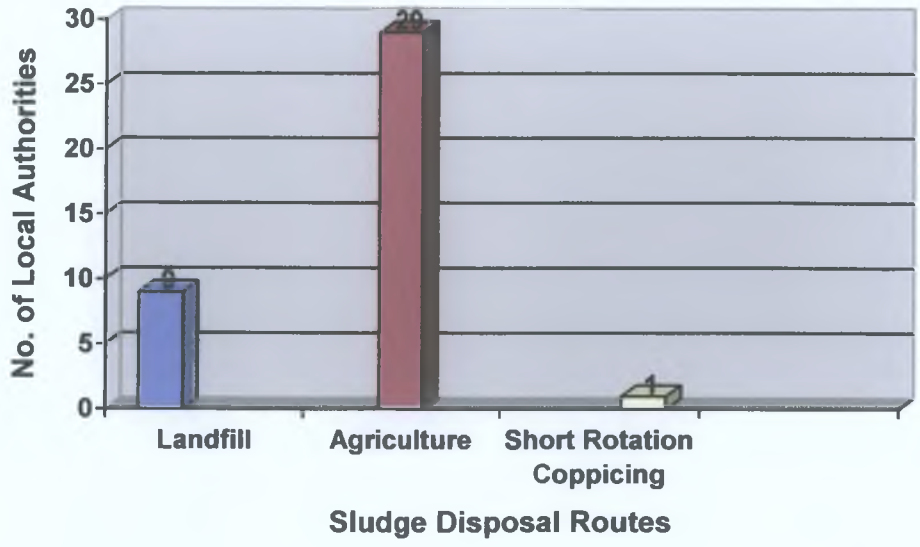


Figure 10 **The number of Local Authorities and the different type of treatments they apply to sludge before it is spread on land.**

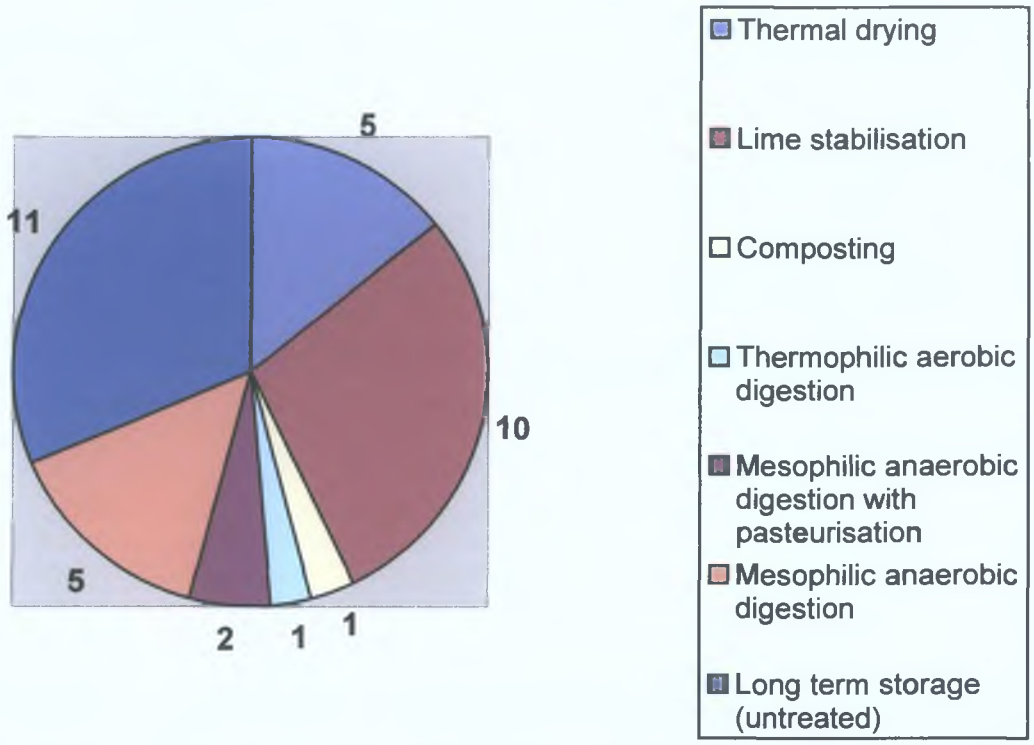


Table 15 **Sludge disposal routes for treated and untreated sludge and quantity (tds/year) for each Local Authority.**

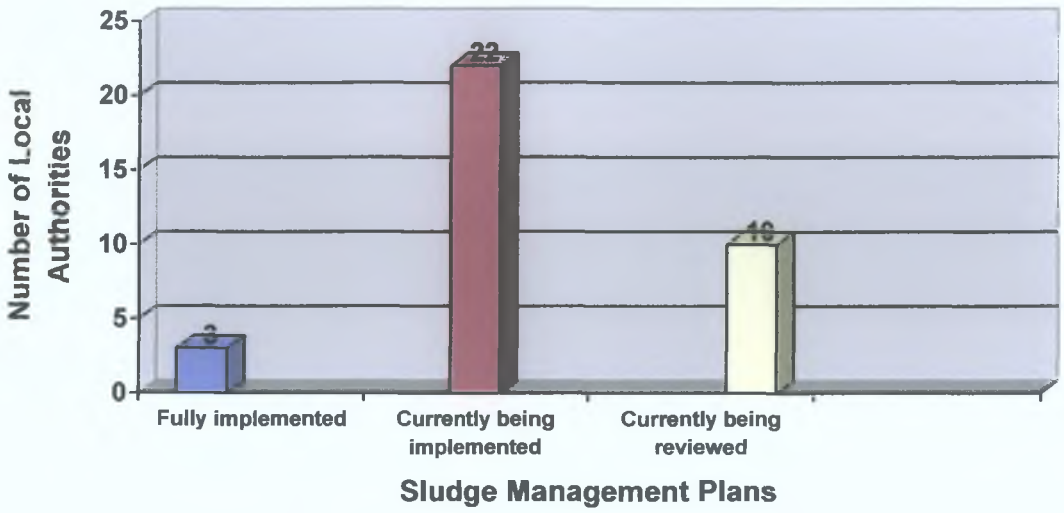
County/City Council	Treated sludge			Untreated sludge	
	Agriculture	Landfill	Short rotation coppicing	Agriculture	Landfill
Carlow	472				
Cavan				797	
Clare	78	323			
Cork City	2,190				
Cork North				482	
Cork South					1,210
Cork West				600	
Donegal				654	
Dublin City	14,600				
Dun Laoghaire	No sludge generated yet				
Fingal		600			415
Galway City	1615				
Galway Co.	657			199	260
Kerry	463.5			463.5	
Kildare	1,180		1,300		
Kilkenny	1,913				
Laois					394
Leitrim				89	

County/City Council	Treated sludge			Untreated sludge	
	Agriculture	Landfill	Short rotation coppicing	Agriculture	Landfill
Limerick City	1,800				
Limerick Co.	573				48
Longford				1,056	
Louth	1,948				
Mayo				1,501	
Meath	1,448				
Monaghan		314			532
Offaly	382				432
Roscommon				295	
Sligo				45	
Tipperary North	209				252
Tipperary South	911				
Waterford City	No sludge generated yet				
Waterford Co.	No sludge figures available - all sludge sent to Tramore landfill				
Westmeath	1024				
Wexford	1278				
Wicklow	587				
Total	**33,328.5**	**1,237**	**1,300**	**6,181.5**	**3543**

3.16 Sludge Management Plans

In June 1999, the DoEHLG circulated copies of "Sludge Management Plans, A Guide to their Presentation and Implementation" and "Sludge Management Plan for Tipperary South Riding (A Model Sludge Management Plan)" and advised that these documents were to be used in the development of sludge management plans which Local Authorities were to proceed with. To date, only three Local Authorities have fully implemented their sludge management plans. These include Dublin City Council, Cork City Council and Wexford County Council.

Figure11 Current state of Local Authority Sludge Management Plans



Question No.19 in the questionnaire asked Local Authorities what type of sludge treatment would be used under their sludge management plans.

Figure 12 Proposed sludge treatment method in Local Authority Sludge Management Plans

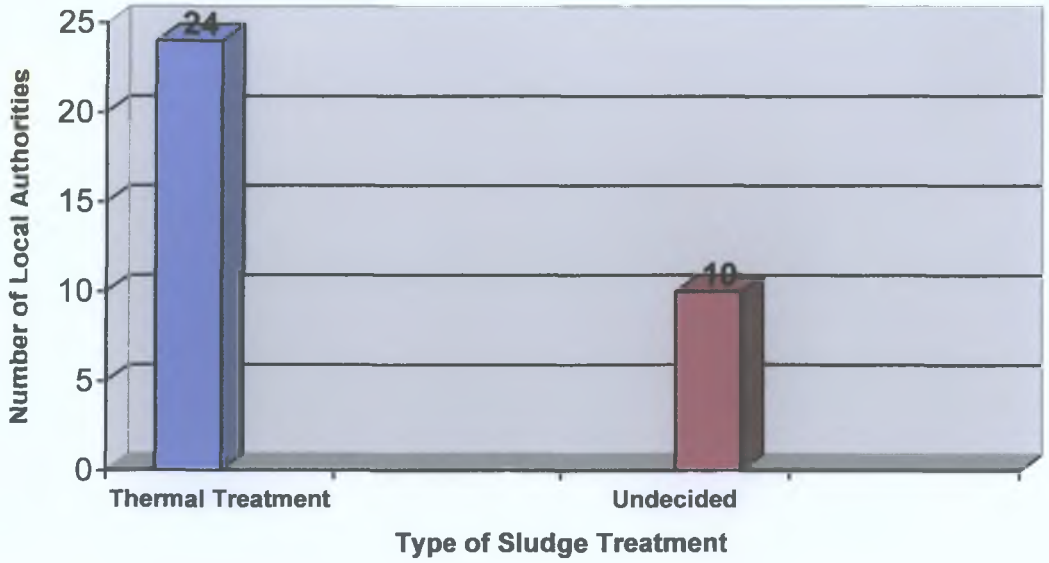


Table 16 Current state of Sludge Management Plans in Local Authorities.

Local Authority	Fully Implemented	Currently being Implemented	Currently being Reviewed
Carlow		X	
Cavan			X
Clare			X
Cork City	X		
Cork North			X
Cork South			X
Cork west			X
Donegal		X	
Dublin City	X		
Dun Laoghaire		X	
Fingal		X	
Galway City		X	
Galway Co.			X
Kerry		X	
Kildare		X	
Kilkenny		X	
Laois		X	
Leitrim			X
Limerick City		X	
Limerick Co.		X	
Longford			X
Louth		X	
Mayo		X	
Meath		X	
Monaghan		X	
Offaly		X	
Roscommon			X
Sligo		X	
Tipperary North			X
Tipperary South		X	
Waterford City		X	
Waterford Co.		X	
Westmeath		X	
Wexford	X		
Wicklow		X	
Total	**3**	**22**	**10**

3.17 Additional Survey of Local Authorities

3.17.1 Introduction

An additional survey was carried to ascertain how Local Authorities estimated their population equivalent (PE) figures for each agglomeration. It was decided to carry out this survey as a result of analysis of the original survey. This analysis highlighted the fact that sludge production in each agglomeration did not correlate with the PE

figures estimated by Local Authorities for that agglomeration. The survey also asked who was responsible for the management of the wastewater treatment plants and the extent to which this system was perceived to work. The survey included twenty-seven Local Authorities.

Note: The full report on this additional survey is included in Appendix A.

Table 17 Details of additional information gathered from second survey of Local Authorities.

Local Authority	Wastewater Treatment Plants			
	Is influent flow measurement device installed at main plants?	How are PE figures estimated?	Who manages the wastewater treatment plants?	Would alternative management be more effective?
Carlow	Yes	No information	Area Engineers	Yes
Cavan	Yes	House count / BOD x flow	Dedicated Water Engineer	No
Clare	Yes	BOD x flow	Dedicated Water Engineer	No
Cork North	No	No information	Area Engineers	Yes
Cork South	No	No information	Area Engineers	Yes
Cork West	No	No information	Area Engineers	Yes
Donegal	Yes	BOD x flow	Dedicated Water Engineer	No
Galway	Yes	BOD x flow	Area Engineers	Yes
Kerry	Yes	BOD x flow	Dedicated Water Engineer	No
Kildare	Yes	BOD x flow	Dedicated Water Engineer	No
Kilkenny	Yes	BOD x flow	Section in Water Services	No
Laois	Yes	House count	Dedicated Water Engineer	No
Leitrim	Yes	House count	Section in Water Services	No
Limerick County	Yes	BOD x flow	Dedicated Water Engineer	No
Longford	Yes	BOD x flow	Section in Water Services	No
Louth	Yes	BOD x flow	Section in Water Services	No
Mayo	Yes	BOD x flow	Area Engineers	No

Local Authority	Wastewater Treatment Plants			
	Is influent flow measurement device installed at main plants?	How are PE Figures Estimated?	Who manages the wastewater treatment plants?	Would alternative management be more effective?
Meath	Yes	BOD x flow	Area Engineers and section in Water Services	Yes
Monaghan	Yes	BOD x flow	Area Engineers	Yes
Offaly	Yes	Census figures	Section in Water Services	No
Roscommon	Yes	BOD x flow	Dedicated Water Engineer	No
Sligo	No	House count	Section in Water Services	No
Tipperary North	Yes	BOD x flow	Dedicated Water Engineer	No
Tipperary South	Yes	BOD x flow	Area Engineers	No
Westmeath	Yes	BOD x flow	Area Engineers	No
Wexford	Yes	BOD x flow	Area Engineers	Yes
Wicklow	No	No information	Area Engineers	Yes

Note: BOD - Biochemical Oxygen Demand.

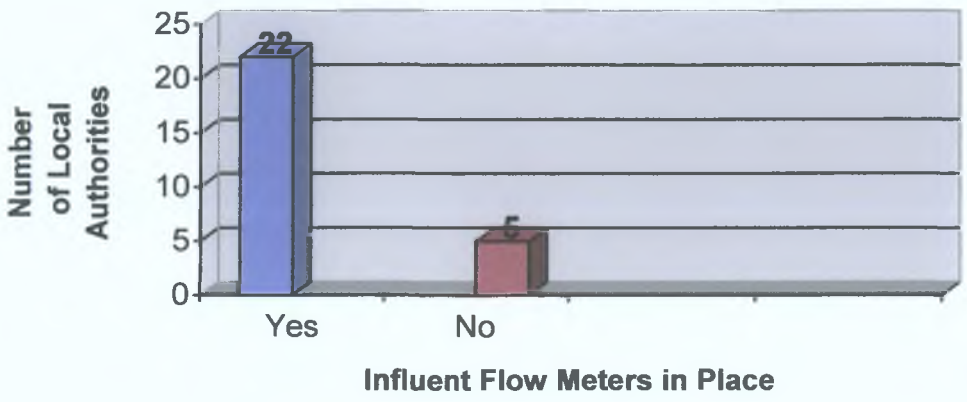
3.17.2 How PE figures are estimated

The figure of 60 grams of BOD per person per day is used when estimating the PE of a wastewater treatment plant. If a composite sample (flow proportional or timed) is taken over twenty four hours and the flow for that period is also measured, then an estimated figure for PE can be calculated. By testing the composite sample and determining a value for the BOD (mg/l), this figure can then be multiplied by the influent flow (m^3/day). The result is the BOD load (kg/day) entering the plant over twenty four hours. If this figure is divided by 0.06 (60g of BOD per person per day), then the PE figure can be estimated for that plant. This is the way most Local Authorities estimate the PE of their wastewater treatment plants.

3.17.3 Influent Flow Measurement

Twenty-two Local Authorities have influent flow measurement on the wastewater treatment plants that de-water sludge in their functional area. Five Local Authorities have some or no influent flow meters on their wastewater treatment plants.

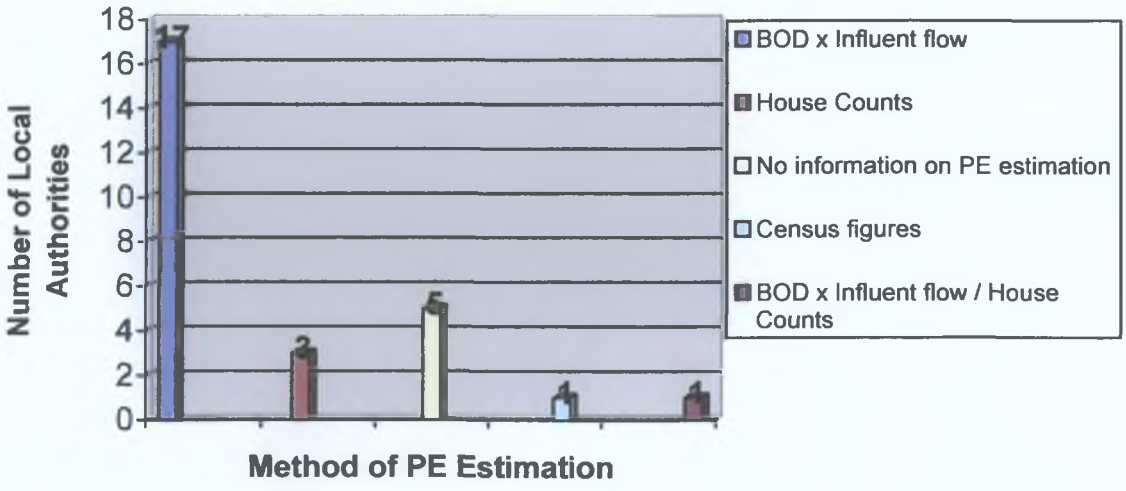
Figure 13 **The number of Local Authorities that have influent flow meters installed on all wastewater treatment plants that de-water sludge in their area.**



3.17.4 Estimation of PE figures

Seventeen Local Authorities estimate the PE of agglomerations in their areas using influent flow measurement and composite samples (BOD x influent flow). Three Local Authorities use house counts. One Local Authority estimates the PE from census figures. One Local Authority estimates the PE figures from both house counts and BOD x influent flow, while five Local Authorities have no information on how PE is estimated.

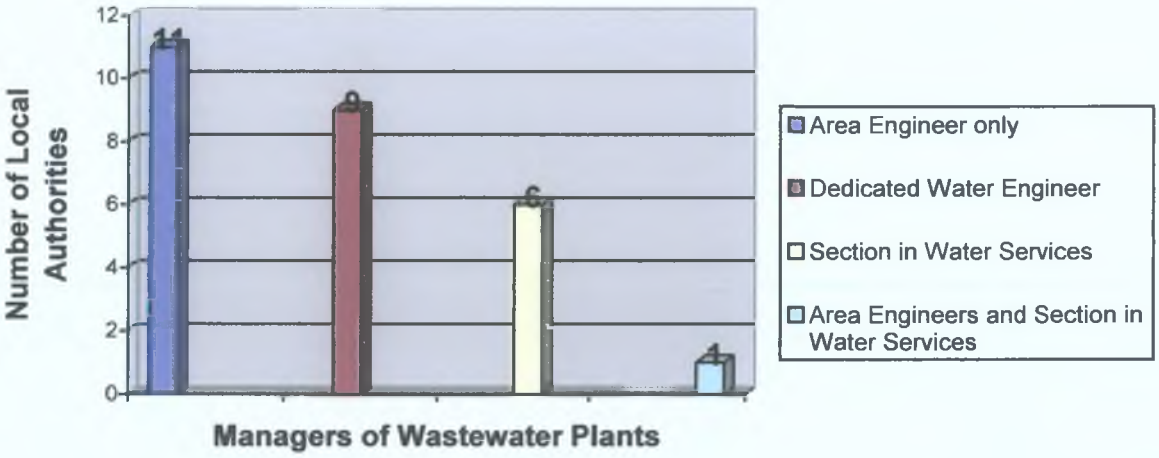
Figure 14 **Method of estimation of PE figures in Local Authorities.**



3.17.5 Management of Wastewater Treatment Plants

Wastewater treatment plants are managed by personnel in three ways in Local Authorities. Area engineers who are involved in all aspects of Local Authority work, dedicated water services engineers managing water and wastewater operations based in the area and engineering and technical personnel managing the plants from head office.

Figure 15 How wastewater treatment plants are managed in Local Authorities.



In nine out of the eleven Local Authorities where area engineers are managing wastewater treatment plants, sources in the water services of those Local Authorities would like to see a change in management practices.

Note:

It is not possible to summarise all of the information in the Local Authority survey as there are very significant differences between Local Authorities. The reader needs to refer to Appendix A to get a better understanding of what is happening in Local Authorities.

3.18 Results obtained from Questionnaire of Engineering Consultants

In order to investigate the direction that engineering consultants in Ireland were taking in relation to sludge management, a questionnaire was formulated (See Table 5). Five consultants were selected on the basis that between them, they had produced ninety five per cent of the sludge management plans for Local Authorities. The consultants were:-

1. Fehily Timoney & Co.;
2. RPS MCOS;
3. Entec and O'Dwyer;
4. P.H. McCarthy & Partners;
5. T. J. O'Connor & Associates.

The following are the results obtained from the questionnaire (Table 5).

Table 18 Rating of the different sludge treatment technologies on a scale of one to six with one representing the most favoured technology and six the least favoured.

Technologies	Consultants A-E				
	A	B	C	D	E
Thermal drying	1	1	1	1	1
Lime stabilisation	2	2	2	2	2
Composting	4	3	3	3	4
Thermophilic aerobic digestion	5	5	5	5	5
Mesophilic anaerobic digestion with pre or post pasteurisation	3	4	4	4	3
Mesophilic anaerobic digestion	6	6	6	6	6

Table 18 indicates that all the consultants who have produced sludge management plans for Local Authorities favour thermal drying as an end treatment for sludge. Lime stabilisation is favoured as a second choice while mesophilic anaerobic digestion is selected last because it does not produce a pasteurised sludge.

Table 19 Reasons Engineering Consultants have selected Thermal Drying.

Consultant A
Thermal drying is selected because it is the most versatile product. It can be incinerated, exported, used in horticulture/agriculture. It has many different outlets if the agricultural route is closed.
Consultant B
Thermal drying is selected because it reduces the volume of the material, the material is easier handled, transport costs are reduced and the product is more versatile. The sludge can be used elsewhere if there is a ban on its use in agriculture.
Consultant C
Thermal drying is selected because it achieves a massive volume reduction in the sludge material, there are less truck movements. The product is more versatile than other end products and can be used elsewhere if there is a food scare from using sewage sludge in agriculture.
Consultant D
Thermal drying achieves a massive volume reduction in the sludge and is the most versatile product. The department (DoEHLG) have driven thermal drying as the most viable option economically.
Consultant E
Thermal drying is selected because it achieves a huge volume reduction in the treated material and is a very versatile product.

Table 19 indicates that the main reason consultants have selected thermal drying is that it produces a versatile product and it achieves a huge volume reduction in the material.

Table 20 Answers by Engineering Consultants in relation to the economics of installing Thermal Drying in smaller Local Authorities

Consultant	
A	Smaller Local Authorities should have joint sludge treatment centres.
B	Yes, dryers have come down in size and cost.
C	Yes, dryers have come down in size and cost.
D	Yes, dryers are now manufactured on a small scale and are cheaper.
E	A certain volume of sludge is required for a dryer to make economic sense. Combustion can be a problem and there is also the danger of an explosion.

Table 21 Answers by Engineering Consultants in relation to Local Authorities having alternative sludge treatment options installed as contingency plans in the event of dryer breakdown.

Consultant	
A	No. Storage for sludge should be built into wastewater treatment plants or Local Authorities should have outlets for sludge arranged with other Local Authorities in the event of problems occurring.
B	No. It would not be in the contractor's interest to let the dryer malfunction and if it does the landfill option is there in the short term if there is a problem.
C	Yes. The alternative sludge treatment type should be constructed on the same site.
D	No. Other outlets such as coppicing can be used as an outlet if there are short term problems
E	No. It would be too expensive.

Table 21 indicates that most consultants would not consider alternative sludge treatments in a Local Authority as a contingency plan.

Table 22 **Answers by Engineering Consultants in relation to whether or not the agricultural outlet for sewage sludge is sustainable in the long term.**

Consultant A
Yes, if the Code of Good Practice is implemented now. If the Code is not implemented and there is an incident with the use of sludge that is not pasteurised, it could jeopardise the future use of sludge in agriculture.
Consultant B
There are too many uncertainties. If there is a scare as a result of the production of food from sludge there could be a complete ban. Recently in the U.K., distilleries have stopped accepting malt and barley from land that sewage sludge was applied to.
Consultant C
From a logic and engineering perspective, yes. But logic does not come into it. If someone finds a link between a disease and the use of sewage sludge in agriculture, this outlet will close immediately.
Consultant D
It will depend on public opinion. If through the spreading of untreated sludge on agricultural land there was a food scare, people would refuse to eat produce grown from recycled sludge.
Consultant E
The agricultural outlet for sludge is not feasible in the long term as there is too much competition from agricultural sludge and sludge from intensive agricultural enterprises.

Table 22 indicates the fear that consultants have, that in some way sludge being recycled to agricultural land could be linked to sickness or disease and as a result the agricultural outlet closed immediately. This would be a major influencing factor when deciding which type of sludge treatment to select.

Table 23 Answers by Engineering Consultants in relation to availability of alternatives if the agricultural outlet is closed.

Consultant	
A	The alternatives would be outlets to forestry, horticulture and incineration of the sludge and heat recovery.
B	The alternatives would be incineration of the sludge and heat recovery, use as a building material or oil from thermally dried sludge.
C	The alternatives would be forestry, set aside land, land reclamation and incineration.
D	The alternatives would be capping on landfills, parks and incineration.
E	The alternatives would be coppicing and incineration.

Table 23 indicates that consultants would favour incineration as a means of disposing of sludge in the future with the possibility of heat recovery in the process.

3.19 Information from other Stakeholders

Other agencies were contacted as part of this study to ascertain their views in relation to sludge treatment and disposal by Local Authorities. These agencies were selected on the basis that they would influence or be affected by the Local Authority management of sludge. The agencies included, the DoEHLG, the EPA, the Food Safety Authority and the Department of Agriculture and Food (primary food production) (Questions listed in Tables 6, 7, 8 and 9).

3.19.1 The Department of the Environment, Heritage and Local Government (DoEHLG)

Officials in the DoEHLG have outlined the following in relation to sludge treatment and disposal in Local Authorities:

- They recommended originally that sludge management plans be carried out for each Local Authority and that finances be made available for this purpose.
- They do not recommend a particular type of end treatment for sludge but state that the treatment selected should offer the maximum flexibility for different outlets. The end product must be the most sustainable type of product.

- It is national policy to tender for projects on a Design, Build and Operate (DBO) basis and this will apply to all wastewater treatment plants eventually.
- Past record keeping by Local Authorities in relation to sampling and monitoring wastewater treatment plants has not been good and the only way to sort this out is in a contractual manner.
- From a legal and environmental point of view, it would be better to outsource operations as the operators would be more accountable.

3.19.2 The Environmental Protection Agency (EPA)

Inspectors in the EPA have outlined the following in relation to compliance with statutory obligations:

- There are very few complete sludge registers in Local Authorities.
- There is a significant number of Local Authorities not complying with the regulations, particularly with regard to sludge registers and spreading sludge on agricultural land where Nutrient Management Plans have not been carried out.
- They would encourage Local Authorities to ensure that third party contractors are monitored on a regular basis to ensure they are complying with regulations and not causing pollution.
- The EPA do not have the resources to audit storage for sludge in Local Authorities.
- The EPA have recommended that all plants over five hundred PE and less than two thousand PE should have six composite samples taken on the effluent every year.
- It is obligatory for Local Authorities to take composite samples on all plants over two thousand PE in their functional area. However a significant number (fifty percent) of these plants are not complying.

3.19.3 The Food Safety Authority

An official in the Food Safety Authority stated that they have no jurisdiction over the primary production of food and the use of sewage sludge for that purpose as they are more interested in how food is prepared and stored.

3.19.4 The Department of Agriculture and Food (Primary Food Production)

Officials in the Department of Agriculture and Food have stated that they have no issue with the use of sewage sludge in primary food production as long as S.I. 148 of 1998 and S.I. 267 of 2001 are complied with.

4.0 DISCUSSION

4.1 Preferred Treatment Option

Thermal drying seems to be the preferred option for sludge treatment in most Local Authorities. The DoEHLG inspectors state that the sludge treatment selected should offer the maximum flexibility for different outlets. Engineering Consultants (those surveyed in this study) point out that the only end sludge product to offer maximum flexibility is a thermally dried one because the dried sludge:-

- Has a much-reduced volume compared to other treatments.
- Is easy to store
- Can be used in horticulture
- Has a calorific value equal to brown coal
- Can be exported

The consultants also point to the fact that it will take only one food scare and the agricultural outlet could be closed, but if the product is thermally dried it can be used elsewhere.

4.2 Agricultural Outlet not Sustainable

Based on the findings of this study, there seems to be a consensus among operating contractors, Local Authority engineers and consultants involved in sludge treatment and disposal that an agricultural outlet for sludge will not be sustainable in the long term. This 'fear' is driving thermal drying as a preferred option for the end treatment of sludge. The contractor operating Ringsend wastewater treatment works for Dublin City Council is already looking at alternative outlets for sludge other than agriculture. The contractor operating Bunlickey wastewater treatment works for Limerick City Council is beginning to find difficulties in locating agricultural outlets for the sludge. Louth County Council are investigating the possibility of using the treated sludge as a fuel source for cement manufacturing.

The wastewater treatment plant in Galway City (Mutton Island) incorporates mesophilic anaerobic digestion with pre-pasteurisation for sludge treatment and as a result, produces a pasteurised sludge. However the sludge management plan for Galway County Council states that the sludge hub centre proposed for the county

which includes a thermal dryer should be sized so as to be capable of accepting all the sludge from Mutton Island. This proposal does not give a vote of confidence to the type of pasteurised sludge already being produced at Mutton Island.

Some consultants state that there could be a problem with food produced from sludge in the long term as competition intensifies in the food industry. Food producers could differentiate themselves from similar producers in the industry by labelling the product as sludge free and this could have a perceived negative impact on food grown on land where sludge was spread.

4.3 Food Safety Authority

When the author contacted an inspector in the food safety authority over any concerns they might have over recycling sludge into food production, the inspector outlined that their main concern was food preparation and storage and not primary production.

This is a surprising comment considering raw sludge contains pathogens, heavy metals and organic compounds. The fact that heavy metals can bio-accumulate in the food chain should be enough to merit the Food Safety Authority's involvement in primary food production, even if it was just liasing with their colleagues in the Department of Agriculture and Food so that an established line of communication is present in the event of any food scare associated with sewage sludge.

4.4 Department of Agriculture and Food

An official in the food division of the Department of Agriculture and Food when contacted over the use of sewage sludge in food production stated that as long as the current regulations (S.I. 148 of 1998 and S.I. 267 of 1991) were being complied with, he would have no concern with the use of sewage sludge in agriculture.

The fact that the present regulations can be interpreted widely and lead to the possibility of farmers spreading this sludge outside the limits of the regulations should necessitate the Department taking on a more proactive role in relation to the production of food where sewage sludge is used as a fertiliser. The Department should be liasing with Local Authorities in regard to where sewage sludge is spread

and the periodic testing of food produced from such sludge. If there was a food scare associated with the use of sewage sludge, an existing data base of information built up by the Department of Agriculture and Food might help in locating the source of contamination.

4.5 Reliability of PE Figures

There is a question mark over some of the PE figures produced by some of the Local Authorities in the EPA Urban Waste Water Returns to the EPA. They are not reliable due to:-

- Lack of flow measurement at wastewater treatment plants;
- Absence of composite samples being taken;
- Non calibration of existing flow metres on plants;
- Lack of training;
- Lack of resources.

Wicklow County Council has only two operational influent flow metres in wastewater treatment works in the county. The Western Division of Cork County Council has none. However, most new plants now being constructed have influent and effluent flow meters installed so that PE figures can be calculated accurately and in turn, expectant sludge quantities.

4.6 Counties unable to recycle sludge

A number of counties are unable to recycle sludge to agriculture in large parts of their functional area as detailed below:

- Monaghan has areas of high soil phosphorus content and as a result, sludge cannot be spread in these areas. The county also has many Intensive Agricultural Enterprises (IAEs) (used for intensive rearing of poultry, pigs and mushrooms) and waste from these industries will take precedence over sewage sludge when it comes to recycling these wastes to agriculture.
- Cavan also has high areas of soil phosphorus content and also contains many IAEs and again this situation will reduce the available land for recycling sewage sludge.

- Clare has thin soil cover over large parts of the county and as a result, this land is unsuitable for sewage sludge recycling.
- Mayo has areas of high soil phosphorus content and as a result, sludge cannot be spread in these areas.
- Kildare has high natural cadmium levels in soil and cadmium is one of the heavy metals that determines if or how much sludge can be recycled to land.
- Leitrim has large areas of poor soil conditions and drainage and therefore unsuitable for recycling sewage sludge as surface water could become contaminated.
- Waterford has a regionally important aquifer and the spreading of sewage sludge could contaminate this aquifer.
- Dublin has no land available for sludge recycling.

4.7 Lack of Awareness

There is a distinct lack of awareness of what is happening in neighbouring Local Authorities in regard to existing and proposed sludge treatment and disposal. Every Local Authority is acting independently and proposing to implement their own sludge management plans. Within Local Authorities, most engineers, technicians and caretakers who are dealing with sludge are not aware of the present state of the sludge management plan or what the plan proposes. Again in most cases, it is a single engineer in the Local Authority that is dealing with the sludge management plan and there seems to be very little communication (consultative or informative) with other technical personnel. This statement is based on the telephone survey which highlighted the lack of knowledge officials (people who are working in sludge treatment and disposal) had of the sludge management plan in their respective counties.

4.8 Variation of Sludge Production Figures

In the EPA 2003 Urban Waste Water Returns, Local Authorities supplied PE figures for population centres (above 500 PE) in their areas. In the author's survey on Local Authorities, sludge production figures were acquired for 2004 for treatment plants with de-watering equipment. Table 24 gives PE figures for each Local Authority and also gives the figures for sludge production based on the survey of Local Authorities.

The Table also gives a sludge production figure of kilograms of dry solids per person per year for each Local Authority which is derived from the two initial figures. This figure works out at an average of nineteen kilograms per person per year (52.1g of dry solids per person per day) and compares favourably to the data in Table 1. However there is a huge variation of approximately 666% between the lowest and highest sludge production figures (6-40kg/person/year). This raises the question as to how reliable these PE and sludge production figures are. The question must also be asked as to how these figures are calculated.

Table 24 PE and Sludge Production Figures for each County

Local Authority	Estimated PE figures for de-watering plants in each jurisdiction based on survey of Local Authorities	Estimated sludge production figures for de-watering plants in each jurisdiction based on survey of Local Authorities (Tonnes of dry solids per annum)	Per capita sludge production based on survey of Local Authorities (Kg dry solids per person per annum)
Carlow	43,900	472	11
Cavan	21,450	797	37
Clare	49,090	401	8
Cork City	328,000	2,190	7
Cork North	39,075	482	12
Cork South	48,700	1,210	25
Cork West	15,000	600	40
Donegal	38,300	654	17
Dublin City	2,587,621	14,600	6
Fingal	60,000*	912*	15
Galway City	73,000	1,615	22
Galway Co.	35,634	1,131	32
Kerry	106,873	927	9
Kildare	143,139	2,480	17
Kilkenny	110,000	1913	17
Laois	34,464	394	11
Leitrim	7,332	89	12
Limerick City	56,000	1,800	32
Limerick Co.	23,800	621	26
Longford	28,318	1,056	37
Louth	235,535	1,948	8

Local Authority	Estimated PE figures for de-watering plants in each jurisdiction based on survey of Local Authorities	Estimated sludge production figures for de-watering plants in each jurisdiction based on survey of Local Authorities (Tonnes of dry solids per annum)	Per capita sludge production based on survey of Local Authorities (Kg dry solids per person per annum)
Mayo	84,500	1,501	18
Meath	42,300	1,448	34
Monaghan	61,498	846	14
Offaly	34,550	814	24
Roscommon	24,367	295	12
Tipperary NR	32,000	461	14
Tipperary SR.	53750	911	17
Westmeath	53,300	1,024	19
Wexford	49,200	1,278	26
Wicklow	32,300	587	18
Average			**19**
			Range: 6-40kg/PE/annum

*using only Malahide and Swords in Fingal County Council

4.9 Some PE figures are notional

Some Local Authorities have produced PE figures for population centres where there is no flow measurement on the wastewater treatment works serving that centre.

4.10 Reasons for non-correlation of PE figures with sludge production

The following could be some of the reasons for sludge production not correlating with PE figures:

- Wastewater treatment plants achieving poor levels of BOD removal, and therefore generating less residual sludge
- No influent flow measurement present at the wastewater treatment plant
- No composite sampling taking place on the wastewater treatment plant
- Incorrect PE figures
- Influent flow metres not calibrated
- Importing sludge from other wastewater treatment plants and not accounting for the associated PE figures

- Incorrect weighing of sludge leaving the plant
- Incorrect values for solids content of sewage sludge
- No storm tanks on the wastewater treatment works, resulting in washout of solids from the system

4.11 Sludge Disposal in North West

In the North West of the country, Local Authorities such as Donegal, Sligo, Leitrim, Roscommon, Mayo, Longford and Cavan have their sludge disposal contracted out to two main contractors. These contractors remove sludge directly from wastewater treatment plants by vacuum tanker and deep inject the sludge into land in Louth, Westmeath and Galway or they store the sludge for a period before spreading. This sludge does not receive any treatment except "long term storage" and in some cases is not screened. In some of the Local Authorities (Roscommon, Leitrim, Longford and Cavan) the sludge that has already been de-watered by belt presses at wastewater treatment plants has to have water added to it again to enable the sludge to be removed by vacuum tanker.

The spreading of untreated sludge on agricultural land is unacceptable especially when there are contractors available to remove this sludge and lime stabilise it before land spreading.

4.12 Unsure of Sludge Recycling Destination

Some Local Authorities are unable to say for certain where their sludge is disposed to. They have records to indicate its removal from the wastewater treatment plants in their functional area but no report as to where it has actually been spread or stored. In some cases, the contractor has informed the Local Authority that all the sludge removed to date is in storage and there is at present no need for any reporting.

This is clearly in breach of legislation and is highly irresponsible as there is no record of where the sludge is disposed to or if Nutrient Management Plans (NMPs) have been prepared. In most cases, this lack of information on sludge disposal applies to liquid sludge. If the regulations are to be complied with, this sludge would have to be stored for three months before spreading. As a result, the Contractor would require an enormous amount of storage capacity for this sludge to leave it undisturbed for

the required three months before spreading. In the author's opinion, this sludge is not receiving the storage retention time as required by the regulations and is possibly being spread directly on to land.

4.13 Absence of Storm Overflows

In some of the older works in Local Authorities, there are no storm tanks or storm overflows in the event of heavy rain. As a result, some of these collection systems which are combined systems divert all of the surface water into the wastewater treatment plant and wash the mixed liquor suspended solids (MLSS) out of the plant. This MLSS effectively contains all the bacteria needed to treat the incoming sewage. The end result is little or no treatment for several weeks after the storm and as a result, no sludge production. This also has a significant negative impact on the quality of the effluent discharged from the wastewater treatment plant.

4.14 Sludge Management Plans not Implemented

Local Authorities were issued with copies of "Sludge Management Plans, A Guide to their Preparation and Implementation" and "A Model Sludge Management Plan (Sludge Management Plan for Tipperary South Riding County Council)" by the DoEHLG in June 1999 and were told to proceed with the development of their sludge management plans. Six years later, only three of those sludge management plans have been implemented i.e. Dublin City Council, Cork City Council and Wexford County Council. The "Model Plan" which was based on Tipperary South Riding County Council in 1999 has not been implemented yet. Some of the sludge plans in Local Authorities are in the process of being implemented and some are being reviewed.

The treatment of sludge to ensure compliance with the code of good practice is very expensive (from 500 euro per tonne of dried solids - Dublin City Council to 900 euro per tonne of dried solids - Wexford County Council) and this is possibly one of the reasons why sludge management plans have been slow to be implemented.

4.15 Lack of Sludge Storage Facilities

Local Authorities in general have no sludge storage facilities of their own and rely on sludge disposal contractors or farmers to provide storage during times of the year when sludge cannot be spread on land. The Engineering Inspector in the DoEHLG

has stated that even in the event of wastewater treatment plants and associated sludge disposal being tendered as Design, Build and Operate (DBO) contracts, Local Authorities will still have a certain responsibility to locate outlets for the sludge along with the DBO contractor. When the Nitrates Directive is implemented, Local Authorities might have to provide storage for sludge for up to six months.

4.16 Importation of Sludge from other Local Authorities

Local Authorities are currently powerless (unless they introduce bye-laws) to prevent the importation of sludge from other Local Authorities by sludge disposal contractors. Where sludge is being imported into a county, the onus is on the sludge contractor to inform the Local Authority whose area the sludge is being spread on and provide details for the sludge register to the Local Authority in question. In an instance recently, sludge removed from a Local Authority was deemed by that Local Authority to have levels of nickel that were too high to comply with the regulations but this sludge was spread in another Local Authority area and was deemed by the contractor to comply with the regulations.

As a result of complaints from the public, Laois County Council have recently implemented bye-laws to control the large quantity of sludge from other Local Authorities being imported by contractors into the county to be spread on lands there. These bye-laws require any farmer or land owner using "industrial sludge, which includes sewage sludge," which is imported from outside the county to apply for a permit before such sludge can be spread on land.

Carlow County Council are currently investigating the quantity of sludge being imported to the county from other Local Authorities by sludge disposal contractors and the degree of compliance with the regulations by these contractors. This is the result of complaints from the public and the threat of legal action being taken against the Council. The Council will consider as a last resort, imposing bye-laws to control the spreading of this imported sludge.

Bye-laws which introduce a permit system should only be considered where non-compliance with the regulations is occurring because the introduction of bye-laws could have the potential to reduce the amount of agricultural land available for sludge recycling.

4.17 Sludge to Landfill

Some Local Authorities are still disposing of sludge to landfill (although in a minority). In most cases, the solids content of the sludge is not meeting the landfill licence requirements i.e. the sludge is too wet.

The sludge from Lismore and Portlaw wastewater treatment plants in County Waterford is disposed of to landfill in Tramore and must be at least fourteen percent before entering the landfill. Both of these wastewater treatment plants have single belt presses which will typically only achieve a sludge solids content of twelve percent maximum.

All the sludge from the Southern Division of Cork County Council is being disposed to landfill at Rosmore where the sludge must be a minimum of twenty percent solids to enter the landfill. The sludge produced in the wastewater treatment plants in the Southern Division of Cork County Council ranges from twelve to twenty percent.

4.18 Double Handling of Sludge

Imported cake sludge brought into the sludge dryer in both Wexford town and Limerick City has to have water added to it again to blend it in with the existing sludge on the plant before being de-watered again in the centrifuge. This practice results in the imported sludge being double handled. This leads to increased polyelectrolyte usage and increased running costs of the centrifuge.

4.19 Local Authorities directly managing Sludge Recycling to Agriculture

There are only three Local Authorities who oversee and implement their own sludge recycling to agriculture i.e. they do not use sludge disposal contractors. These Local Authorities are Galway County Council, Kerry County Council and Wicklow County Council. These Local Authorities have located their own land banks within their county boundaries and oversee all aspects of sludge disposal and produce their own sludge registers. If these Local Authorities can do this, why are other Local Authorities relying heavily on sludge contractors to carry out all aspects of sludge disposal?

4.20 No Sludge Registers

Some Local Authorities had no sludge registers available (a minority) and had no information on the destination of their sludge, even though this sludge had been land spread. These Local Authorities are clearly in breach of the legislation.

4.21 No Data Collection Management System

There seems to be no dedicated system for collecting data on sludge treatment and disposal in Local Authorities at present. There is no central data base that personnel can access to input results. Each caretaker or technician produces the results from his or her area and when requested, sends this data into headquarters. In the process of the survey for this study, contact had to be made with up to twelve people in some Local Authorities in order to get the requested information for sludge production and disposal. This begs the question as to who is responsible for producing the sludge register. In some Local Authorities, they did not have the 2004 results for sludge production as they were not available (Donegal, Sligo). There seems to be no urgency in implementing some form of an Environmental Management System that would make data more accessible to everyone in the Local Authority.

4.22 Lack of Responsibility for Monitoring and Reporting

In some Local Authorities, there seems to be no urgency or motivation to solve the sludge problem as long as there is an outlet for the sludge. Sludge contractors in most cases are supplying these outlets for Local Authorities through a network of farmers and land owners. Local Authorities are not complying with legislation with regard to monitoring and reporting of sludge disposal and some Local Authorities appear to be pointing the finger at the sludge disposal contractors implying they are responsible for complying with the regulations. However, it is the Local Authority that is ultimately responsible for ensuring that all sludge handling complies with legislation and a sludge register is compiled according to the regulations. It is clear that some Local Authorities are relying too much on these sludge disposal contractors.

4.23 Discrepancy in Sludge Production Figures

In the 'Urban Waste Water Discharges in Ireland, A Report for the years 2002 and 2003' compiled by the EPA, Sligo County Council had sludge production figures of 169tds and 16tds for the years 2002 and 2003 respectively. It is highly unlikely that sludge production figures could drop by over one thousand per cent in one year. However, during the survey for this study, the figures received from Sligo County Council for sludge production amounted to 45tds for 2003 and some of the Sligo wastewater treatment plants were not included in this figure. This again raises the question as to how accurate the sludge returns from Local Authorities are and how this information is collected in the first instance.

4.24 Compliance with Code of Good Practice

Some Local Authorities view compliance with the "Code of Good Practice for the use of Biosolids in Agriculture" as an exorbitant cost and will only comply with it when forced to do so by legislation. There are two issues here:-

(a) The commitment of Local Authority Management to build these new wastewater and sludge treatment plants, and

(b) Arranging the necessary finance to run the plants after they are built.

Both scenarios will possibly involve unpopular decisions being made by management in the form of increased commercial rates, and inevitably domestic, water and wastewater charges being implemented in the future.

4.25 Dried sludge as a Fuel Source for Cement Production

Louth County Council are currently investigating the possibility of using the treated dried sludge from the thermal dryer as a fuel source for cement production. During the survey for this study, the technical director of Irish Cement was interviewed on this question. He stated that Irish Cement would be happy to accept dried sewage sludge as a fuel source in the cement kilns both from an environmental view point i.e. assisting the community in disposing of waste and as a cheap fuel source. The logistical problems of transporting large quantities of dried sewage sludge to a cement works would have to be planned and then the operation would have to comply with the regulations under the Waste Management Act and to this end would require an Integrated Pollution Prevention Control (IPPC) Licence.

4.26 EPA view of Local Authority Compliance

The EPA have stated that a significant number of Local Authorities are not complying with the regulations in regard to the sludge register. Non-compliance includes sludge being spread on land without carrying out nutrient management plans. These Local Authorities are in clear breach of the regulations.

4.27 Complaints

There appears to be very little evidence of complaints to Local Authorities in regard to the disposal of sludge. This could be due to the fact that people are not aware of what is happening to sewage sludge in their community. It could also be due to the lack of monitoring and documenting of complaints received by the Local Authorities.

4.28 Composite Sampling

Based on the survey of the study of Local Authorities, 55% of Local Authorities use composite sampling for reporting purposes on their main plants and 44% use both composite and grab sampling. This would be in line with the EPA Inspector's comments where he stated that 50% of plants (over 2,000 PE) are not complying with their statutory obligations in taking composite samples at wastewater treatment plants.

4.29 The views of the DoEHLG Inspectorate

The DoEHLG Inspectorate have stated that it is national policy to adopt the Design, Build and Operate (DBO) tendering system in regard to sludge treatment and disposal. The Inspectorate referred to the EPA report (2003), which showed that some Local Authorities did not even take samples on some of the wastewater treatment plants and stated that this was unacceptable. The Inspectorate also stated that from a legal and environmental perspective, it would be better to out-source operations as it would be more accountable. This statement does not reflect well on Local Authorities.

4.30 Definition of "Treated Sludge" in S.I. 148 of 1998

Under S.I. 148 of 1998, "treated sludge" means sludge which has undergone biological, chemical or heat treatment, long-term storage or any other appropriate

process so as to significantly reduce its fermentability and the health hazards resulting from its use. The key phrase here is to "significantly reduce its fermentability" which leaves the description of treated sludge (biosolids) open to wide interpretation. This is a major weakness of the 1998 Use of Sewage Sludge in Agriculture Regulations as it does not quantify the term "significant".

4.31 Privatisation of Wastewater Treatment Plants

Investment in wastewater infrastructure in Local Authorities has been substantial, but only in the last ten years. Prior to this there was very little investment in wastewater treatment plants in Local Authorities. Operational budgets for these wastewater treatment plants were insufficient and facilities for Local Authority personnel working on these plants were at best basic or non-existent. However, now there seems to be plenty of resources available to construct new wastewater treatment plants as long as they are operated by the private sector under DBO type contracts which are being promoted by the DoEHLG. The DoEHLG are possibly basing this strategy on past history of poor Local Authority operation of these wastewater treatment plants when there was very little investment in such plants and insufficient finance for operation.

There are advantages and disadvantages in the argument for Local Authorities operating wastewater treatment plants as opposed to private contractors. The advantages are:

- The Local Authority retain the expertise in operation and maintenance of wastewater treatment plants. This would be valuable in times of crises.
- Local Authorities would not be operating the wastewater treatment plants to make a profit, so in theory, the Local Authority should operate it for less.
- Local Authorities would have no contractual problems in relation to the operation of the wastewater treatment plant.

The disadvantages are:

- There is the possibility that management in the Local Authority would not provide sufficient resources to operate the wastewater treatment plant.

There does not appear to be any evidence to show that a private contractor can run a wastewater treatment plant more effectively and efficiently than a Local Authority.

However a private contractor operating a wastewater treatment plant under a DBO type contract with the Local Authority will be guaranteed sufficient funding to operate the plant. Past history shows that this same funding could not be guaranteed if the Local Authority were operating the plant.

The Local Authorities themselves are presently unable or prevented from tendering for the operation of such plants. It could be argued that this practice should be changed. In the event of this happening and a Local Authority submitting a successful tender, funding would have to be guaranteed by some form of a legal agreement.

4.32 Problems associated with existing DBO Type Contracts

Both Dublin City Council and Limerick City Council state that they are encountering problems already in securing land for recycling of the sludge and as a result more of it has to be stored. There is also a major contractual dispute between Dublin City Council and the operating contractor at Ringsend wastewater treatment works in relation to unforeseen costs and foul odours in the vicinity of the plant due to maintenance difficulties.

One of the sludge dryers in the Dublin City Council wastewater treatment plant at Ringsend exploded last year while in operation, which is worrying in regard to health and safety. This dryer is still unavailable. As a result, there are only two dryers currently in operation and there is an ongoing difficulty in trying to cope with the throughput of sludge. If one of the remaining dryers break down or need maintenance, then Dublin City Council will have a very serious problem on their hands.

There is a problem with the sludge dryer in the Wexford County Council wastewater treatment plant at Kerlogue in Wexford town as it has caused foul odours to permeate the surrounding area during the summer months. In the last summer of 2004, the sludge drier had to be shut down and a contractor hired to remove the de-watered sludge at twenty five per cent solids and lime stabilise it before land spreading. This dryer is still shut down.

There are problems with the sludge treatment section of the wastewater treatment plant at Mutton Island in Galway City. The capacity of the sludge treatment centre is too small. Sludge storage, secondary sludge thickening drums and the pre-pasteurisation vessel are too small and will need to be increased.

5.0 CONCLUSIONS

Local Authorities have a responsibility to treat and dispose of safely the resultant sewage sludge from wastewater treatment plants to comply with the Waste Management Act (Use of Sewage Sludge in Agriculture) Regulations, 1998, S.I. No. 148 of 1998 and the Waste Management Act (Use of Sewage Sludge in Agriculture)(Amendment) Regulations, 2001, S.I. No. 267 of 2001. It can be concluded from this research that compliance with statutory obligations within Local Authorities with regard to sludge treatment and disposal leaves considerable room for improvement.

Failure to achieve compliance with regulations has arisen because of the following:

- There is an inadequate system currently in Local Authorities for monitoring and reporting sludge production, treatment and disposal.
- There is a certain lack of interest/indifference to sludge treatment and disposal (the present system works, leave it alone).
- There is very little public accountability and therefore no pressure to change.
- There has been a consistent lack of investment in infrastructure over the years in sludge treatment and disposal.
- There is a lack of resources and training in regard to monitoring and controlling sludge disposal to ensure compliance with regulations.
- There has been a lack of monitoring and enforcement by the EPA with regard to sludge treatment, storage and disposal by Local Authorities.

There is a need for an environmental management system to be introduced so that personnel know:

- What legislation they have to comply with?
- What they have to do to comply with this legislation?
- Documented procedures on what to monitor, measure and report?
- Who will be responsible to ensure the procedures are carried out correctly and then recorded?

To this end, the Performance Management System (PMS) should be implemented if possible at all wastewater treatment plants.

Local Authorities have been very slow to implement sludge management plans partially because of the running costs involved and partially because the 'Code of Good Practice for the Use of Biosolids in Agriculture' is currently an aspiration and not a statutory obligation.

The DoEHLG have insisted that new plants or plants that require upgrading should be run by private contractors as they would be more accountable. While the building of new wastewater treatment plants or the upgrading of existing plants is to be welcomed, Local Authorities should be free to tender for these plants under DBO type contracts.

In estimating PE loads into wastewater treatment plants, the figure of 60g BOD per person per day (which equates approximately to 30g per person per day of dried solids) has been universally used. From the research, a new figure of 19 kilograms of dried solids per person per annum has emerged which equates to 52.1g of dried solids per person per day. This figure is based on the existing sludge production and PE figures in waste water treatment plants in Local Authorities countywide. However, the problem is the variability of the figures (6-40kg/PE/annum) from county to county as the dry solids generation rate "ignores" sludge treatment method and results should be less variable. The accuracy of these figures and how they are calculated needs to be examined.

The limitations to this research are mainly that it was carried out over the telephone and people will generally paint the best picture. Employees of Local Authorities do not want to run down their employer or highlight areas of non compliance in which they themselves could be held accountable. Also, some additional questions should have been asked of the sludge disposal contractors with regard to records of sludge treatment, storage and disposal and Nutrient Management Planning.

6.0 RECOMMENDATIONS

6.1 Auditing of Contractors

All sludge disposal contractors being used by Local Authorities should be audited on a regular basis to ensure that the information they are supplying to Local Authorities on sludge recycling is accurate. This auditing should encompass all aspects of sludge movement, storage and disposal.

6.1.1 Sludge Movement

The movement of sludge from the wastewater treatment plant to the disposal site should occur without offending any member of the public. To this end:-

- All trucks should be in a clean state when leaving the wastewater treatment works;
- There should be no leakage or spillage from the trucks during transportation;
- There should be no odours emanating from the truck during transport.

6.1.2 Sludge Storage

- When sludge is being stored before spreading, details of location, type of storage and length of storage time should be recorded.
- The contractor should have enough storage capacity for sludge in times when sludge spreading is prohibited.
-

6.1.3 Sludge Disposal (Land spreading)

- A Nutrient Management Plan (NMP) should be carried out on the land prior to sludge spreading.
- The correct quantity of sludge should be spread on the land according to the NMP.
- The sludge should be spread according to the code of good agricultural practice.
- The sludge and soil should be tested according to the regulations.
- The sludge should be tested for pathogen kill.
- The Local Authority should have a complaints register set up to log any complaints in relation to the movement, storage and spreading of this sludge.

6.2 Record Keeping to Trace Sludge

Sludge source, transport and destination should be recorded using a triplicate docket system for each load of sludge removed from the wastewater treatment plant, whereby the plant operator would sign the sludge out, the carrier would sign acceptance of the sludge and the farmer would sign that the sludge was received all on the same docket. The carrier would return the completed docket to the plant operator for record purposes on arrival at the plant to remove the next load. This would make all parties accountable and enable the plant operator to trace each load of sludge exported from the plant.

6.3 Scrubbing of Odours

All sludge operations in wastewater treatment plants in populated areas should be housed in buildings and the foul odour generated should be extracted through scrubbers before being discharged to the atmosphere. The promotion of treated sewage sludge (biosolids) as a valuable fertiliser begins in the wastewater treatment plant. If the local community is antagonised by foul odours from the plant, the argument for using sewage sludge as a fertiliser is likely to be lost.

6.4 Installation of Flow Meters

Local Authorities should install influent flow meters on all wastewater treatment plants above 500 PE. Influent and effluent samplers should also be installed on all these plants. For the smaller plants, portable composite samplers should be purchased. The BOD load entering all the plants can then be calculated accurately and as a result, accurate estimates can be made of the PE and associated sludge production. By taking a composite sample of the effluent, the treatment efficiency of the plant can be calculated. The EPA has recommended that six composite samples should be taken per year on all wastewater treatment plants between 500-2000 PE. This is over and above the recommendations of the Urban Waste Water Treatment Regulations,1994.

6.5 Storage of Sludge

Local Authorities should provide dedicated storage for treated sludge. This storage should be located close to land banks and well away from any dwelling house. This storage should be sized so as to accommodate six months production of sludge in

each Local Authority area. The storage could be divided into a number of holding areas to suit the land banks. When the Nitrates Directive is implemented in this country, sludge will have no outlet to agriculture for up to six months of the year.

6.6 Provision for Cake Sludge in Dryers

All sludge hub centres with thermal drying as an end treatment for sludge should be designed so that they can accept imported cake sludge (at say minimum 18% solids) directly into the drier. This would avoid having to blend the imported sludge with the existing sludge by adding water to it and then sending the sludge to a centrifuge to be de-watered again. This would avoid double handling of the sludge and save energy, maintenance and polyelectrolyte costs.

6.7 Alternative Strategies for Sludge Treatment

There should be some diversification of end treatment of sludge i.e. composting, lime stabilisation and thermal drying. The engineering consultants (e.g. five consultants that produced 95% of sludge management plans for Local Authorities) state that a thermally dried product is the most versatile product and therefore the most desirable. However, if this type of product suffers from any negative publicity or dryers run into problems with odours or breakdowns, Local Authorities should have an alternative strategy in place to pasteurise the sludge.

6.8 Training

Training (both theory and practical) needs to be implemented for Engineering, Technical and Operating staff to ensure that they are familiar with all aspects of the operation of a wastewater treatment plant, particularly process operations. They need to understand that the importance of achieving a pasteurised sludge is as critical as achieving a clear effluent. They can achieve this by knowing what to monitor, measure and report. In this regard the "Performance Management System (PMS)" (refer to literature review) should be implemented at all plants.

6.9 Resources for Sludge Operations

Local Authorities need to provide resources so that sludge operations in each county can be delivered and monitored satisfactorily. In this regard, management should set up a dedicated Operations Section to oversee wastewater and sludge treatment in

each Local Authority. The Local Authority should allocate the job of sludge treatment and disposal as a full time job for one person at least in the county. Their responsibilities would include:

- The tracing of all movements of sludge within the county
- Calculation of the correct amount of sludge to be removed from each of the smaller plants on a specified time basis.
- The acquisition of spread lands for sludge.
- The testing of sludge and spread lands.
- The production of the sludge register.
- Dealing with complaints in relation to treatment, transport and spreading of the treated sludge.

6.10 In House Meetings

There should be regular meetings of personnel involved in the treatment and disposal of sludge within each Local Authority. All area engineers and personnel involved in sludge treatment and disposal should be familiar with the sludge management plan in the Local Authority. Local knowledge is crucial when making decisions on sludge disposal as the situation on the ground can change at short notice.

6.11 Responsibility

Some Local Authorities operate a system whereby the Area Engineer is responsible for everything in his or her area. This includes planning, roads, housing, water treatment and supply and sewage treatment and disposal. This system needs to be changed. Planning, roads, housing and water supply occupy most of the area engineer's time with wastewater treatment getting attention in times of crisis. The operation and maintenance of the wastewater treatment works should be managed from the core of the Environment/Water Services section within the Local Authority or alternatively have a dedicated water services engineer in the area who would have responsibility for running the plants. The advantages of this would be:

- Proper budgeting of each plant for the year ahead taking into account the need for improvements.
- A schedule of improvements for each plant every year with an on-going three year programme of improvements

- Expertise would be on hand immediately in the event of a crisis.
- Environment/Water Services section would have an overall view of what is happening with treatment and disposal of sludge and operators.
- Operators and technical personnel could exchange valuable information in relation to operation of plants and treatment and disposal of sludge in other parts of the county.

6.12 Country-wide Information

A conference should be held once a year, organised by engineering inspectors within the DoEHLG to outline what the current situation is in relation to sludge treatment and disposal in Local Authorities. Personnel involved in sludge treatment and disposal from each Local Authority should be invited to attend. This would keep personnel informed of the current situation and outline problems and how they were solved or how successful counties have managed their sludge.

6.13 Policing

The EPA should ensure that Local Authorities make their returns (results from sampling all aspects of wastewater treatment plants) on time. The returns are normally due back to the EPA at the end of February, early March, however some returns from Local Authorities are not sent back until September. Presently, the EPA can issue a notice under section 63 of the EPA Act to compel Local Authorities to make the returns on time or face court action. It would only take one or two court appearances by Local Authorities for late returns to ensure all Local Authorities returned the appropriate information to the EPA on time. Alternatively, the Local Authorities could be named and shamed in the Urban Waste Water Returns publication for the late return of results.

6.14 Alternative Treatment Strategy

The construction of all new sludge hub centres in Local Authorities will be tendered on a Design, Build and Operate (DBO) basis and the sludge treatment selected in these hub centres will be the thermal drying option. When these hub centres are set up, Local Authorities will bring sludge from all other plants in their functional area to these hub centres. In the event of breakdowns or other problems at these sludge hub

centres, Local Authorities should have alternative strategies available to deal with sludge. This could include the installation of a pasteurised lime stabilisation plant at another wastewater treatment plant in their functional area, which could be used when required or used if economics dictate. Alternatively, some form of agreement could be made with another Local Authority to take sludge in an emergency.

6.15 Screening

Local Authorities should end the practice of spreading raw unscreened sludge on agricultural land. To this end, fine screens (6mm perforated plate) should be installed at all wastewater treatment plants regardless of size to prevent ragging material (paper, plastics, condoms, etc.) being spread on agricultural land.

6.16 Auditing of Storage Facilities

The EPA should include sludge storage facilities in their audits of Local Authorities to ensure that there is no contamination of surface or ground water. They should carry out regular spot checks of Local Authority sludge storage and spreading operations.

6.17 Review of Discharge Licences

Local Authorities should review their licences for discharge to the sewer from industrial/commercial sources to ensure that these type of discharges are not adding potentially toxic elements to the sewage sludge and possibly make it unfit for recycling to agriculture.

6.18 Location of Wastewater Treatment Plants

Local Authorities should ensure that when constructing new wastewater treatment plants, that there should be a substantial buffer zone between the plant and the nearest dwelling houses, to limit the effect that the discharge of any foul odours caused by maintenance and operation would have on the public.

6.19 Sludge to Landfill

Sludge should not be disposed of to landfill. There are several contractors in the country that will remove raw sludge from Local Authorities, treat it and then recycle it to land. Some Local Authorities are sending treated sludge to landfill, which

alternatively could be recycled to agriculture if the Local Authorities in question had the will to do so.

6.20 Food Safety Authority - testing of produce

The Food Safety Authority should be periodically testing food that is fertilised by sewage sludge, particularly food that is fertilised by raw sludge.

6.21 Procuring Finances for the Operation of New Wastewater Treatment Plants

Local Authorities should introduce water and wastewater charges to finance the building and operation of new wastewater treatment plants. Water and wastewater charges are in operation in most other European countries.

6.22 Provision of Guarantee Fund

Local Authorities are currently recycling 86.7% of sewage sludge to agriculture. If there are any incidents or accidents with the use of sewage sludge in agriculture, farmers could take legal action against the Local Authority. As a result, Local Authorities should investigate the possibility of setting up a guarantee fund to compensate farmers in the event of any accident caused by the use of sewage sludge in agriculture. This type of system already exists in Germany and is being negotiated for in Austria and France (see literature review, page 12).

6.23 Provision of Data Management System

Local Authorities should install a data management system for sludge treatment and disposal so that all relevant data can be recorded and documented. The accumulation of quality data on sludge treatment and disposal will give Local Authorities information on what needs to be done.

The Performance Management System (PMS) should be implemented as part of the data management system as it outlines the reporting procedures to be undertaken for sludge analysis, sludge movement and sludge recycling to agriculture.

Local Authorities are already supplying data to the EPA on wastewater treatment plants over 500 PE on a yearly basis. This information together with data on all wastewater treatment plants below 500 PE should be recorded and documented.

However the following additional data should also be recorded to ensure accurate sludge production figures for each wastewater treatment plant:

Wastewater treatment Plant that import sludge

- The names of wastewater treatment plants that import sludge
- The quantity (tds) of imported sludge to each wastewater treatment plant per year
- The breakdown of this sludge (tds) into sludge from other wastewater treatment plants and sludge from the private sector
- The source (name and address), quantity (m^3) and solids content of each load entering the wastewater treatment plant
- The carrier of the sludge

Wastewater treatment plants that export sludge i.e. without de-watering equipment

- The frequency in which sludge is removed from these plants
- The quantity (m^3) and the solids content of the sludge removed during each sludge removal operation
- The type of sludge
- The disposal end route for this sludge
- The carrier of the sludge

6.24 EPA - Request of additional information from Local Authorities

The following data is already required to be submitted by Local Authorities to the EPA for wastewater treatment plants over 500 PE on a yearly basis:

- Plant name
- Plant PE
- Sludge quantity (tds)
- Plant type
- Is there nutrient reduction (yes/no)
- Nutrient reduction type
- Other treatment type
- Is PE measured (yes/no)
- BOD load (kg/day)
- Is there influent flow measurement (yes/no)

- Average daily inflow (m^3/day)
- Is effluent flow measured (yes/no)
- Average daily outflow (m^3/day)

The EPA should request additional information from Local Authorities in light of the huge variation in sludge production figures from county to county. This additional information (to be submitted with annual returns) should include:

- The method used to calculate PE figures for each wastewater treatment plant
- The names of the wastewater treatment plants that import sludge
- The quantity of imported sludge to each plant per year (tds)
- The breakdown of this sludge (tds) into sludge from other Local Authority wastewater treatment plants within the county and sludge from the private sector.
- The source of this sludge (names and addresses) and the quantities from each source
- Location and size of land banks for recycling sludge
- Location, ownership and capacity of sludge storage facilities.
- Confirmation that Nutrient Management Plans (NMP's) have been prepared for all sludge recycling locations and the name and address of the person that carried the Nutrient Management Plans (Details of these plans should be requested on a random basis from Local Authorities).

6.25 Compliance with Code Of Good Practice

All Local Authorities should comply with the Code of Good Practice.

6.26 Septic Tank Sludge

This research does not include sludge that is produced from septic tanks of which there are approximately 400,000 in Ireland or private wastewater treatment plants. The end disposal route and quantity of this sludge should be documented and recorded to ensure compliance with regulations and this merits additional research. Local Authorities could then use the findings of this research to install reception facilities for this type of sludge at selected wastewater treatment plants to facilitate the removal of screenings and treatment of sludge.

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Appendix A

Survey of Local Authorities

Carlow County Council

Introduction

Carlow County Council currently have three wastewater treatment plants that de-water sludge. Mortarstown wastewater treatment plant in Carlow town has lime stabilisation installed as sludge treatment. It achieves this by placing approximately five tonnes of de-watered sludge into a diet feeder (trailer for feeding silage). Quick lime is then added at a rate of twenty per cent by volume. A tractor transports the load one mile up the road to a covered storage area where the diet feeder agitates the lime and sludge for thirty minutes until an even paste is achieved. This produces a pasteurised sludge. The load of treated sludge is then placed in the storage area and piled high with a wheeled loader. There is a good demand for this sludge by the farmers. There is no other sludge treatment plant in the county. Total sludge production in the county for 2003 was estimated at 546 tds (EPA, 2003).

Table 1. List of the main wastewater treatment plants in County Carlow.

Plants	Estimated PE	Type of wastewater treatment	Type of Sludge treatment	Type of sludge de-watering	Solid Content (%)	Quantity generated tds/year
Carlow	36,000	Secondary	Lime stabilisation	Double belt press	16%	388
Bagnelstown	4,000	Secondary	None	Single belt press	12%	56
Tullow	3,900	Secondary	None	Single belt press	9-12%	28
Total						**472**

Sludge Disposal

The county council have hired a contractor (Agri Life) to recycle the treated sludge to land. Agri Life has hired the covered storage area (as above) from a local farmer for the storage of the treated sludge. Agri Life spread eighty eight per cent of the sludge in Carlow and twelve per cent in Laois. The county council test the sludge and the contractor tests the land and produces a nutrient management plan. The county council have identified cadmium levels as a problem in some soils. Twenty seven acres of land that were used for land spreading of sludge in 2004 cannot be used in 2005 because of high cadmium levels.

Sludge Management Plan

The sludge management plan proposed Carlow to be a hub centre with two satellites, Bagnelstown and Tullow feeding into it. The sludge from thirteen septic tanks and holding tanks (i.e. small plants) feed into these two satellites.

Imported Sludge

Carlow County Council is currently concerned with the amount of sludge that is being imported into the county from other Local Authorities and they have very little control over this practice. They are currently investigating the extent of this and the level of compliance with regulations by these contractors. As a last resort, the council will consider imposing by-laws as a means of controlling sludge spreading.

Flow Metering and Sampling

All of the main wastewater treatment plants in County Carlow that de-water sludge have influent flow metering installed. The flow meters are calibrated as required. Composite samples are taken for reporting purposes. The number of samples taken complies with regulations. Council personnel have found that PE figures generated from flow proportional sampling are too unreliable. There is no information on how PE is calculated.

Management of Wastewater Treatment Plants

Carlow County Council is divided into a number of areas and an area engineer is responsible for planning, housing, roads, water treatment and supply and wastewater treatment in these areas. Sources in the county buildings have suggested that control of wastewater treatment plants should be handed to a section in water services where expertise would be available in plant operation.

Cavan County Council

Introduction

Cavan County Council currently has six wastewater treatment plants in the county that de-water sludge. There will also be two additional plants becoming operational later in 2005. There is no sludge treatment at any of the plants. There is a mobile press in operation to de-water sludge from some of the smaller plants. Total sludge production in the county for 2003 was estimated at 250 tds (EPA, 2003).

Table 2. List of the main wastewater treatment plants in County Cavan.

Plants	Estimated P.E	Type of Wastewater treatment	Type of Sludge treatment	Type of Sludge de-watering	Solid Content (%)	Quantity estimated tds/year
Cavan	13,850	Secondary	None	Double belt press	19%	434
Virginia	1,400	Secondary	None	Double belt press	14%	73
Bailieborough	1,900	Secondary	None	Double belt press	14%	87
Ballyconnell	1,200	Secondary	None	Double belt press	14%	58
Cootehill	1,700	Secondary	None	Double belt press	14%	87
Ballyjamesduff	1,400	Secondary	None	Double belt press	14%	58
Kingscourt	1,950	Secondary	None	Currently being revamped		
Belturbet	1,950	Primary	None	Currently Being revamped		
Total						**797**

Sludge Disposal

All the sludge from Cavan County Council originally went to landfill. The sludge from Cavan town is now drawn to a central storage station outside the town. Cavan County Council have employed a contractor (Evergreen Fields) to remove the sludge from the central storage station and dispose of it and recycle it to land.

At the central storage station, the contractor removes the sludge by bulk tanker. Water has to be added to the de-watered sludge to enable it to be sucked into the tanker. This is also required at other plants in the county. The sludge is removed to

farmer's storage facilities where it is treated by long-term storage before being spread on land in Westmeath, Roscommon and Galway. The contractor provides a sludge register to the county council and it is available for inspection. Sewage sludge is not spread in the county due to the quantity of agricultural waste and unsuitable soils.

Sludge Management Plan

The sludge management plan proposes that Cavan town be a sludge hub centre for the county incorporating a thermal dryer but no decision has been made yet on this strategy. It is hoped that this plan will be implemented in four years.

Flow Metering and Sampling

Cavan County Council have installed influent flow measurement on all of its wastewater treatment plants that de-water sludge. However the rest of the plants do not have flow measurement. There is no information on calibration of flow meters. Composite and grab samples are taken for reporting purposes and the number of samples taken comply with the regulations. Some PE figures are calculated by multiplying the BOD value of the composite sample by the influent flow and some are estimated on a house count basis.

Management of Wastewater Treatment Plants

Cavan County Council is divided into a number of areas and each area has a dedicated water services engineer to manage wastewater treatment plants.

Clare County Council

Introduction

Clare County Council currently have ten wastewater treatment plants that de-water sludge in the county. Ennis wastewater treatment plant has lime stabilisation and a thermal dryer (100-150^0 C). The sludge coming into the plant must be a minimum of eleven per cent solids. This is the only sludge treatment facility in Clare. Total sludge production in the county for 2003 was estimated at 333 tds (EPA, 2003). However, the figure that was given to this author following discussions with county council staff at an early stage of the survey was 548 tds from Ennis wastewater treatment plant (this included imported sludge).

Table 3. List of the main wastewater treatment plants in County Clare.

Plants	Estimated PE	Type of wastewater treatment	Type of sludge treatment	Type of sludge de-watering	Solid Content (%)	Quantity generated tds/year
Shannon Town	12,500	Secondary	None	Double belt press	Unable to acquire figures	
Lisdoonvarna	2,500	Tertiary	None	Double belt press	20%	27
Lahinch	8,400	Secondary	None	Double belt press	16%	10
Inagh	500	Secondary	None	Single belt press	12%	2
Mount Shannon		Tertiary	None	Single belt press	10%	3
Six Mile Bridge	1,500	Secondary	None	Centrifuge	16%	35
Newmarket on Fergus	1,940	Secondary	None	Single belt press	10%	22
Ennis (clonroadmore)	17,000	Secondary	Lime Stabilisation/ Thermal Drying	Double belt press	18%	169
Ennis (Clarecastle)	4,000	Secondary	None	Single belt press	12%	120
Kilkishen	750	Tertiary	None	Double belt press	19%	13
Kilrush	2,600	None	None	None		
Total						**401**

Sludge Disposal

Ennis is acting as a sludge hub centre and is currently taking some of the sludge from other plants in the county to be treated. The treated sludge was originally sent to landfill but that has now stopped. The treated sludge is currently being stock piled

in an open county council yard and the county council are currently awaiting approval from the EPA to use the sludge as a soil conditioner in Dorra land fill. The remainder of the sludge from Lisdoonvarna, Lahinch, Inagh, Newmarket on Fergus and fifty per cent of the sludge from Sixmilebridge is sent for composting to McGill Environmental in Cork.

Sludge Management Plan

The sludge management plan has been submitted to the Department for approval and the council is awaiting a reply. The plan proposes a joint venture in sludge management between Clare County Council, Limerick County Council and Limerick City Council offering two scenarios. One scenario involves extending the existing plant at Bunlickey in Limerick City to service the entire region. The second scenario involves extending the plant at Bunlickey in Limerick to service Limerick City and County and build a separate sludge hub centre for Clare County Council in Ennis with thermal drying as sludge treatment.

Flow Metering and Sampling

All of the main wastewater treatment plants that de-water sludge in the county have influent flow measurement installed. There is no information on the calibration of these flow meters. Composite samples are taken on these plants on a weekly basis. PE is calculated by multiplying the BOD value of the composite sample by the influent flow (usually taken over twenty four hours).

Management of Wastewater Treatment Plants

Clare County Council is divided into a number of areas and each area has a dedicated water services engineer who is supported by technicians and caretakers in the operation of wastewater treatment plants.

Cork City Council

Introduction

Cork City Council have their main wastewater treatment plant situated in Little Island. It was commissioned in September 2003. The sludge treatment in place is mesophilic anaerobic digestion followed by thermal drying, which produces a pelletised sludge.

Table 4. Details of the main wastewater treatment plant in Cork City.

Plant	Estimated PE	Type of wastewater treatment	Type of Sludge treatment	Type of sludge de-watering	Solids Content (%)	Quantity generated (tds/year)
Cork City	328,000	Secondary	Thermal drying	Centrifuge	92%	2190

Sludge Disposal

The wastewater treatment plant in Little Island is operated by Northumbria Water Project Ltd. (NWPL). This is a twenty year DBO contract. The sludge treatment plant produces 5-6 tonnes of dry solids (92%) per day. This is not as much as was predicted at design stage. The sludge is removed and recycled to agriculture in the midlands by Landfeeds who is subcontracted to the main contractor. The contractor provides a sludge register for the city council. The city council has no sludge storage facilities.

Sludge Management Plan

The sludge management plan has been implemented.

Cork County Council – Northern Division

Introduction

There are five wastewater treatment plants currently de-watering sludge in the northern division of Cork County Council. There is no sludge treatment at any of the plants. Mallow and Fermoy are being upgraded and will be commissioned in the summer of 2005 under a design/build (DB) contract. Buttevant, Doneraile and Kilbrin are to be tendered for DBO contracts later in 2005. Total sludge production in the northern division of Cork County Council was estimated at 559 tds (EPA, 2003).

Table 5. List of the main wastewater treatment plants in the northern division of Cork County Council.

Plant	Estimated PE	Type of wastewater treatment	Type of Sludge treatment	Type of Sludge de-watering	Solid Content (%)	Quantity generated (tds/year)
Buttevant	1,200	Secondary	None	None		
Charleville	6,415	Secondary	None	Single belt press	10%	117
Fermoy	12,960	Secondary	None	Double belt press	13%	107
Kanturk	1,700	Secondary	None	Single belt press	11%	99
Mallow	12,000	Secondary	None	Double belt press	10%	103
Millstreet	1,600	Secondary	None	Drying beds		
Mitchelstown	6,000	Secondary	None	Double belt press	21%	56
Newmarket	1,100	Secondary	None	None		
Watergrasshill	1,500	Secondary	None	None		
Total						**482**

Sludge Disposal

The northern division of Cork County Council employ a contractor (Munster Waste Management) to remove sludge from all the plants and then inject it into land. This contractor provides a sludge register to the council. There is a sludge storage lagoon in Kanturk wastewater treatment plant. This is used as storage for sludge over the winter period when sludge cannot be spread on land. The lagoon has a capacity of 3600m^3. In extreme circumstances sludge will be sent to the landfill at Rossmore.

Sludge Management Plan

The sludge management plan is currently being reviewed. See plan under the Southern Division.

Flow Metering and Sampling

There are currently no operational influent flow meters in wastewater treatment plants in the northern division of Cork County Council. Grab samples are taken for reporting purposes. There is no information on how PE figures are generated.

Management of Wastewater Treatment Plants

The northern division of Cork County Council is divided into a number of areas, each of them under the control of an area engineer. The area engineer is responsible for planning, roads, housing, water treatment and supply and wastewater treatment. Sources in the northern division of Cork County Council have stated that there should be a central water services section and it should be in direct control of the wastewater treatment plants as the area engineers have an excessive workload.

Cork County Council – Southern Division

Introduction

There are currently six wastewater treatment plants de-watering sludge in the southern division of Cork County Council. There is no sludge treatment at any of the plants. The wastewater treatment plant at Blarney is currently being upgraded. Total sludge production in the southern division for 2003 was estimated at 927 tds (EPA, 2003).

Table 6. List of the main wastewater treatment plants in the southern division of Cork County Council.

Plant	Estimated PE	Type of wastewater treatment	Type of sludge treatment	Type of sludge de-watering	Solids Content (%)	Quantity generated (tds/year)
Ballincollig New	15,000	Secondary	None	Centrifuge	20%	500
Bandon	6,200	Secondary	None	Double belt press	17%	159
Ballymakeera	1,800	Primary	None	None		
Blarney	8,000	Secondary	None	Double belt press	13%	195
Carrigaline	12,000	None	None	5-6 years away		
Carrigtohill	4,500	Secondary	None	Single belt press	12%	105
Castlemartyr	2,000	Secondary	None	None		
Cobh	10,000	None	None	5-6 years away		
Crosshaven	2,000	Preliminary	None	5-6 years away		
Glanmire	10,000	Preliminary	None	Pumped into Cork city treatment plant		
Kinsale	5,000	Preliminary	None	3-4 years away		
Macroom	5,000	Secondary	None	Double belt press	17%	78
Midleton	10,000	Secondary	None	Centrifuge	19-20%	173
Passage/ Monkstown	5,000	None	None	5-6 years away		
Tramore River Valley	37,000	None	None	Pumped into Cork City treatment plant		
Youghal	8,000	None	None	3-4 years away		
Total				**1,210**		

Sludge Disposal

All sludge in the southern division is currently going to landfill in Rossmore. It must have a minimum of twenty per cent solids to enter the landfill. Sludge is being land spread in other parts of Cork. The county council have no sludge storage facilities.

Sludge Management Plan

The sludge management plan is under review. Fehily Timoney and Co. produced the original sludge management plan. Under this plan, County Cork was divided into five regions. The sludge hub centres in these regions were to be Skibbereen and Castletownbere in region one, Ringaskiddy in region two, Ballincollig in region three, Midleton in region four and Mallow and Mitchelstown in region five. Satellites were to feed sludge into these hub centres and they in turn would be fed sludge from smaller plants.

However, the senior engineer in Cork has stated that some of these hub centres are untenable and are poorly located.

Now Cork County Council are preparing a brief for consultants to look at 150 plants in relation to facilities for reception and extraction of sludge. They also want the consultants to prepare a service contract to collect sludge from about 20 major plants (satellites) and the successful contractor or contractors would remove this sludge and treat/dispose of it under a DBO contract. The county council would continue to operate most of the wastewater treatment plants in the county and the sludge treatment would be tendered to private contractors. The council want to look at all aspects of sludge treatment i.e. vermiculture, short rotation coppicing and thermal drying.

Flow Metering and Sampling

There are currently no influent flow meters on any of the wastewater treatment plants in the Southern Division of Cork County Council. Composite and grab samples are taken for reporting purposes. There is no information on how PE figures are calculated.

Management of Wastewater Treatment Plants

There are serious issues at present in the southern division of Cork County Council, as resources are needed to ensure proper operational control and monitoring of wastewater treatment plants. The council do not have the staff available to ensure correct operation of their wastewater treatment plants.

Cork County Council – Western Division

Introduction

There is currently only one wastewater treatment plant de-watering sludge in the western division. There is no sludge treatment at any of the plants. Five wastewater treatment plants namely, Skibbereen, Baltimore, Schull, Ballylickey and Dunmanway are due to be advertised for tender under a DBO contract later in 2005. Total sludge production in the western division for 2003 was estimated at 170 tds (EPA, 2003).

Table 7. List of the main wastewater treatment plants in the western division of Cork County Council.

Plant	Estimated PE	Type of wastewater treatment	Type of sludge treatment	Type of sludge de-watering	Solids Content (%)	Quantity generated (tds/year)
Bantry	2,700	None	None	2 years away		
Castletownbere	1,100	None	None	3-4 years away		
Clonakilty	15,000	Secondary	None	Double belt press	15-18%	600
Dunmanway	1,500	Secondary	None	None		
Rosscarbery	2,500	Primary	None	None		
Schull	1,100	Primary	None	None		
Skibbereen	3,500	None	None	None		
Total						**600**

Sludge Disposal

A contractor in the past came in once a year with a mobile belt press to de-water the sludge from all the smaller plants consisting of septic tanks. This mobile press would de-water the sludge to eighteen per cent solids content. This would then be landfilled. In 2002, 400 tonnes of sludge at 18% solids content was disposed of in this way.

More recently all the sludge from the Western Division is injected into land by a contractor on behalf of the council. There is no sludge register available. The council admitted that they have to start producing a register.

Sludge Management Plan

The sludge management plan is currently being reviewed. See plan under Southern Division.

Flow Metering and Sampling

There is only one wastewater treatment plant in the Western Division of Cork County Council that has flow metering installed. Clonakilty wastewater treatment plant has an influent flow meter installed but it has not worked for considerable periods. There is no information on the calibration of this meter. Composite and grab samples are taken for reporting purposes. The number of samples taken complies with regulations. There is no information on how PE is estimated.

Management of Wastewater Treatment Plants

There are serious issues in the Western Division of Cork County Council in relation to the management of wastewater treatment plants. Area engineers are involved in all aspects of Local Authority work (planning, housing, roads, water treatment and supply and wastewater treatment) in their respective areas. Sources in the courthouse in Skibbereen state that resources are needed in the form of operational and technical personnel to oversee and manage the wastewater treatment plants in the county.

Donegal County Council

Introduction

Donegal County Council currently have four wastewater treatment plants that de-water sludge in the county. Buncrana wastewater treatment plant had mesophilic anaerobic digestion installed as sludge treatment but the digestion unit never operated properly and became uneconomic to run as there was no use for the methane gas generated. This digestion unit has now been shut down. There is no sludge treatment at any of the wastewater treatment plants. Total sludge production in the county for 2003 was estimated at 707 tds (EPA, 2003).

Table 8. List of the main wastewater treatment plants in County Donegal.

Plant	Estimated PE	Type of Wastewater treatment	Type of Sludge treatment	Type of Sludge de-watering	Solid content (%)	Quantity generated tds/year
Letterkenny	22,500	Secondary	None	Double belt press	9-10%	156
Buncrana	5,500	Primary	None	Double belt press	30%	186
Carndonagh	5,200	Secondary	None	Double belt press	16%	112
Ballybofey/ Stranorlar	5,100	Secondary	None	Double belt press	16%	200
Total						654

Sludge Disposal

The county council has a contract with O' Reilly Transport to remove all the sludge from the county and dispose of it. This contractor removes the sludge from treatment plants to long term storage in farmers' storage facilities before land spreading it. There were no official details of land use or sludge tests from the contractor at this time and therefore a sludge register was not available. The council has no sludge storage facilities.

Sludge Management Plan

The sludge management plan has been adopted. It proposes that Letterkenny and Donegal town will be sludge hub centres with thermal dryers. All the sludge from the county will feed into these two centres from outer satellites. It has passed the Environmental Impact Statement (EIS) stage and will possibly be operational in three

years time. County council officials have expressed concern as to how the implementation of the sludge management plan can be financed.

Flow Metering and Sampling

All the main wastewater treatment plants in the county that de-water sludge have influent flow measurement systems installed. There is no information on the calibration of these flow meters. Composite and grab samples are taken for reporting purposes. The number of samples taken complies with regulations. PE is calculated by multiplying the BOD value of the composite sample by the influent flow (usually taken over twenty four hours).

Management of Wastewater Treatment Plants

Donegal County Council is divided into a number of areas and each area has a dedicated water services engineer to manage wastewater treatment plants supported by technicians and caretakers.

Dublin City Council

Introduction

Dublin City Council's main wastewater treatment plant is situated in Ringsend and is operated by Celtic Anglian under a twenty year DBO contract. The sludge is treated here in three stages. The first stage is a hydrolysis process (steam treatment). This conditions the sludge for the second stage, which is mesophilic anaerobic digestion. Because of the hydrolysis process, the digestion removes a lot more of the volatile content of the sludge than would otherwise be the case. The third stage is thermal drying which dries the sludge to 92% solids content. There are three dryers. The dried sludge was originally supposed to be a pelletised product but fifty per cent of it consists of a powder product. Sludge production is approximately forty tonnes of dry solids per day. Sixty per cent of the wastewater treatment plant's power requirement is produced on site. Sludge production in the city for 2003 was estimated at 11,705 tds (EPA, 2003).

Table 9. Details of Ringsend wastewater treatment plant in Dublin City.

Plant	Estimated PE	Type of wastewater treatment	Type of Sludge treatment	Type of sludge de-watering	Solids Content (%)	Quantity generated (tds/year)
Dublin City	2,587,621	Tertiary	Thermal drying	Centrifuge	92%	14,600

Sludge Disposal

Initially Dublin City Council looked after sludge disposal themselves and contracted this to Quinns of Baltinglass in County Wicklow. However in 2004, Celtic Anglian took over responsibility for sludge disposal and awarded a five year contract to Quinns. Quinns carry out nutrient management plans for farmers and also spread the sludge. The farmer is charged a nominal fee of eight euro per acre spread. There are problems already in acquiring suitable spread lands because of background metal levels in the soils. As a result, the agricultural outlet is becoming more restricted and this disposal route might not be able to take all the sludge over five years. Celtic Anglian is already investigating alternative strategies for sludge disposal routes. These include fuel for cement production and heat recovery from incineration.

Sludge Management Plan

The sludge management plan has been implemented but long term sustainable outlets for sludge will have to be found.

Problems with the Sludge Dryers

One of the sludge dryers at the wastewater treatment plant in Ringsend exploded in 2004 while in operation and caused damage to the building it was housed in. Luckily there were no personnel within the vicinity of the dryer at the time. This dryer is still unavailable. As a result, there are only two dryers currently in operation and there is an ongoing difficulty in trying to cope with the throughput of sludge.

Dun Laoghaire-Rathdown County Council

Introduction

There is only one wastewater treatment plant producing sludge in Dun Laoghaire-Rathdown County Council. This is a small oxidation plant in Corke Abbey, which produces liquid sludge. However a pumping station is being constructed on this site, commencing in February 2005 and it should be completed by the end of 2005. Then sewage from Corke Abbey will be pumped to Shanganagh. There is only preliminary treatment at Shanganagh after which the sewage goes to sea through a long sea outfall. Total sludge production in the county for 2003 was estimated at 31 tds (EPA, 2003).

Table 10. List of the main wastewater treatment plants in Dun Laoghaire-Rathdown County Council.

Plant	Estimated PE	Type of wastewater treatment	Type of Sludge treatment	Type of sludge de-watering	Solids Content (%)	Quantity generated (tds)/year
Coliemore	1,000	None	None	None		
Corke Abbey	2,000	Secondary	None	None		
Shanganagh	65,700	Preliminary	None	None		
Total						

Sludge Disposal

Liquid sludge from Corke Abbey is tankered to the main pumping station at the West Pier and pumped along with the rest of the sewage to Ringsend sewage treatment works for treatment.

Sludge Management Plan

Under this plan, the construction of the Bray/Shanganagh wastewater treatment plant will be a DBO type contract as required by the DoEHLG and the contract documents should be ready in June 2005. Realistically, this plant will not be operational for four to five years. The sludge treatment selected will be determined by the contractor. The main pumping station in Dun Laoghaire will continue to pump sewage to Ringsend.

Fingal County Council

Introduction

Fingal County Council currently have two wastewater treatment plants de-watering sludge in the county. Swords wastewater treatment plant has mesophilic anaerobic digestion with post pasteurisation. There is no other sludge treatment centre in the county presently. Total sludge production in the county for 2003 was estimated at 6700 tds (EPA, 2003).

Table 11. List of the main wastewater treatment plants in Fingal County Council.

Plant	Estimated PE	Type of Wastewater treatment	Type of Sludge treatment	Type of Sludge de-watering	Solid Content (%)	Quantity generated tds/year
Malahide	14,000	Secondary	None	Centrifuge	18-21%	312
Swords	46,000	Secondary	Thermophilic Anaerobic digestion	Centrifuge	25%	600
Balbriggan	13,000	None	None	Commissioning in 20 months		
Skerries	12,500	Primary	None	Commissioning In 12 months		
Portrane	8,000	Secondary	None	Centrifuge	21-22%	89
Rush	7,500	None	None	None		
Lusk	3,000	Primary	None	None		
Old town				Centrifuge	16-18%	14
Total						**1,015**

Sludge Disposal

All sludge produced by the county council is currently disposed to Balleally landfill in Lusk. The sludge must be a minimum of twenty per cent solid for acceptance to the landfill. The sludge from six smaller plants in the county is imported to Portrane and Oldtown for de-watering. A council official stated that sludge can be spread in the county if the will is there. The council has no sludge storage facilities.

Sludge Management Plan

The sludge management plan is adopted. It proposes a new sludge hub centre with thermal drying for the county to be built at Kilshane Cross on the Ashbourne road. This centre will also incorporate a recycling village. The EIS is approved for the sludge hub centre, but because it is inter linked with the recycling village it cannot proceed as the recycling village is not yet approved. This sludge hub centre should be operational in three years.

Galway City Council

Introduction

Galway City Council wastewater treatment plant is situated on Mutton Island. Earthtech are operating this under a two year operating contract. The sludge treatment on site consists of pre-pasteurisation and mesophilic anaerobic digestion, after which the sludge is pumped to centrifuges to produce a pasteurised sludge at 23% solids content.

Table 12. Details of Mutton Island wastewater treatment plant.

Plant	Estimated PE	Type of wastewater treatment	Type of Sludge treatment	Type of sludge de-watering	Solids content	Quantity generated (tds/year)
Galway City (Mutton Island)	73,000	Secondary	Mesophilic Anaerobic Digestion with Pre-pasteurisation	Centrifuge	23%	1,615

Sludge Disposal

Earthtech have contracted the sludge disposal to Landfeeds. Landfeeds are removing approximately 135 tonnes of wet sludge per week (23% solid) and spreading it directly on land. This amounts to 31tds per week or 1615tds per year. The city council has no sludge storage facilities.

Sludge Management Plan

The plan has been implemented in the city and will be integrated with the Galway County Council sludge management plan when it becomes operational.

Problems with sludge treatment

Problems have recently come to light regarding the existing capacity of the sludge treatment works. Hydraulically, the wastewater treatment plant has an additional 50% capacity but there is a bottleneck at the sludge treatment stage. The sludge storage capacity, prior to pasteurisation needs to be increased. The drum thickeners for secondary sludge are too small. The pre-pasteurisation plant is too small and creates a bottleneck. The centrifuges were installed to operate as duty and standby

but need to operate as duty and assist. To add to these problems, there is very little room on site to expand.

Galway County Council

Introduction

Galway County Council currently has seven wastewater treatment plants that de-water sludge. Tuam, Loughrea and Portumna have lime stabilisation as sludge treatment. There is no sludge treatment at the rest of the plants. Total sludge production in the county for 2003 was estimated at 994 tds (EPA, 2003).

Table 13. List of the main wastewater treatment plants in County Galway.

Plant	Estimated PE	Type of Wastewater treatment	Type of Sludge treatment	Type of sludge de-watering	Solids content (%)	Quantity generated tds/year
Athenry	3,639	Secondary	None	Single belt press	10-12%	114
Ballinasloe	5,667	Secondary	None	Double belt press	16-18%	243
Clifden	2,500	Primary	None	None		
Gort	4,836	Secondary	None	Single belt press	10-12%	85
Headford	1,390	Secondary	None	None		
Loughrea	4,800	Secondary	Lime stabilisation	Double belt press	21.83%	71
Mountbellow	1,033	Secondary	None	None		
Moycullen	600	Secondary	None	Centrifuge	16-18%	17
Oughterard	2,184	Secondary	None	None		
Portumna	2,842	Secondary	Lime stabilisation	Double belt press	22.25%	34
Tuam	13,250	Secondary	Lime stabilisation	Double belt press	25-30%	552
Total						**1,116**

Sludge Disposal

The sludge from Tuam, Loughrea and Portumna is lime stabilised producing a "class B" sludge and is recycled to land. The county council have acquired land banks from local farmers to recycle the sludge and they also produce their own sludge register. Sludge from other plants in the county that do not have de-watering equipment is currently brought to Tuam wastewater treatment plant for treatment. These include Oughterard, Mountbellew, Dunmore, Ballymore and Glenmaddy. The sludge from Gort and Athenry is treated by long term storage before being spread on land. The sludge from Ballinasloe and Moycullen is disposed to a landfill. Smaller plants are using long-term storage of sludge as a form of treatment before land spreading.

Tuam wastewater treatment plant has storage for approximately 350 tonnes at 30% solids content.

Sludge from other Local Authorities is currently being spread on land in Galway.

Sludge Management Plan

Under the sludge management plan, Tuam was designated a sludge hub centre with thermal drying to produce a pelletised sludge, but there was considerable local opposition to this. However this has now been overcome. The sludge management plan is in the process of being reviewed as the Industrial Development Authority (IDA) are building a large industrial site in Galway city and as a result, the sludge hub centre might have to be moved depending on economics and logistics. The current state of the sludge management plan is that it has not been adopted as the county council is awaiting a decision from the IDA.

There is also a provision in the plan that any sludge hub centre in the county would accommodate the sludge from the Mutton Island wastewater treatment plant (Galway city) in the event that this sludge (25% solids) would become unmarketable.

Flow Metering and Sampling

Most of the wastewater treatment plants that de-water sludge in the county have influent flow measurement. The flow meters are calibrated. Composite samples are taken as required for reporting under the regulations. PE is calculated by multiplying the BOD value of the composite sample by the flow (usually over twenty four hours).

Management of Wastewater Treatment Plants

Galway County Council is divided up into eleven areas with an area engineer in charge of each area. The area engineers are responsible for the wastewater treatment plants in their respective areas. Sources in water services indicated a preference for the wastewater treatment plants to be managed by one section in the county council who would have the expertise to operate these plants.

Kerry County Council

Introduction

Kerry County Council has ten wastewater treatment plants in the county that de-water sludge. Tralee has mesophilic anaerobic digestion and Killarney has thermophilic aerobic digestion. The remaining de-watering plants have no sludge treatment. Killarney wastewater treatment plant is already established as a sludge hub centre but does not take in any sludge due to the prohibitive transport costs involved. Total sludge production in the county for 2003 was estimated at 933 (tds), (EPA, 2003).

Table 14. List of the main wastewater treatment plants in County Kerry.

Plant	Estimated PE	Type of wastewater treatment	Type of sludge treatment	Type of sludge de-watering	Solids Content (%)	Quantity generated (tds)/year
Tralee	24,633	Secondary	Mesophilic anaerobic digestion	Centrifuge	22%	130
Killarney	32,814	Secondary	Thermophilic aerobic digestion	Belt thickener	3.5%	330
Dingle	8,600	Secondary	None	Double belt press	18%	35
Cahersiveen	4,502	Secondary	None	Double belt press	12%	31
Castleisland	6,650	Secondary	None	Single belt press	12%	81
Kenmare	9,100	Secondary	None	Double belt press	13%	40
Ballybunion	4,725	Secondary	None	Double belt press	17.5%	57
Ballyhaigue	2,222	Secondary	None	Double belt press	18.5%	57
Listowel	9,861	Secondary	None	Double belt press	16%	112
Killorglin	3,776	Secondary	None	Centrifuge	19-20%	54
Total	**106,883**					**927**

Sludge Disposal

All the sludge in the county is presently being land spread within the county. Sludge from Tralee and Killarney comply with the regulations in regard to land spreading. Sludge from the rest of the plants meet the requirements of the regulations by being stored before land spreading i.e. long term storage (3 months). This sludge is transported to individual farmers where it is stored in their storage facilities for a

period before being land spread. This sludge is sometimes spread on land without storage. The council has no sludge storage facilities.

Sludge Management Plan

The sludge management plan has been adopted and has been sent to the Department of the Environment, Heritage and Local Government (DoEHLG) for approval. The plan proposes two sludge hub centres in the county, one in Killarney and one in Tralee. There will be a number of satellites feeding the hub centres. All hub centres and satellites will be Design, Build and Operate (DBO) type contracts as requested by the DoEHLG. This plan is expected to be operational by 2006-2007.

Flow Metering and Sampling

All the main wastewater treatment plants that de-water sludge have influent flow measurement. The flow meters are calibrated on a regular basis. Composite samples are taken on a weekly basis at these plants. PE is calculated by multiplying the BOD value of the composite sample by the flow over that period (usually 24 hours). There are some plants (above 500 PE) in the county that do not have influent flow measurement installed.

Management of Wastewater Treatment Plants

Kerry County Council is divided into a number of areas and each area has a dedicated water services engineer who is supported by technicians in the operation and maintenance of these wastewater treatment plants.

Kildare County Council

Introduction

Kildare County Council currently have four wastewater treatment plants that de-water sludge. There are a further two plants being built in Kildare and Monasterevin. The wastewater treatment plants in Naas and Leixlip have installed mesophilic anaerobic digestion systems. There is no other sludge treatment in the county. Total sludge production in the county for 2003 was estimated at 2605 tds (EPA, 2003).

Table 15. Lists of the main wastewater treatment plants in County Kildare

Plants	Estimated PE	Type of Wastewater treatment	Type of Sludge treatment	Type of Sludge de-watering	Solid Content (%)	Quantity generated tds/year
Osberstown, Naas	66,100	Tertiary	Mesophilic Anaerobic digestion	Double belt press	20.43%	1,300
Leixlip	64,539	Tertiary	Mesophilic Anaerobic digestion	Centrifuge	20%	1,012
Athy	11,000	Tertiary	None	Double belt press	16%	150
Castledermot	1,500	Tertiary	None	Double belt press	18-20%	18
Rathangan	2,000	Secondary	None	None		
Kildare	4,735	Secondary	None	Currently being revamped		
Monasterevin	2,500	Primary	None	Currently Being revamped		
Total						**2,480**

Sludge Disposal

Kildare County Council have a contract with Advanced Environmental Services (AES) to remove all the sludge in the county and recycle it. AES treat the sludge by lime stabilisation and then recycle it to land. AES provides details to the county council for the sludge register. Sludge cannot be spread in Kildare and North Carlow due to high cadmium levels in the soil (2 ppm). The county council carried out a pilot study in 2004 with a private company (Clean Power) investigating recycling of sludge using willow coppicing. The county council has recently signed a two year contract with Clear Power to remove the sludge from Osberstown wastewater treatment plant and recycle it to willow coppicing.

Sludge Management Plan

The sludge management plan for Kildare has been adopted. It proposes that Osberstown wastewater treatment plant in Naas will become a sludge hub centre for the county. This sludge operation will be a DBO type contract and will involve the treatment and disposal of the sludge. It proposes thermal drying and pelletising of the sludge. The contract has gone to tender stage and the report is with the DoEHLG. The county council is awaiting authorisation from the DoEHLG. It should be operational in two years.

Flow Metering and Sampling

All of the main wastewater treatment plants in the county that de-water sludge have influent flow measurement installed. The flow meters do not need calibration. Both composite and grab samples are taken for reporting purposes. The number of samples taken complies with the regulations. PE is calculated by multiplying the BOD value of the composite sample by the influent flow (usually taken over twenty four hours).

Management of Wastewater Treatment Plants

Kildare County Council is divided into a number of areas. Each of the areas has a dedicated water services engineer to manage the wastewater treatment plants supported by technicians and caretakers.

Kilkenny County Council

Introduction

There is only one wastewater treatment plant currently de-watering sludge in County Kilkenny and this is in Kilkenny City at Purcellsinch. The sludge is treated here by lime stabilisation. Total sludge production in the county for 2003 was estimated at 2313 tds (EPA, 2003).

Table 16. List of the main wastewater treatment plants in County Kilkenny.

Plants	Estimated PE	Type of wastewater treatment	Type of Sludge treatment	Type of sludge de-watering	Solid Content (%)	Quantity generated tds/year
Callan	2,500	Secondary	None	None		
Castlecomer	1,750	Secondary	None	None		
Kilkenny City	110,000	Secondary	Lime stabilisation	Double belt press	25%	1,913
Thomastown	2,500	Primary	None	None		
Waterford City & Environs	4,000	None	None	None		
Total						**1,913**

Sludge Disposal

The county council have employed a local contractor to remove the treated sludge from Kilkenny City and recycle it to land. The sludge is spread on land in County Kilkenny. The contractor uses storage facilities on farms to store excess sludge during times when it can not be spread. The county council keep the sludge register themselves at the plant. The county council does not have any sludge storage facilities.

Sludge Management Plan

The sludge management plan has been adopted and proposes Kilkenny to be a sludge hub centre for the county with sludge treatment possibly incorporating a thermal dryer. However, progress on implementing the plan has been delayed by the local brewery, as they have not decided whether they will build their own plant or discharge into the county council facility. The type of sludge treatment will be decided by the successful contractor under a DBO type contract. The implementation of this plan is still three years away.

Flow Metering and Sampling

The main wastewater treatment plant in Kilkenny City has influent flow metering installed, as have some of the smaller plants in the county. The meter in Kilkenny is calibrated as required. Composite and grab samples are taken for reporting purposes. The numbers of samples taken comply with regulations. PE is estimated by multiplying the BOD value of the composite sample by the influent flow (usually taken over twenty four hours).

Management of Wastewater Treatment Plants

All the wastewater treatment plants in the county are managed from a section in water services in County Buildings, as the area engineers do not have time or expertise to manage these plants.

Laois County Council

Introduction

Laois County Council have currently four wastewater treatment plants that de-water sludge. There is no sludge treatment at present in the county. Total sludge production in the county for 2003 was estimated at 974 tds (EPA, 2003).

Table 17. List of the main wastewater treatment plants in County Laois.

Plant	Estimated PE	Type of Wastewater treatment	Type of Sludge treatment	Type of Sludge treatment	Solid Content (%)	Quantity generated tds/year
Portarlington	5,000	Secondary	None	Double belt press	16%	28
Mountmellick	4,500	Secondary	None	Centrifuge	18%	26
Portlaoise	23,000	Secondary	None	Centrifuge	20%	332
Abbeyleix	2,172	Secondary	None	None		
Mountrath	1,964	Secondary	None	Double belt press	16%	8
Rathdowney	1,668	Secondary	None	None		
Stradbally	2,172	Primary	None	None		
Total						**394**

Sludge Disposal

Most of the sludge produced in the county is currently disposed to Kyletaleshia landfill, which is located between Mountmellick and Portlaoise. Portarlington wastewater treatment plant accepts liquid sludge from smaller plants. Portlaoise and Mountmellick cannot accept liquid sludge because the centrifuges cannot take unscreened liquid sludge. The liquid sludge from Rathdowney and other smaller plants is being directly injected into land. A contractor is carrying out this work on behalf of the county council. The county council will have a problem with an outlet for sludge after March 2006, as all sludge must have solids content of at least 25% to be accepted to landfill (condition of the EPA licence). To get over this problem, the council is installing a lime stabilisation plant for the sludge at the wastewater treatment plant in Portlaoise. Ormonde Organic is carrying out this work and they will recycle the treated sludge to agriculture. Portlaoise will then act as a sludge hub centre for the county producing a "Class B" sludge until the sludge management plan is implemented. This should be operational by November 2005. The county council has no sludge storage facilities.

Bye-laws for sludge

Laois County Council have recently introduced bye-laws to control the spreading of sewage sludge in the county. These bye-laws were introduced as a result of the increasing amount of complaints received from local people about sewage sludge being spread and the associated odours. Most of this sludge is imported from other Local Authorities by sludge disposal contractors. Farmers in the county will now be required to apply for a permit before any treated sludge can be spread on their land. These bye-laws come into effect from the middle of March 2005.

Sludge Management Plan

The sludge management plan is adopted. The proposal is for Portlaoise to become a sludge hub centre and all sludge from the county will be brought here for treatment. This contract is presently going to tender. This will be a DBO type contract as requested by the DoEHLG. The successful contractor will select the type of sludge treatment and obtain a disposal route for the treated sludge over twenty years. This should be operational in four years.

Flow Metering and Sampling

All of the main wastewater treatment plants in the county that de-water sludge have influent flow meters installed. There is no information on the calibration of flow meters. Composite samples are taken for reporting purposes. The number of samples taken complies with regulations. PE figures are estimated by taking house counts as sources in water services state that PE figures generated from flow proportional samples have been shown to be inaccurate.

Management of Wastewater Treatment Plants

Laois County Council is divided into a number of areas and each area has its own dedicated water services engineer who manages wastewater treatment plants in conjunction with technicians and caretakers.

Leitrim County Council

Introduction

There are three plants currently de-watering sludge in County Leitrim. There is no sludge treatment at any of the plants presently. Total sludge production in the county for 2003 was estimated at 134 tds (EPA, 2003)

Table 18. List of the main wastewater treatment plants in County Leitrim.

Plant	Estimated PE	Type of Wastewater treatment	Type of sludge treatment	Type of Sludge de-watering	Solids content (%)	Quantity generated (tds)/year
Ballinamore	1,380	Secondary	None	Single belt press	11%	20.24
Manorhamilton	1,650	Secondary	None	Single belt press	11%	9.9
Carrick-on-shannon	4,302	Secondary	None	Double belt press	14.5%	58.87
Total	**7,332**					**89**

Sludge disposal

Leitrim County Council currently has a mobile de-watering unit (belt press) in operation. This unit de-waters sludge from plants in Mohill, Carrigallen, Newtowngore, Dromad, Kesh, Drumshanbo and Drumkerrin. This sludge is then brought to the wastewater treatment plant in Carrick-on-Shannon where it is stored in hoppers. The council has a contract with O' Reilly Transport to remove and dispose of this sludge. The contractor adds water to the sludge to enable it to be sucked into a tanker in Carrick before being removed for disposal. The sludge treatment provided by the contractor is long term storage in farmers' storage facilities before being spread on land in County Louth. The contractor provides the council with the sludge register and it is available for inspection. The council does not own any sludge storage facilities.

The county in general is not deemed suitable for the land spreading of sewage sludge because of poor soil conditions.

Sludge Management Plan

The sludge management plan has been adopted and has proposed that Carrick would be a sludge hub centre for the county with satellites feeding into it. However

this plan is going to be reviewed because of changing circumstances since the original plan was approved. There has been a lot of development due to tax incentives and a lot of the smaller sewage treatment plants cannot cope with the increased loading. Therefore plants will probably require up-grading. The council are in the process of appointing consultants to carry out this review and it should be carried out by the end of 2005.

The county council, as part of the review, will ask the consultants to look at a joint hub centre with a neighbouring county, possibly Roscommon or Sligo. The engineering department in the county council have indicated that this would make more sense because of the relatively small quantity of sludge generated in the county.

Flow Metering and Sampling

All of the main wastewater treatment plants in County Leitrim that de-water sludge have influent flow metering installed. All plants over five hundred PE will have influent flow measurement installed by December 2005. The flow meters will be calibrated as required. Composite and grab samples are taken for reporting purposes. The number of samples taken in the past have not complied with regulations for reporting purposes as set out under the Urban Waste Water Treatment Regulations, 1994. PE figures are estimated by house counts but later this year they will be estimated from composite sampling and flows.

Management of Wastewater Treatment Plants

All of the wastewater treatment plants in County Leitrim are controlled and managed from water services in County Buildings in Carrick-on-Shannon. Sources in water services state that this is a more efficient way of managing the plants as the area engineers do not have the time or expertise to manage the plants.

Limerick City Council

Introduction

Limerick City Council have installed a new wastewater treatment plant at Bunlickey and it began operation in 2003. It is being operated by contractors on a two year commissioning operation. EPS operate the wastewater treatment plant while Bowen Water Group operate the sludge treatment system. The sludge is treated by thermal drying and a granulated product (2-5mm) is produced.

Table 19. Details of the Bunlickey wastewater treatment plant in Limerick City.

Plant	Estimated PE	Type of wastewater treatment	Type of Sludge treatment	Type of sludge de-watering	Solids Content (%)	Quantity generated (tds/year)
Limerick city (Bunlickey)	56,000	Secondary	Thermal drying	Centrifuge	92%	1,800

Sludge Disposal

All sludge from the plant is currently being land spread. Limerick City Council have a contract with SEDE Ireland Ltd. to remove and dispose of the sludge. They provide details of the spreading operation to the council for the sludge register. However they have difficulty in finding enough suitable land to accommodate the sludge. The only storage on site is two silos, which can accommodate ninety tonnes (equivalent to two and a half weeks storage). The contractor provides the sludge register for the city council.

Sludge Management Plan

The sludge management plan proposes that in the next two years, one contractor will run the whole sewage treatment plant at Bunlickey. This contract will be for ten or twenty years and will service Limerick City, Limerick County and possibly Clare. The sludge disposal contract will probably be for ten years as an agricultural outlet might be difficult to find.

Limerick County Council

Introduction

Limerick County Council currently have five plants that de-water sludge in the county. Three additional plants will be upgraded and have sludge de-watering equipment installed. There is no sludge treatment at any of the plants. Total sludge production in the county for 2003 was estimated at 659 tds (EPA, 2003).

Table 20. List of the main wastewater treatment plants in County Limerick.

Plants	Estimated PE	Type of Wastewater treatment	Type of Sludge treatment	Type of Sludge de-watering	Solids content (%)	Quantity generated tds/year
Abbeyfeale	1,500	Secondary	None	Single belt press	11%	59
Adare	1,600	Secondary	None	None		
Ballykeefe	25,500	Preliminary	None	The sewage from both of these plants is now being pumped into Limerick City.		
Caherdavin	5,600	None	None			
Castletroy	13,000	Secondary	None	Double belt press	16.5%	390
Kilmallock	2,400	Secondary	None	None		
Newcastle West	6,100	Secondary	None	Single belt press	12%	122
Patrickswell	1,500	Secondary	None	None		
Croom	1200	Secondary	None	Single belt press	12%	22
Rathkeale	2,000	Secondary	None	Single belt press	12%	28
Total						**621**

Sludge Disposal

Until recently all sludge was disposed to landfill. However, the sludge from Abbeyfeale, Castletroy and Newcastle West is now brought to Bunlickey wastewater treatment plant in Limerick City for treatment by thermal drying. Water is added to this sludge to blend it with the sludge from the plant. Sludge from Croom and Rathkeale is still disposed to landfill.

The sludge from all the smaller plants is transported to the larger plants for de-watering. The county council has no sludge storage facilities. There are no land banks available for spreading sludge in the county at the moment.

Sludge Management Plan

The proposal under this plan is for the treatment plant at Bunlickey to be tendered for a twenty year DBO contract and act as a sludge hub centre for the county and city. This plan might also include sludge from Clare County Council.

Flow Metering and Sampling

All of the main wastewater treatment plants that de-water sludge in the county have influent flow measurement installed but some of these flow meters are not operational at the moment. There is no information on meter calibration. Some composite samples are taken but grab samples are also taken for reporting purposes. PE is calculated by multiplying the BOD value of the composite sample by the influent flow.

Management of Wastewater Treatment Plants

Limerick County Council is divided into a number of areas and each area has a dedicated water services engineer to manage the wastewater treatment plants in that area.

Longford County Council

Introduction

Longford County Council currently has four wastewater treatment plants that de-water sludge in the county. There is no sludge treatment at present in the county. Liquid sludge is tankered into Longford wastewater treatment plant from smaller plants to be de-watered. Total sludge production in the county for 2003 was estimated at 597 tds (EPA, 2003).

Table 21. List of the main wastewater treatment plants in County Longford.

Plant	Estimated PE	Type of Wastewater treatment	Type of Sludge treatment	Type of Sludge de-watering	Solid Content (%)	Quantity generated tds/year
Longford	20,000	Secondary	None	2 no. double belt press	20%	864
Granard	3,200	Secondary	None	Centrifuge	22%	53
Edwardstown	3,000	Secondary	None	Double belt press	14%	101
Ballymahon	2,118	Secondary	None	Double belt press	16%	38
Drumlish	1,500	Secondary	None	None		
Lanesboro	1,000	Primary	None	None		
Newtownforbes	1,000	Secondary	None	None		
Total						**1,056**

Sludge Disposal

Longford County Council employs a contractor (Evergreen Fields) to remove and dispose of all the sludge generated at wastewater treatment plants. The contractor has to add water to the sludge to get it into tankers at all the de-watering plants except Longford where the sludge goes directly into a trailer. The sludge is recycled to agriculture after long term storage using farmers' storage facilities or is deep injected into soil. The contractor provides the sludge register for the county council. The council has no sludge storage facilities.

Sludge Management Plan

The sludge management plan proposes that Longford will become a sludge hub centre and it will be up to the successful contractor to select the type of sludge treatment and disposal. However, this plan is currently being reviewed as thermal drying will not be considered for sludge treatment due to the small quantity of sludge generated in the county. The council is looking at short rotation coppicing as an

outlet for sludge in the long term. The Senior Executive Engineer has expressed doubts about the plan stating that compliance with the sludge management plan requires compliance with the code of good practice which in itself involves prohibitive costs.

Flow Metering and Sampling

All of the main wastewater treatment plants in the county that de-water sludge have influent flow metering installed. The flow meters are calibrated once a year. Composite samples are taken on all the wastewater treatment plants once a month. PE is calculated by multiplying the BOD value of the composite sample by the influent sample (usually taken over twenty four hours).

Management of Wastewater Treatment Plants

The plant manager in Longford wastewater treatment plant is responsible for the rest of the wastewater treatment plants in the county. The caretakers report directly to him and he oversees all aspects of operation and maintenance. The plant manager reports directly to the senior engineer in water services.

Louth County Council

Introduction

Louth County Council has two sludge de-watering plants. They are situated in Dundalk and Drogheda and both are currently acting as hub centres. They are both operating as DBO contracts and are being operated by a company called EPS. Total sludge production in the county for 2003 was estimated at 2563 tds (EPA, 2003).

Table 22. List of the main wastewater treatment plants in County Louth.

Plant	Estimated PE	Type of wastewater treatment	Type of sludge treatment	Type of sludge de-watering	Solids content (%)	Quantity generated (tds)/year
Ardee	4,900	Secondary	None	None		
Blackrock	4,500	Secondary	None	None		
Castlebellingham	1,000	Secondary	None	None		
Clogherhead	1,100	Secondary	None	None		
Drogheda	56,000	Secondary	Mesophilic Anaerobic Digestion	Centrifuge	18-22%	1,100
Dromiskin	1,200	Secondary	None	None		
Dundalk	179,535	Secondary	Mesophilic Anaerobic Digestion	Centrifuge	18.7%	848
Dunleer	1,200	Secondary	None	None		
Total						**1,948**

Sludge Disposal

All treatment plants in the county send sludge to Drogheda or Dundalk in a thickened liquid form. Both plants are unable to accept cake sludge at the moment. A sludge disposal contractor called Agri-life currently removes the de-watered sludge from both plants and lime stabilises this sludge in a facility in County Meath. This sludge is then land spread in Laois, Carlow and other midland counties. A sludge register is produced by the contractor and submitted to the county council in a six monthly report. The county council has no sludge storage facilities of its own. Sludge from other Local Authorities is currently being spread in Louth.

Sludge Management Plan

Under the sludge management plan, Dundalk is to be the sludge hub centre with a thermal dryer producing pelletised sludge. This thermal dryer is due to be commissioned in June 2005. However, the county council has noted that farmers are

more interested in a lime stabilised product than a dry pelletised form of the sludge. As a result, the council proposes to accommodate farmers in this regard even after the thermal dryer is operational by using a contractor to lime stabilise the sludge for them if this would guarantee a sludge outlet for the county council. Some aspects of the plan are currently being reviewed.

Dried sludge as a Fuel Source for Cement Production

The county council is currently investigating the possibility of using the pelletised sludge as a fuel source for the kilns in the cement factory in Drogheda. The Technical Director of Irish Cement has stated that Irish Cement would be happy to accept dried sewage sludge as a fuel source in the cement kilns both from an environmental view point i.e. assisting the community in disposing of waste and as a cheap fuel source. The logistical problems of transporting large quantities of dried sewage sludge to a cement works would have to be planned and then the operation would have to comply with the regulations under the Waste Management Act and to this end would require an Integrated Pollution Prevention Control (IPPC) Licence.

Flow Metering and Sampling

Louth County Council has influent flow measurement installed at all wastewater treatment plants that de-water sludge in the county. The flow meters are calibrated on a regular basis. Composite samples are taken as required for reporting under the regulations. PE is calculated by multiplying the BOD value of the composite sample by the flow (usually over twenty four hours).

Management of Wastewater Treatment Plants

The process operations and maintenance of the wastewater treatment plants are managed centrally from County Buildings, however the caretakers report to their respective area engineers.

Mayo County Council

Introduction

Mayo County Council currently has eleven wastewater treatment plants that de-water sludge. Castlebar and Ballina had temporary sludge drying plants installed but they were shut down a year ago because of odour and noise nuisance, constant break downs and high running costs. There is currently no sludge treatment at any of the sewage treatment plants in the county. Total sludge production in the county for 2003 was estimated at 700 tds (EPA, 2003).

Table 23. List of the main wastewater treatment plants in County Mayo.

Plant	Estimated PE	Type of wastewater treatment	Type of Sludge treatment	Type of sludge de-watering	Solids Content (%)	Quantity generated tds/year
Achill Island	4,000	Secondary	None	Double belt press	14-15%	87
Ballina	16,000	Secondary	None	Double belt press	12-13%	263
Ballinrobe	5,000	Secondary	None	Double belt press	16-17%	132
Ballyhaunis	4,000	Secondary	None	Double belt press	17%	51
Belmullet	2,250	None	None	None		
Castlebar	20,000	Secondary	None	Double belt press	13-14%	432
Claremorris	5,500	Secondary	None	Centrifuge	16-17%	99
Charlestown	1,100	Secondary	None	None		
Cong	1,500	Secondary	None	None		
Crossmolina	2,000	Secondary	None	Double belt press	17%	34
Foxford	1,800	Secondary	None	None		
Killala	1,500	None	None	None		
Kiltimagh	2,000	Primary	None	None		
Knock	2,000	Secondary	None	Double belt press	17-18%	26
Swinford	5,000	Secondary	None	Double belt press	15%	105
Bangor Erris	1000	Secondary	None	Single belt press	12%	12
Westport	20,000	Secondary	None	Centrifuge	20%	260
Total						**1,501**

Sludge Disposal

Mayo County Council currently has a contract with two contractors to dispose of all the sludge produced in the county. The contractors are O' Reilly Transport and Evergreen Fields Ltd. and they each remove approximately 50% of the sludge. The

contractors remove the sludge from the county where it is treated by long term storage in farmer's storage facilities in the midlands. Sludge from the smaller plants is brought to the larger plants for de-watering. The sludge cannot be spread in certain areas of County Mayo because phosphate levels in the soil are too high. The county council has no sludge storage facilities.

Sludge Management Plan

The sludge management plan is adopted . It proposes to set up a sludge hub beside Derrynumer (the biggest landfill in the county, half way between Castlebar and Newport). This hub centre will treat all of the sludge in the county by thermal drying. It is hoped to have this operational in two years (2007).

Flow Metering and Sampling

Most of the main wastewater treatment plants in the county that de-water sludge have influent flow metering installed. Flow meters are calibrated if required. Some composite samples are taken but some grab samples are also taken for reporting purposes. Sample are taken as required for reporting under the Urban Waste Water Treatment Regulations. PE is calculated by multiplying the BOD value of the composite sample by the influent flow (usually taken over twenty four hours).

Management of Wastewater Treatment Plants

Mayo County Council is divided into a number of areas. The area engineer in each area is responsible for planning, roads, housing, water treatment and supply and wastewater treatment.

Meath County Council

Introduction

Meath County Council currently has five plants that de-water sludge in the county. Farganstown wastewater treatment plant in Navan has mesophilic anaerobic digestion, followed by sludge de-watering followed by lime stabilisation, followed by heat exchangers to heat the sludge to 80 degrees centigrade for twenty minutes to give a pasteurised sludge. This is the only sludge treatment centre in the county. Total sludge production in the county for 2003 was estimated at 1250 tds (EPA, 2003).

Table 24. List of the main wastewater treatment plants in Meath County Council.

Plant	Estimated PE	Type of Wastewater treatment	Type of sludge treatment	Type of sludge de-watering	Solids Content (%)	Quantity generated (tds)/year
Navan	25,000	Secondary	Lime stabilisation	Centrifuge	18-20%	1,045
Trim	7,500	Secondary	None	Centrifuge	20-21%	208
Enfield	1,800	Secondary	None	Double belt press	17%	75
Kells	5,500	Secondary	None	Single belt press	12%	83
Athboy	2,500	Secondary	None	Single belt press	12%	37
Dunshaughlin	4,000	Secondary	None	Centrifuge	Due in July 2005	
Ballivor	500	Secondary	None	Double belt press	Due in March 2005	
Mornington	6,000	Preliminary	None	None	Being pumped to Drogheda	
Duleek	2,500	Secondary	None	None	DBO type contract Proposed	
Laytown	2,500	Secondary	None	None	Being pumped to Drogheda	
Total						**1,448**

Sludge Disposal

Navan currently acts as a sludge hub centre for the county. However, it is unable to take cake sludge at present and as a result, all sludge coming into the plant is in liquid form (3% solids). They are experimenting presently with a hopper and auger to ascertain if this will enable cake sludge to be accepted at the plant. The county council hopes to have this facility in place by the end of June 2005. All sludge treated at the plant is disposed of by land spreading. Sludge recycling is contracted

out to Agri Life. This contractor has an agreement with a local farmer whereby the company uses his sheds as storage for the sludge. Agri Life also provides the sludge register for the county council.

Meath County Council originally put a public notice in the local newspaper advertising for farmers to take treated sludge. Approximately twenty farmers replied. After land testing, the county council had to discard 50% of these farms due to high cadmium and phosphate levels in the soil. Presently, all sludge is being spread in the county.

Sludge Management Plan

The sludge management plan has been adopted and it proposes that Navan be the hub centre for the county. However there have been modifications to the plan, the main one being a proposal for a thermal dryer in Navan, which has been approved by the councillors. Consultants are to be appointed soon to implement this proposal. This will be a DBO type contract as requested by the DoEHLG.

Six contractors have also been short-listed to operate eight plants under a DBO type contract for twenty years. The plants are Athboy, Duleek, Donore, Kilmannan Wood, Moynalty, Rathcairn, Summerhill and Rathmoylan.

Flow Metering and Sampling

Meath County Council have installed influent flow measurement on all the wastewater treatment plants that de-water sludge. There is no information on how often these meters are calibrated. Composite samples are taken on a weekly basis at the de-watering plants and as required by the regulations on the smaller plants. PE is calculated by multiplying the BOD value of the composite sample by the influent flow (usually over twenty four hours).

Management of Wastewater Treatment Plants

The plant manager at the wastewater treatment plant in Navan also manages some of the other wastewater treatment plants in the county and this arrangement works well. However area engineers are responsible for the rest of the plants in the county. Sources in water services have indicated a preference for all of the plants to be managed from the existing sludge hub centre in Navan.

Monaghan County Council

Introduction

Monaghan County Council currently has six wastewater treatment plants that de-water sludge in the county. Monaghan wastewater treatment plant has installed lime stabilisation and thermal drying and this plant was commissioned on the first week of October 2004. However, they are having teething problems with the dryer and as a result, the sludge treatment is not yet fully operational. There is no other sludge treatment centre in the county. Total sludge production in the county for 2003 was estimated at 901 tds (EPA, 2003).

Table 25. List of the main wastewater treatment plants in County Monaghan.

Plant	Estimated PE	Type of Wastewater treatment	Type of Sludge treatment	Type of Sludge de-watering	Solid Content (%)	Quantity generated tds/year
Ballybay	4,528	Secondary	None	Single belt press	8%	120
Smithborough	1,466	Secondary	None	Single belt press	13%	44
Castleblayney	12,920	Secondary	None	Double belt press	15%	123
Carrickmacross	12,087	Secondary	None	2 no. double belt press	16.5%	245
Monaghan	30,497	Lime Stabilisation	Lime stabilisation	Double belt press	19%	314
Clones	3,893	Secondary	None	None		
Total						**846**

Sludge Disposal

All sludge produced in the wastewater treatment plants in the county is currently disposed to landfill at great cost. Sludge from the smaller plants is imported into the plants with sludge de-watering equipment. Agriculture recycling of the sludge in the land in County Monaghan is not possible due to the quantity of agricultural waste and waste from intensive agricultural enterprises (i.e. Mushroom compost and chicken manure). Sludge from water treatment plants is imported and currently mixed with sewage sludge in Monaghan wastewater treatment plant before being treated and dried. The council has no sludge storage facilities.

Sludge Management Plan

The sludge management plan has been adopted. Under the plan, Monaghan wastewater treatment plant will be a sludge hub centre and will take sludge cake from the rest of the county to be treated. This treated sludge will then be used as landfill cover for the foreseeable future.

Flow Metering and Sampling

All of the main wastewater treatment plants in the county that de-water sludge have influent flow metering installed. The flow meters are calibrated as required. Composite samples are taken at the main plants once a week and at other plants as required for reporting purposes. PE is calculated by multiplying the BOD value of the composite sample by the influent sample (usually taken over twenty four hours).

Management of Wastewater Treatment Plants

Monaghan County Council is divided into a number of areas and in each area the caretaker reports to the local area engineer. However, personnel in the water services section in County Buildings wish to bring the wastewater treatment plants and caretakers under its control. They have intimated that plants would run more effectively and efficiently under this change of management.

Offaly County Council

Introduction

Offaly County Council has seven wastewater treatment plants in the county that de-water sludge. Tullamore has mesophilic anaerobic digestion in place and is the only plant in the county that has sludge treatment. Total sludge production in the county for 2003 was 941 tds (EPA, 2003).

Table 26. Lists of the main wastewater treatment plants in County Offaly.

Plant	Estimated PE	Type of wastewater treatment	Type of sludge treatment	Type of sludge de-watering	Solids Content (%)	Quantity generated (tds)/year
Tullamore	15,000	Secondary	Mesophilic anaerobic digestion	Double belt press	21%	382
Edenderry	6,750	Secondary	None	Centrifuge	18%	216
Clara	3,000	Primary	None	Centrifuge	18%	44
Ferbane	1,500	Primary	None	New sewage treatment plant to be commissioned in April 2005		
Banagher	1,300	Secondary	None	Single belt press	10%	49
Birr	8,500	Secondary	None	Double belt press	16%	123
Kilcormac	1,400	Secondary	None	None		
Total						**814**

Sludge Disposal

The county council recycles approximately 50% of sludge to land and the other 50% goes to landfill. The sludge from Tullamore wastewater treatment plant is land spread for nine months of the year and land filled for the other three months in Derryclure landfill while the rest of the sludge in the county is also land filled in Derryclure landfill. The sludge has to be twenty five per cent solids content or greater to enter the landfill. The sludge register is maintained and kept at Tullamore wastewater treatment plant and is available for public inspection. The Local Authority has no sludge storage facilities of its own.

The council is in the process of seeking to hire a contractor to remove sludge from the plants that have no sludge treatment and treat this sludge and recycle it. The council had to withdraw the initial process of hiring a contractor, as one of the main

sludge treatment companies in the country objected as they were not included in the initial tendering process.

Sludge Management Plan

The sludge management plan has been adopted and is being implemented. It proposes to have a sludge hub centre at Tullamore wastewater treatment plant, which will be a DBO type contract as required by the DoEHLG. Ferbane, Birr and Edenderry will be sludge satellite centres feeding into the main hub. The plan is expected to be operational in about three years.

Flow Metering and Sampling

All of the wastewater treatment plants that de-water sludge in the county have influent flow measurement installed. The meters are calibrated when required. Composite and grab samples are taken on the plants as required for reporting under the Urban Waste Water Treatment Regulations. PE figures are estimated from census figures.

Management of Wastewater Treatment Plants

Offaly County Council is divided into a number of areas and while the area engineer has responsibility for the wastewater treatment plants in his or her area, the water services section in County Hall oversee a substantial part of the process operations and maintenance.

Roscommon County Council

Introduction

Roscommon County Council has four wastewater treatment plants in the county that de-water sludge. There is no sludge treatment at any of the plants. A new plant is currently being constructed in Castlerea, and it will be commissioned in 2005. The county council does not have any sludge storage facilities. Total sludge production in the county for 2003 was estimated at 392 tds (EPA, 2003).

Table 27. List of the main wastewater treatment plants in County Roscommon.

Plant	Estimated PE	Type of wastewater treatment	Type of Sludge treatment	Type of sludge de-watering	Solids Content (%)	Quantity generated tds/year
Ballaghderreen	1,417	Secondary	None	Centrifuge	16-17%	16
Ballinlough	1,200	Secondary	None	None		
Boyle	6,300	Secondary	None	Centrifuge	16-17%	69
Castlerea	3,411	Secondary	None	New plant being constructed		
Monksland	5,983	Secondary	None	Double belt press	12-13%	68
Roscommon	10,667	Secondary	None	Double belt press	13%	142
Strokestown	1,000	Secondary	None	None		
Total						**295**

Sludge disposal

Roscommon County Council have contracted the sludge disposal to a company called Evergreen Fields. In Roscommon wastewater treatment plant, the de-watered sludge is held in a holding tank and the contractor adds water to the sludge to enable it to be sucked into a tanker. This liquid sludge is directly applied to tillage or grassland or it is stored in slatted units in farmers storage facilities for up to three months before being land spread. This contractor also removes the sludge from the other county council wastewater treatment plants for long term storage and land spreading. The contractor provides details to the county council for the sludge register. The county council has no sludge storage facilities.

There is currently a bad odour problem from Monksland wastewater treatment plant caused by the sludge de-watering operation. This plant is only two to three years

old. The county council are investigating the installation of a different type of sludge de-watering system.

Sludge Management Plan

The sludge management plan stipulated that Roscommon be a sludge hub centre for the county with the probability of thermal drying as sludge treatment. However consultants are currently reviewing the sludge management plan on behalf of the council. The plan is expected to be operational within three years.

Flow Sampling and Metering

All the main wastewater treatment plants that de-water sludge have influent flow measurement. The meters are calibrated on a regular basis. Composite samples are taken as required for reporting under the Urban Waste Water Treatment Regulations. PE is calculated by multiplying the BOD value of the composite sample by the flow (usually over twenty four hours).

Management of Wastewater Treatment Plants

Roscommon County Council is divided into a number of areas and each of these areas has a dedicated water services engineer who manage the wastewater treatment plants in their respective areas.

Sligo County Council

Introduction

Sligo County Council has currently no de-watering equipment on any of its wastewater treatment plants. However, there are six plants that have sludge drying beds. There is no sludge treatment in the county. Total sludge production in the county for 2003 was estimated at 16 tds (169 tds in 2002) (EPA, 2003).

Table 28. List of the main wastewater treatment plants in County Sligo.

Plants	Estimated PE	Type of Wastewater treatment	Type of Sludge treatment	Type of Sludge de-watering	Solid Content (%)	Quantity generated tds/year
Strandhill	2,090	Secondary	None	Drying beds		4.77
Collooney	1,456	Secondary	None	Drying beds		10.8
Grange	578	Secondary	None	Drying beds		0.365
Gurteen	571	Secondary	None	Drying beds		6.82
Ballymote	2,468	Primary	None	Drying beds		3.5
Tubbercurry	2,335	Secondary	None	Drying beds		
Enniscrone	2,727	Secondary	None	None		18.917
Ballisodare	1,631	Secondary	None	None	No sludge removal	
Rosses Point	1,498	Primary	None	None		
Mullaghmore	1,306	Primary	None	None		
Sligo	20,000	None	None	None		
Total						**45.172**

Sludge Disposal

Sligo County Council has hired a contractor to dispose of all its sludge. Evergreen Fields remove the sludge by tanker from each plant and it is transported to farm storage facilities in Louth, Westmeath, Roscommon and Galway. It is treated by long term storage before being land spread. The county council has no sludge storage facilities.

Sludge Management Plan

The sludge management plan is adopted. The proposal is that Sligo Town will become a sludge hub centre for the county with a thermal dryer. There will be a

number of sludge collection centres in the county to feed the hub. This should be operational in four years.

Flow Metering and Sampling

There are no influent flow meters on the wastewater treatment plants in the county. Composite and grab samples are taken for reporting purposes. There is no information on the number of samples taken. PE figures are estimated using a house count method (3.5 persons per house) for each urban area.

Management of Wastewater Treatment Plants

All the wastewater treatment plants in the county are managed by the water services section at head office. The section has divided the county into four areas with two engineers and two technicians managing the wastewater treatment plants in each area.

South Dublin County Council

Introduction

There are no de-watering plants in the county. All of the existing wastewater treatment plants were closed down and currently all the sewage from the county is discharged to Ringsend wastewater treatment plant in Dublin City.

Tipperary North Riding County Council

Introduction

Tipperary North Riding County Council have currently two wastewater treatment plants in the county that de-water sludge. There is a mesophilic anaerobic digestion system in Roscrea and this is the only sludge treatment in the county. Total sludge production in the county for 2003 was estimated at 1170 tds (EPA, 2003).

Table 29. List of the main wastewater treatment plants in Tipperary North Riding County Council

Plants	Estimated PE	Type of Wastewater treatment	Type of Sludge treatment	Type of Sludge de-watering	Solid Content (%)	Quantity generated tds/year
Nenagh	18,000	Secondary	None	Double belt press	14%	252
Roscrea	14,000	Secondary	Mesophilic Anaerobic digestion	Centrifuge	20-25%	209
Templemore	5,000	Primary	None	None		
Thurles	10,600	Secondary	None	Drying Beds		
Borrisoleigh	1,000	Secondary	None	None		
Ballina	2,500	Secondary	None	None		
Total						**461**

Sludge Disposal

The sludge from Roscrea is being recycled to land. Landfeeds have a contract to remove the sludge from Roscrea and lime stabilise it and land spread it. They provide details to the county for the sludge register. Sludge from smaller plants in the north of the county is brought to Nenagh in liquid form. The sludge from Nenagh is currently disposed to landfill. The sludge from the drying beds in Thurles is landspread. Some of it is deep injected and some is spread on the local land. The county council has no sludge storage facilities. Some of the personnel involved in sludge treatment and disposal in the county did not want to discuss some aspects of sludge treatment and disposal.

Sludge Management Plan

The sludge management plan proposes to make Thurles, Roscrea and Nenagh sludge hub centres and tender for a single DBO contract. The contractor would be responsible for sludge treatment and disposal. However the council are currently in

the process of hiring consultants to review this plan as certain aspects of it are dated. It could be five years before this plan is operational.

Flow Metering and Sampling

All the main wastewater treatment plants that de-water sludge in the county have influent flow measurement installed. The smaller wastewater treatment plants have no flow measurement. Flow meters are calibrated when required. Composite samples are taken for reporting purposes. The number of samples taken complies with regulations. PE figures are calculated by multiplying the BOD value of the composite sample by the influent flow (usually taken over twenty four hours).

Management of Wastewater Treatment Plants

Tipperary North County Council is divided into a number of areas. Each area has a dedicated water services engineer supported by technicians and caretakers.

Tipperary South Riding County Council

Introduction

Tipperary South Riding County Council currently has four plants in the county that de-water sludge. Clonmel has mesophilic anaerobic digestion after which the sludge is lime stabilised. This is the only sludge treatment centre in the county. In 2003, Earthtech was awarded a 20 year DBO contract for twelve plants in the county. This 20 year contract will see the building of five new plants at Carrick-on-Suir, Ballyclerihon, Ardfinnan, Ballypreen and Clonhean and the upgrading of another seven plants. Total sludge production in the county for 2003 was estimated at 513 tds (EPA, 2003).

Table 30. List of the main wastewater treatment plants in Tipperary South Riding County Council.

Plant	Estimated PE	Type of Wastewater treatment	Type of Sludge treatment	Type of sludge de-watering	Solids content (%)	Quantity generated (tds)/year
Clonmel	40,000	Secondary	Lime stabilisation	Double belt press	25%	450
Carrick-on-Suir	6,000	Preliminary	None	Centrifuge	20.4%	140
Cashel	2,280	Secondary	None	None		
Cahir	3,000	Secondary	None	Centrifuge	18.85%	96
Tipperary town	4,750	Secondary	None	Centrifuge	18.9%	225
Killenaule	864	Tertiary	None	None		
Fethard	1,920	Tertiary	None	None		
Ballyclerihon		Tertiary	None	None		
Ardfinnan	572	Primary	None	None		
Ballyporeen				Currently being upgraded		
Clonhean				Currently being upgraded		
Total						**911**

Sludge Disposal

Sludge produced at the Clonmel plant, which is operated by Earthtech is currently lime stabilised and then land spread. The plant is in the Clonmel Borough Council area and the council has contracted the sludge disposal and recycling to land to a local contractor (Sheehan Bros.)

Up until Earthtech were awarded the contract in 2003, Cashel was the sludge hub centre for the county council treating all the rest of the sludge by lime stabilisation.

This sludge was recycled to land by Tim Burke & Associates who are sludge contractors and they provided the sludge register for the county council.

When Earthtech was awarded the 20 year DBO contract, Cashel was no longer available as a hub centre as it was being upgraded. Earthtech is now responsible for sludge treatment and disposal and has subcontracted this to Landfeeds who transport the de-watered sludge to Nurney in County Kildare where it is lime stabilised and then land spread.

The liquid sludge from smaller plants in the county is recycled by Landfeeds who deep inject it into tillage soil. All sludge produced in the county, except sludge from Clonmel, is currently disposed of by Earthtech, who provides the sludge register for the county. The county council does not own any sludge storage facilities.

Sludge Management Plan

The sludge management plan has been adopted. Under this plan, Clonmel will become a sludge hub centre and a thermal dryer will be installed. This will be a separate DBO contract for 20 years and tenderers have been short listed for it. This could leave a situation where two contractors will be operating in the same plant over twenty years, one operating the wastewater treatment plant and the other operating the sludge treatment plant. Clonmel sludge hub centre will be able to take liquid or cake sludge. Satellites feeding the hub centre will be situated in Tipperary town, Carrick-on-Suir and Fethard. This plan should be operational in two years.

Sludges from all plants outside the DBO contract will either go for composting to a local farmer who has a composting facility or will go for de-watering to one of the satellite centres.

Flow Metering and Sampling

Some of the main wastewater treatment plants in the county have influent flow measurement installed but all the plants under the DBO contract will have influent flow measurement installed by December 2005. Composite samples are taken on the main plants weekly. PE is calculated by multiplying the BOD value of the composite sample by the influent flow (usually over twenty four hours).

Management of Wastewater Treatment Plants

The wastewater treatment plants outside the DBO contract are managed by the area engineers.

Waterford City Council

Introduction

There is no wastewater treatment plant in Waterford city at the moment. The sewage is carried by an interceptor sewer to a pumping station where it is pumped to the estuary via. the River Suir.

Sludge Disposal

No sludge is generated or disposed of by the City Council.

Sludge Management Plan

The sludge management plan has been adopted by the city council. It proposes the building of a wastewater treatment plant at Gorteens, Belfier, County Kilkenny which will have a mesophilic anaerobic digestion system with pre or post pasteurisation to produce pasteurised sludge thickened to twenty three per cent solids. This will be a DBO type contract for both sludge treatment and disposal. It is hoped to start building in May 2005, with a twenty seven month build period before commissioning. There is a long term plan to add a thermal dryer to this plant at a later stage.

Waterford County Council

Introduction

Waterford County Council has two wastewater treatment plants in the county that de-water sludge. There is no sludge treatment at any of the plants. New wastewater treatment plants are currently being constructed in Dungarvan and Tramore under DBO contracts. Total sludge production in the county for 2003 was estimated at 8 tds (EPA, 2003).

Table 31. List of the main wastewater treatment plants in County Waterford.

Plant	Estimated PE	Type of wastewater treatment	Type of Sludge treatment	Type of Sludge de-watering	Solids content (%)	Quantity generated (tds)/year
Dungarvan	10,000	None	None	None		
Tramore	15,300	None	None	None		
Dunmore East	1,600	None	None	None		
Lismore	1,000	Secondary	None	Single belt press	14%	
Portlaw	1,250	Secondary	None	Single belt press	14%	
Ballinrode			None	None		
Tallow	1,450	None	None	None		
Cappoquin	950	None	None	None		
Total						

Sludge production

Personnel in the county council stated that there were no figures available for sludge production. They also stated that there is only an estimate made of sludge produced and the figure for 2003 of eight tonnes of dried solids was probably an under-estimate.

Sludge Disposal

The sludge produced at Lismore and Portlaw is disposed to landfill in Tramore. The landfill will only accept sludge of fourteen per cent solids content or more. The rest of the sludge in the county (liquid sludge from septic tanks and smaller package plants) is disposed to reed beds at Lemybrien. The county council does not have any sludge storage facilities.

Sludge Management Plan

The sludge management plan has been adopted and is currently being implemented. Under the plan, the Dungarvan wastewater treatment plant, which is being constructed under a DBO contract, will be a hub centre for sludge in the county and will have a thermal dryer. The contractor is Ascon, Bowen, Vevendi. The sludge from this plant will be recycled to agriculture. This plant is expected to be commissioned in April 2006.

The new wastewater treatment plant in Tramore will have to de-water sludge to between sixteen per cent and twenty three per cent dry solids when it is commissioned and this sludge will be transferred to the hub centre. There will also be two sludge satellites centres, Cappoquinn and Portlaw which will thicken the sludge to between sixteen and twenty three per cent and then transfer it to the hub centre.

Flow Metering and Sampling

No information was available on flow metering and sampling.

Westmeath County Council

Introduction

Westmeath County Council currently has five wastewater treatment plants that de-water sludge in the county. There is no sludge treatment at any of the plants. Total sludge production in the county for 2003 was estimated at 1213 tds (EPA, 2003).

Table 32. List of the main wastewater treatment plants in County Westmeath.

Plant	Estimated PE	Type of Wastewater treatment	Type of Sludge treatment	Type of Sludge de-watering	Solid content (%)	Quantity generated tds/year
Mullingar	21,500	Secondary	None	Double belt press	15-16%	600
Athlone	22,500	Secondary	None	Double belt press	16-17%	260
Castlepollard	1,800	Secondary	None	Single belt press	10-11%	30
Kinnegad	2,500	Secondary	None	Single belt press	10-11%	36
Moate	5,000	Secondary	None	Double belt press	15%	98
Total						**1,024**

Sludge Disposal

The county council has a contract with Landfeeds to remove all sludge and dispose of it. They are lime stabilising the sludge in Nurney in County Kildare and spreading it on land in Westmeath, Carlow and Laois. The contractor produces a sludge register for the county council. Sludge from the smaller plants in the county is imported into the larger plants with de-watering equipment. The council has no sludge storage facilities.

Sludge Management Plan

The sludge management plan has been adopted. It proposes Mullingar to be the sludge hub centre with thermal drying under a DBO type contract. The plan should be operational in three years.

Flow Metering and Sampling

All of the main wastewater treatment plants in the county that de-water sludge have influent flow metering systems installed. The flow meters are calibrated every two

years. Composite samples are taken for reporting purposes. The number of samples taken complies with regulations. PE is calculated by multiplying the BOD value of the composite sample by the influent sample (usually taken over twenty four hours).

Management of Wastewater Treatment Plants

Westmeath County Council is divided into a number of areas and each area has two area engineers each covering all aspects of Local Authority work i.e. planning, housing, roads, water treatment and supply and wastewater treatment.

Wexford County Council

Introduction

Wexford County Council has eight wastewater treatment plants in the county that de-water sludge. The wastewater treatment plant in Wexford town has a thermal dryer and it is being operated under a DBO contract by Earthtech for a twenty year period. This is the only sludge treatment centre in the county. There is no sludge storage centre in the county. Total sludge production in the county for 2003 was estimated at 815 tds (EPA, 2003).

Table 33. List of the main wastewater treatment plants in County Wexford.

Plant	Estimated PE	Type of wastewater treatment	Type of Sludge treatment	Type of sludge de-watering	Solid content (%)	Quantity generated (tds)/year
Wexford	17,000	Thermal drying	Thermal drying	Centrifuge	90%	780
Courtown	10,000	Secondary	None	Single belt press	8%	50
Gorey	6,500	Secondary	None	Single belt press	11%	150
Kilmuckerage	1,000	Secondary	None	Double belt press	15%	8
Blackwater	1,200	Secondary	None	Single belt press	11%	13
Castlebridge	1,000	Secondary	None	Single belt press	11%	18
Enniscorthy	8,500	Secondary	None	Double belt press	16%	210
Rosslare	4,000	Secondary	None	Single belt press	10%	49
Total						1278

Sludge Disposal

Currently all de-watered sludge in the county is transported to the wastewater treatment plant at Kerlogue in Wexford town. This is the sludge hub centre for the county. Here, process water is added to the imported sludge to reduce its solids content to five per cent as the centrifuges cannot accept a higher solids content sludge. The sludge is de-watered in the centrifuge to twenty two per cent dry solids and then sent to the thermal dryer. Quinns of Baltinglass are contracted by Earthtech to remove this treated sludge and recycle it to land.

There have been problems with this thermal dryer with regard to odours in the past and as a result it was shut down for six months. The main contractor, Earthtech are investigating the installation of an odour attenuation system at the plant. During this time, Landfeeds had to be subcontracted to remove the de-watered sludge (cake) from the centrifuges and lime stabilise it before land spreading as Quinns have no facility to lime stabilise the sludge. The dryer is not in use presently.

Sludge Management Plan

The sludge management plan is almost fully implemented. The only real deviation is that the county council do not have covered skips for transporting sludge to the hub centre. It is costing the county council 1.1 million euro per year to have the sludge from the rest of the county accepted at the gates of the sludge hub centre and this figure does not include transport costs.

Flow Metering and Sampling

All the main wastewater treatment plants that de-water sludge have influent flow measurement installed. The flow meters are calibrated on a two yearly basis. Composite samples are taken on a weekly basis. PE figures are calculated by multiplying the BOD value of the composite sample by the influent flow over twenty four hours. There are some plants (above 500 PE) that do not have influent flow measurement installed.

Management of Wastewater Treatment Plants

The wastewater treatment plants in the county are partially controlled by area engineers and partially controlled by a small section in water services. However sources in water services would like to see all the wastewater treatment plants come under the control of this section for more efficient management of the plants.

Wicklow County Council

Introduction

Wicklow County Council currently has six wastewater treatment plants that de-water sludge. Greystones wastewater treatment plant has mesophilic anaerobic digestion installed as sludge treatment and the rest of the sludge de-watering plants in the county have lime stabilisation as sludge treatment. Greystones is currently operated on a month to month contract basis by Earthtech. Tenders have been evaluated and a contractor is soon to be selected to operate the plant under a twenty year DBO type contract. Sludge production in the county for 2003 was estimated at 680 tds (EPA, 2003).

Table 34. List of the main wastewater treatment plants in County Wicklow.

Plant	Estimated PE	Type of wastewater treatment	Type of Sludge treatment	Type of Sludge de-watering	Solids content (%)	Quantity generated tds/year
Bray	40,000	Preliminary	None	Five years away		
Greystones	22,000	Secondary	Mesophilic anaerobic digestion	Centrifuge	22%	172
Wicklow	8,500	Preliminary	None	Construction starting in 2007		
Arklow	15,000	None	None	Construction starting in 2008		
Enniskerry	1,800	Secondary	Lime stabilisation	Single belt press	15%	132
Kilcoole	2,400	Secondary	Lime stabilisation	Single belt press	13%	16
Blessington	1,900	Secondary	Lime stabilisation	Single belt press	15%	111
Baltinglass	3,000	Secondary	Lime stabilisation	Double press	24%	81
Carnew	1,200	Secondary	Lime stabilisation	Single belt press	16%	75
Total						**587**

Sludge Disposal

Wicklow County Council is currently spreading all of the sludge produced in the county on agricultural land. The liquid sludge from all the smaller plants in the county is brought to the plants that have de-watering equipment. The council uses transport contractors or the farmers themselves to remove the treated sludge from the treatment plants to the land. The county council oversees this operation and

produces the sludge register. Approximately 0.5% of the land area (1,012 hectares) in County Wicklow is used for sludge disposal.

Sludge Management Plan

The sludge management plan has been adopted. It proposes to have a sludge hub centre in Wicklow town which will have a thermal dryer. Arklow, Carnew, Baltinglass, Blessington, Rathdrum and Enniskerry will be satellite centres feeding the hub centre. However there is an option to send sludge from Baltinglass and Blessington to Kildare to be treated. No decision has been taken on this yet. There has been a review of the plan and interim measures are about to be implemented which were not in the original plan. This includes a quick lime stabilisation plant to be installed in Enniskerry to give a pasteurised sludge and a picket fence thickener and double belt press to be installed in Kilcoole to produce a sludge with a greater dried solids content. It is hoped that the Wicklow plant will begin construction in mid 2006 with a two year build before commissioning. The Arklow scheme has finally been given authorisation to proceed by An Bord Pleanála in January 2005. The Bray scheme involves pumping the sewage into Shanganagh wastewater treatment plant in Dun Laoghaire-Rathdown County Council when it is operational in approximately five years.

Flow Metering and Sampling

Two of the wastewater treatment plants in Wicklow County Council that de-water sludge have influent flow measurement. The rest of the de-watering plants have no working flow measurement. There is no information on the calibration of these flow meters. Composite samples are taken at only a few of the plants, the rest are grab samples. The samples are taken as required to meet the regulations, however some plants were not sampled at all. There is no information on how PE is calculated.

Management of Wastewater Treatment Plants

Wicklow County Council is divided up into areas and the area engineer is responsible for the operation and maintenance of the wastewater treatment plants in their respective areas. They are also responsible for planning, roads, housing and water supply in these areas. Sources have suggested that the wastewater treatment plants

could be managed more effectively and efficiently if they were managed from the water services section in County Buildings.

Appendix B

Limit Values for Heavy Metals in Biosolids and Soils in Member States and Limit Values for Organic Compounds in Biosolids in Member States.

Table 1 European Union Limit Values for Heavy Metals in Biosolids, milligrams per kilogram of dry matter (DM) (Shaded cells represent limit values below those required by directive 86/278/EEC.)

	Cd	Cr	Cu	Hg	Ni	Pb	Zn	As	Mo	Co
Directive 86/278/EEC	20-40	---	1,000-1,750	16- 25	300-400	750-1,200	2,500-4,000	--	--	--
Austria	2[a] 10[b] 10[c] 4[d] 10[e] 0.7-2.5[f]	50[a] 500[b] 500[c] 300[d] 500[e] 70-100[f]	300[a] 500[b] 500[c] 500[d] 500[e] 70-300[f]	2[a] 10[b] 10[c] 4[d] 10[e] 0.4-2.5[f]	25 100[b] 100[c] 100[d] 100[e] 25-80[f]	100[a] 400[b] 500[c] 150[d] 500[e] 45-150[f]	1,500[a] 2,000[b] 2,000[c] 1,800[d] 2,000[e] 200-1,800[f]	20[e]	20[e]	10[a] 100[e]
Belgium (Flanders)	6	250	375[f]	5	100	300	900[f]	150	--	--
Belgium (Walloon)	10	500	600	10	100	500	2,000		--	--
Denmark - dry matter basis - total phosphorus basis	0.8 100	100	1,000	0.8 200	30 2,500	120[g] 10,000[g]	4,000	25[h]	--	--
Finland	3 1.5[i]	300	600	2 1[i]	100	150 100[i]	1,500	--	--	--
France	20[j]	1,000	1,000	10	200	800	3,000	--	--	--
Germany	10	900	800	8	200	900	2,500	--	--	--
Greece	20-40	500	100 -1,750	16-25	300-400	750-1,200	2,500-4,000	--	--	--
Ireland	20	--	1,000	16	300	750	2,500	--	--	--
Italy	20	--	1,000	10	300	750	2,500	--	--	--
Luxembourg	20-40	1,000-1,750	1,000-1,750	16-25	300-400	750-1,200	2,500-4,000	--	--	--
Netherlands	1.25	75	75	0.75	30	100	300	--	--	--
Portugal	20	1000	1,000	16	300	750	2,500	--	--	--
Spain - soil pH <7 - soil pH >7	20 40	1,000 1,750	1,000 1,750	16 25	300 400	750 1,200	2,500 4,000	--	--	--
Sweden	2	100	600	2.5	50	100	800	--	--	--
United Kingdom	--	--	--	--	--	--	--	--	--	--
Accession countries										
Estonia	15	1,200	800	16	400	900	2,900	--	--	--
Latvia	20	2,000	1,000	16	300	750	2,500	--	--	--
Poland	10	500	800	5	100	500	2,500	--	--	--

[a] Lower Austria (grade II);
[b] Upper Austria;
[c] Burgenland;
[d] Vorarlberg;
[e] Steiermark;
Carinthia;
[f] These values will be reduced to 125 (Cu) and 300 (Zn) from December 31, 2007; [g] For private gardening, lead value is reduced to 60 mg/kg of dry matter (DM) or 5000 mg/kg P;
[h] For private gardening;
[i] Target limit values for 1998;
[j] 15 mg/kg of DM from January 1, 2001 and 10 mg/kg of DM from January 1, 2004.

Abbreviations: As, arsenic; Cd, cadmium; Co, cobalt; Cr, chromium; Cu, copper; Hg, mercury; Mo, molybdenum; Ni, nickel; Pb, lead; Zn, zinc.

Source: Adapted from European Communities 2001.

Table 2 European Union Limit Values for Heavy Metals in Soil (milligrams per kilogram of dry matter)
(Shaded cells represent limit values below those required by Directive 86/278/EEC.)

	Cd	Cr	Cu	Hg	Ni	Pb	Zn	As	Mo	Co
Directive 86/278/EEC (6<pH<7)	1-3	--	50-140	1-1.5	30-75	50-300	150-300	--	--	--
Austria	1.5[a]	100[a]	60[a]	1[a]	50[a]	100[a]	200[a]	--		
	1[b]	100[b]	100[b]	1[b]	60[b]	100[b]	300[b]			
	2[c]	100[c]	100[c]	1.5[c]	60[c]	100[c]	300[c]			
	2[d]	100[d]	100[d]	1[d]	60[d]	100[d]	300[d]			
	2[e]	100[e]	100[e]	1[e]	60[e]	100[e]	300[e]		10[e]	50[e]
	0.5-1.5[f]	50-100[f]	40-100[f]	0.2-1[f]	30-70[f]	50-100[f]	10-200[f]			
Belgium (Flanders)	0.9	46	49	1.3	18	56	170	22	--	--
Belgium (Walloon)	2	100	50	1	50	100	200	--	--	--
Denmark	0.5	30	40	0.5	15	40	100	--	--	--
Finland	0.5	200	100	0.2	60	60	150	--	--	--
France	2	150	100	1	50	100	300	--	--	--
Germany	1.5	100	60	1	50	100	200	--	--	--
Greece	1-3	--	50-140	1-1.5	30-75	50-300	150-300	--	--	--
Ireland	1	--	50	3	30	50	150	--	--	--
Italy	1.5	--	100	1	75	100	300	--	--	--
Luxembourg	1-3	100-200	50-140	1-1.5	30-75	50-300	150-300	--	--	--
Netherlands	0.8	100	36	0.3	35	85	140	--	--	--
Portugal									--	--
-soil pH <5.5	1	50	50	1	30	50	150			
-5.5< soil pH <7	3	200	100	1.5	75	300	300			
-soil pH >7	4	300	200	2	110	450	450	--		
Spain										
- soil pH <7	1	100	50	1	30	50	150	--	--	--
- soil pH >7	3	150	210	1.5	112	300	450	--	--	--
Sweden	0.4	60	40	0.3	30	40	100-150	--	--	--
United Kingdom										
-5 < soil pH 5.5	3	--	80	1	50	300	200	--	--	--
-5.5 < soil pH <6	3	--	100	1	60	300	250			
-6≤ soil pH ≤7	3	--	135	1	75	300	300			
-soil pH >7	3	--	200	1	110	300	450			
Estonia	3	100	50	1.5	50	100	300	--	--	--
Latvia	0.3-1	15-30	10-25	0.1-0.15	8-30	15-30	35-100	--	--	--
Poland	1-3	50-100	25-75	0.8-1.5	20-50	40-80	80-180	--	--	--

[a] Lower Austria (grade II);
[b] Upper Austria;
[c] Burgenland;
[d] Vorarlberg;
[e] Steiermark;
[f] Carinthia.
Abbreviations: Cd, cadmium; Cr, chromium; Cu, copper; Hg, mercery; Ni, nickel; Pb, lead; Zn, zinc; As, arsenic; Mo, molybdenum; Co, cobalt.
Source: Adapted from European Communities 2001.

European Limit Values for Organic Compounds in Biosolids (milligrams per kilogram of dry matter)

	Dioxins and Furans (PCDD, PCDF) ng/TE/kg of DM	PCBs	AOX	LAS	DEHP	NPE	PAH	Toluene
Austria	100[a,b,c] 50[e]	0.2[a,b,c] 1[e]	500[a,b,d]	--	--	--	6[d]	--
Belgium (Flanders)[e]								
Denmark from 1/07/2000 from 1/07/2002	--	--	--	2,600 1,300 1,300	100 50 50	50 30 10	6 3 3	--
France	--	0.8[f]	--	--	--	--	2-5[g] 1.5-4[h]	--
Germany	100	0.2[i]	500	--	--	--	--	--
Sweden	--	0.4		--	--	100	3	5

[a]Lower Austria.
[b]Upper Austria.
[c]Vorarlberg.
[d]Carinthia.
[e]Limit values for approximately 30 organic compounds.
[f]Sum of seven principal PCBs (PCB 28, 52, 101, 118, 138, 153, 180).
[g]Fluoranthene.
benzo[*b*]fluoranthene, benzo[*a*]pyrene.
[h]When used on pasture land.
[i]For each one of the six congeners.
Abbreviations: AOX, sum of organohalogenous compounds; DEPH, di(2-ethylhexyl)phthalate; LAS, linear alkyl-benezene sulfonates; NPE, nonylphenol and nonylphenolethoxylates; PAH, polyaromatic hydrocarbons; PCBs, polychlorinated biphenyls; PCDD, polychlorodibenzodioxins; PCDF, polychlorodibenzofurans; TE, 2,3,7,8-tetrachloro-*p*-dioxin toxicity equivalents.
Source: Adapted from European Communities 2001.

Appendix C

Medium and Long Term Targets for the Sewage Sludge.

Elements	Medium term (about 2015)		Long term (about 2025)	
	Limit values for concentrations of heavy metals in sludge for use on land (mg/kg dm)	Limit values for amounts of heavy metals which may be added annually to soil, based on a ten year average (g/ha/y)	Limit values for concentrations of heavy metals in sludge for use on land (mg/kg dm)	Limit values for amounts of heavy metals which may be added annually to soil, based on a ten year average (g/ha/y)
Cd	5	15	2	6
Cr	800	2400	600	1800
Cu	800	2400	600	1800
Hg	5	15	2	6
Ni	200	600	100	300
Pb	500	1500	200	600
Zn	2000	6000	1500	4500

Where:
Cd -- Cadmium
Cr -- Chromium
Cu -- Copper
Hg -- Mercury
Ni -- Nickel
Pb -- Lead
Zn -- Zinc

Appendix D

Table 1. Comparisons of Limit values for Metals in Soil.

Metal	Directive 86/278/EEC (mg/kg)	S.I. 148 of 1998 (mg/kg)	Code of Good Practice		Working Document 3rd Draft		
			5<pH<6	Ph>6	5<pH<6	6<pH<7	pH>7
Cadmium	1-3	1	1	1.5	0.5	1	1.5
Copper	50-140	50	80		20	50	100
Nickel	30-75	30	50	80	15	50	70
Lead	50-300	50	80		70	70	100
Zinc	150-300	150	100	150	60	150	200
Mercury	1-1.5	1	1		0.1	0.5	1
Chromium	-		100		30	60	100

Table 2. Comparisons of Limit values for Metals in Sludge

Metal	Directive 86/278/EEC (mg/kg)	S.I. 148 of 1998 (mg/kg)	Working Document 3rd Draft (mg/kg)
Cadmium	20-40	20	10
Copper	1000-1750	1000	1000
Nickel	300-400	300	300
Lead	750-1200	750	750
Zinc	2500-4000	2500	2500
Mercury	16-25	16	10
Chromium	-	-	1000

Table 3. Limit Values of Heavy Metals which may be added annually to Soil (based on a 10 year average).

Metal	Directive 86/278/EEC (g/ha/y)	S.I. 267 of 2001 (g/ha/y	Code of Good Practice (g/ha/y)	Working Document 3rd Draft (g/ha/d)
Cadmium	150	50	50	30
Copper	12000	7500	7500	3000
Nickel	3000	3000	3000	900
Lead	15000	4000	4000	2250
Zinc	30000	7500	7500	7500
Mercury	100	100	100	30
Chromium	-	3000	3500	3000

Appendix E

Periods when the land application of certain types of fertiliser is prohibited under the Nitrates Action Programme.

Zones	Chemical Fertilizer	Organic Fertilizer	
		All Organic Fertilizers Excluding Farmyard Manure	Farmyard Manure
	Grassland and Other Land	All Land	
A	15 Sept. to 12 Jan	15 Oct. to 12 Jan.	1 Nov. to 12 Jan.
B	15 Sept. to 15 Jan	15 Oct. to 15 Jan.	1 Nov. to 15 Jan.
C	15 Sept. to 31 Jan	15 Oct. to 31 Jan.	1 Nov. to 31 Jan.

Appendix F

Zones and Minimum Periods of Storage Capacity for Livestock Manure under the Nitrates Action Programme.

Zones and Minimum Periods of Storage Capacity for Livestock Manure		
Zone A	**Zone B**	**Zone C**
16 weeks	**18 weeks**	**20 or 22 weeks**
Carlow	Clare	Cavan (22 weeks)
Cork	Galway	Donegal (20 weeks)
Dublin	Kerry	Leitrim (20 weeks)
Kildare	Limerick	Monaghan (22 weeks)
Kilkenny	Longford	
Laois	Louth	
Offaly	Mayo	
Tipperary	Meath	
Waterford	Roscommon	
Wexford	Sligo	
Wicklow	Westmeath	

Appendix G

Limits on Organic Compounds in Sludge

The Working Document proposes that sludge should not be used if the concentration of one or more of the specified organic compounds exceeds particular limits in Annex IV of the Document.

Organic Compounds	Description	Working Document 3rd Draft
AOX	Sum of halogenated organic compounds	500
LAS	Linear alkylbenzene	2600
DEPH	Di(2-ethylhexyl)phthalate	100
NPE	Nonyphenol and nonylphenolethoxylates with 1 or 2 ethoxy groups	50
PAH	Sum of specific polyclyclic aromatic hydrocarbons	6
PCB	Sum of specific polychlorinated byphenils	0.8
PCDD/F	Polychlorinated dibenzodixins / dibenzofuranes	100 ng TE/kg dm

Appendix H

Bye Laws for the land spreading of imported sewage sludge on agriculture land in County Laois

COMHAIRLE CHONTAE LAOIS

Laois County Council

BYE LAWS

FOR

THE REGULATION OF THE LANDSPREADING

OF

INDUSTRIAL ORGANIC WASTE

John Daly
Director of Services,
Environment & Water Services

LAOIS COUNTY COUNCIL

WATER POLLUTION (REGULATION OF LAND APPLICATION OF INDUSTRIAL ORGANIC WASTE) BYE LAWS 2002

Bye laws for the purpose of preventing the entry of polluting matter to waters

The County Council of the County of Laois, in exercise of the powers conferred upon it by Section 37 of the Local Government Act 1994 and Section 21 of the Local Government (Water Pollution) (Amendment) Act 1990, hereby makes the following Bye Laws in relation to agricultural activity in the functional area of the County Council of Laois.

1 General

1.1 These Bye laws shall come into effect 30 days after adoption by the Council of Laois County Council.

1.2 In these Bye Laws: -

"activity" has the meaning assigned in the Local Government (Water Pollution)(Amendment) Act 1990, as amended.

"approved body" means any organisation approved by Laois County Council for the purposes of these By-laws.

"approved nutrient management plan" means a nutrient management plan approved by Laois County Council when granting a waste permit.

"approved person" means a person deemed suitable by Laois County Council or Environmental Protection Agency to prepare a Nutrient Management Plan and who is registered by Laois County Council.

"authorised person" means a person appointed by Laois County Council to be an authorised person for the purpose of these Bye Laws under section 28 (1) c) of the Local Government (Water Pollution) Act 1977.

"Council" means Laois County Council.

"environmental quality standard" has the meaning assigned in Directive 2000/60/EC establishing a framework for Community action in the field of water policy.

"facility" has the meaning assigned in the Waste Management Act 1996.

"industrial organic waste" means organic wastes generated by an industrial or agri-industrial process, or sewage sludge, that is applied to land to promote grass or other crop production, or as a method of recovery and or disposal.

"land area" means the lands used or intended for use for the application of industrial organic waste.

"occupier" has the meaning assigned to it in the Environmental Protection Agency Act 1992.

"owner" means the person that owns, or is legally entitled, or in beneficial occupation of the land area.

"nutrient" has the meaning assigned by the Local Government (Water Pollution)(Amendment) Act 1990, as amended.

"nutrient management plan" means a plan that specifies limits for nutrient application for a defined land area based on soil analyses, soil type, cropping regime, environmental sensitivity of the land area, the volume and composition of the industrial organic waste to be applied to the land area and the volume and composition of organic and chemical fertilizer applied to the land area.

"person" means the individual or entity responsible for carrying out the land application and or the owner/occupier of the land area.

"waste" means industrial organic waste.

"waste permit" means a permit issued by the Council under Waste Management (Permit) Regulations 1998 as may be amended.

"waters" has the meaning assigned to it in the Local Government (Water Pollution) Act 1977 as amended by the Local Government (Water Pollution Act)(Amendment) Regulations 1990.

2 Land Application of Industrial Organic Waste.

2.1 Waste produced within County Laois shall be the only waste applied to lands within County Laois.

2.2 The application of waste to land shall only be carried out in accordance with a Waste Permit issued by the Council.

2.3 Every person who intends to carry out the application of waste to a land area after the commencement of these Bye-Laws shall submit an application for a Waste Permit to the Council. The application shall be made in accordance with the requirements of the Waste Management (Permit) Regulations 1998, as amended. The application shall contain the information specified in Article 10 of the Waste Management (Permit) Regulations 1998, as amended and in Schedules 1 & 2 of these Bye Laws.

2.4 Every person carrying out the application of waste to a land area at the time these Bye Laws come into effect shall submit an application for a Waste Permit to the Council within 2 months of that date.

2.5 Every application shall be accompanied with an application fee, as specified in Article 10 of the Waste Management (Permit) Regulations 1998, as amended.

2.6 Any Nutrient Management Plan provided to the Council as part of the application shall be prepared by an approved person, registered for such purpose and shall contain the information specified in Schedule 2.

2.7 Upon receipt of the application, the Council may: -

(a) Grant a waste permit.

(b) Where it considers that the information submitted does not meet the requirements of Article 10 of the Waste Management (Permit) Regulations 1998, as amended request the applicant to furnish such information.

(c) Grant a waste permit subject to such modifications as it considers necessary to the Nutrient Management Plan including, but not limited to, amendments to the proposed land area, the proposed soil quality monitoring programme, the application timing and rates, the reporting format, and approve the application on that basis.

(d) Refuse the application.

2.8 The timing and application rate of waste to lands shall be carried out in accordance with the measures specified in the approved Nutrient Management Plan.

2.9 Waste shall not be applied: -

- To exposed bedrock.
- On lands where the aquifer is designated as Regionally Important and where the aquifer is overlain by shallow (less than 2 metres) of overburden (top soil and subsoil combined).
- On lands where the aquifer is designated as Locally Important and where the aquifer is overlain by shallow (less than 1 metre) of overburden (top soil and subsoil combined.
- On lands sloping towards rivers, streams or lakes, where the gradient is more than 1:10 or in situations where there is a significant risk of causing water pollution.
- To frozen or snow covered land.

- To wet or waterlogged ground.
- Where heavy rainfall is predicted within the following 48 hours.
- Within 15 metres of exposed karstified limestone or karst features such as swallow holes and collapse features.
- Within 50 metres of domestic wells.
- Within 20 metres of lakes and main river channels and within 10 metres of other watercourses.
- Within 300 metres of a public water supply source not having a source protection scheme.
- In an area prohibited by a public water source protection scheme

2.10 The duration of the Waste Permit shall not exceed three years. The Council may require a review and amendment of the conditions of the Waste Permit, including the Nutrient Management Plan, during its period of operation, where it considers it necessary to prevent pollution, or to achieve an Environmental Quality Standard.

2.11 Where the annual assessment of soil nutrient levels identifies that the soil Phosphorous levels exceed the soil Target Index 3, as defined by Teagasc or other approved body, for the relevant soil type and crop, the application of waste shall immediately cease on the affected fields or lots.

2.12 The landspreading of waste in accordance with an Integrated Pollution Control licence issued by the Environmental Protection Agency under Part IV of the Environmental Protection Agency Act 1992 shall not exempt a person from complying with these Bye Laws.

3 Records

3.1 The person to whom a waste permit has been granted shall maintain those records specified in the approved Nutrient Management Plan. The records shall be kept up-to-date and shall be available for inspection at all reasonable times by an authorised person.

3.2 The person to whom the Waste Permit has been granted shall submit to the Council a copy of the records maintained in accordance with subsection 3.1, for the twelve-month period following the start of the land application, whether any waste has been spread or not. The records shall be submitted annually thereafter and include details of all chemical N and P inputs.

3.3 In addition to the information specified in the approved Nutrient Management Plan, the land owner/occupier shall maintain a Register which contains the following information: -

- Origin of all waste applied to the land area.
- Date of each separate application to the land area.
- Name of person who carried out each application.
- Volume of industrial organic waste applied in each application.
- The field or plot number used for each application.
- The type of treatment, if any, applied to the waste before land application.

The Register shall be kept up-to-date and copies shall be submitted to the Council at quarterly intervals from the date of issue of the approval. A copy of the Register shall be maintained at a location within 1.5 kilometers of the application lands. The Register shall be available for inspection at all reasonable times by an authorised person.

4 Penalties

4.1 Any person who contravenes or fails to comply with these Bye laws shall be guilty of an offence pursuant to Section 21(3)(a) of the Local Government (Water Pollution)(Amendment) Act 1990, as amended.

4.2 Any person guilty of an offence as defined in sub section 4.1 shall be liable to the penalties in accordance with Section 21(3)(b) of the Local Government (Water Pollution)(Amendment) Act 1990, as amended.

5 Fees

The following fees shall be applied to these Bye Laws and shall be as set out in Schedule 3

- Registration of an approved person.
- Application for a Waste Permit.

SCHEDULE 1

The application for the Waste Permit shall contain the information specified in Article 10 of the Waste Management (Permit) Regulations 1998, as amended, which includes the following: -

1 Name and address of the person making the application.

2 Name and address of the owner/occupier of the land area to be used for landspreading, if different from that in Section 1.

3 The location of the land area, by means of a copy of Land Registry, or Ordnance Survey maps and the Land Parcel Identification System (LPIS) number and field or plot number in accordance with Area Aid maps, or where the LPIS number is not available, the townland and field and plot number.

4 Name, address, telephone number and contact name of the producer of the waste. Where the producer of the waste is subject to an Integrated Pollution Control Licence the IPC Register Number shall be provided, along with a copy of the written approval of the Environmental Protection Agency for the proposed landspreading operations.

5 A report on the content of all wastes shall be provided. The report shall include laboratory analyses of the heavy metals, micropollutants, agricultural nutrient content and other contaminants, which demonstrates that the waste is suitable for landspreading.

6 Name, address, telephone number and contact name of the person transporting the waste to the lands, if different from 2 above.

7 Name and address of the person maintaining the Register specified in Sub-section 3.3, if different from 1 and 2 above.

8 Where the waste is delivered to the lands by a third party (e.g. waste contractor/waste producer), a copy of the relevant Waste Collection Permit issued to the third party.

9 A Nutrient Management Plan which shall contain the information specified in Schedule 2.

SCHEDULE 2

A Nutrient Management Plan prepared in accordance with Section 8 of Schedule 1 shall meet the following requirements: -

1 Include the name, address and relevant experience of the person who prepared the Plan.

2 Identify the proposed spreadlands on appropriate maps. The maps prepared in accordance with Section 3 of Schedule 1 will be acceptable.

3 Identify the current agricultural land use and proposed land use, if different.

4 Provide information on the existing soil nutrient levels based on analyses of soil samples and crop type. The number and depth of soil samples analysed shall be in accordance with the most recent guidelines issued by Teagasc or other approved body.

5 Provide information on the type and thickness of the soils and the depth to bedrock or sand and gravel aquifers. The extent of the information shall comply with the guidance in the Groundwater Protection Responses for Landspreading (1999).

6 Specify the maximum quantities of the waste that can be landspread on the lands annually based on: -

- Current and proposed land use.
- Soil type, depth and soil nutrient levels.
- Application of other organic and chemical fertilizer.
- Animal stocking rate.
- Efficient use of nutrients to prevent or minimise the loss of nutrients to waters.
- The most recent guidelines on nutrient application rates published by Teagasc, or other approved body.

7 Specify the times when the waste can be applied to the lands and the method of application (e.g. injection) having regard to crop nutrient requirements and the overriding objective of preventing or minimising the direct or indirect loss of nutrients to waters.

8 Identify any areas of the proposed spreadlands where the application is restricted or prohibited in order to comply with the requirements of Item 5 of Schedule 2.

9 Specify an annual on-going soil sampling and nutrient analyses programme to confirm that the land application will be carried out in a manner that avoids or minimises the loss of nutrients.

10 Provide for the keeping and maintenance of records relating to the following: -

- The producer, type, quantities, and characteristics of all the industrial organic waste spread on the lands.
- The timing, location and application rates of the industrial organic wastes.
- The types, quantities, timing, location and application rates of chemical and farm organic wastes.
- The type numbers and ages of the animals on the farm.
- The winter housing dates of livestock.
- The results of sampling programmes and or assessments to determine the soil nutrient levels.

SCHEDULE 3

The fees to be applied in connection with Section 5 of these Bye-Laws shall be as follows: -

- The fee for the registration of an approved person shall be €100 at the time of adoption of these Bye-laws and thereafter shall be reviewed annually at the time of preparation of the Annual Estimate of Expenses of the County Council.

- The fee to accompany the application of the Waste Permit shall be as specified in the Waste Management (Permit) Regulations 1998 as amended.