Disposal and recycling routes for sewage sludge
Part 1 – Sludge use acceptance report
A great deal of additional information on the European Union is available on the Internet. It can be accessed through the Europa server (http://europa.eu.int).

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Disposal and recycling routes for sewage sludge

Part 1 - Sludge use acceptance

October 2001
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1. Executive summary and main conclusions

The debate on sludge recycling and disposal has recently been the target of growing interest. This is due to the fact that some concern was expressed about the potential risks of the agricultural use of sludge for health and the environment as early as the beginning of the 1990s. Therefore, most of the debate on sludge has focused on this route (past and present debate on disposal routes is not focused on sludge but relates to waste in general).

The debate on the use of sludge in agriculture originated mainly in Northern Europe at the beginning of the 1990s, before gaining in intensity from 1995 onwards. Analysing the context of this period is crucial to understanding the various stakeholders’ attitudes, motivations and constraints concerning the use of sludge. In particular, the recent health “scares” related to GMOs (Genetically Modified Organisms), dioxins, and BSE (Bovine Spongiform Encephalopathy, that is, "mad cow disease") have cast doubts on the safety of the food products on the markets and on the ability of existing regulations and controls to minimise human exposure to potential risks.

The concern expressed about food safety is also related to growing pressure on the agricultural sector, which in certain countries is considered by consumer associations or nature protection associations as being too focused on intensive production and not sufficiently concerned about the impact of its activities on health and on the environment.

The above holds true for most European countries, however, certain countries are under considerable pressure from both sewage sludge, i.e. a high rate of production per inhabitant, and from other fertilising materials, in terms of nitrogen and phosphate content. This is one reason why the debate has not been the same in all countries and has been most heated in the Netherlands, Flanders and Scandinavian countries.

Analysis by country

Past and current events show that it is possible to divide countries up into the following groups:

- 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.

- 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 on the Application of Waste Products for Agricultural Purposes) have played a large part in ending the debate, as they are considered sufficiently strict to reduce risks to an acceptable level. 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. In addition, farmers’ associations support the agricultural use of sludge, both for economic and for agronomic reasons.

- The cases of Germany and Sweden are special. 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 Waste Water 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. In Germany, opinion has recently swung in favour of agricultural land spreading, mainly because this practice is considered economically viable and it is considered that the potential risks are sufficiently reduced by the existing legislation. However, political
developments in 2001 have considerably heated the debate, which is quite high at present as some Länder support an increase of regulatory constraints on sludge landspreading.

- In Austria, France and Walloon, a national (or regional) agreement is currently under negotiation between the different parties, and hence the debate is heated. The situation is particularly tense in France where the 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 (the FNSEA and CDFA) 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 Finland and Luxembourg, the farming community is generally hostile towards the use of sludge for land spreading, mainly because of the pressure to use animal manure for land spreading. For example, the Finnish Union of Agricultural Producers asked for a ban on the use of sewage sludge for land spreading in 1990, and have renewed their stand against the use of sludge in agriculture in 2001.

- In Ireland and Portugal, farmers support, in some cases, the agricultural use of sludge, both for economic and for agronomic reasons (mainly in terms of organic matter and phosphorus content), although it is difficult to obtain information on this matter. In both countries, the use of sludge seems to be too recent an issue to generate much public debate.

- In Spain, Italy and Greece, the debate remains limited, as far as can be judged from the available information.

This summary of the debate mostly shows that the debate is more "advanced" in Northern Europe, but remains limited in Southern Europe. In addition, it is important to mention that the debate is currently heated in certain countries (Austria, Walloon, France, Germany and Sweden).

A comparison with the national legal requirements also demonstrates that "tight" legal constraints (such as very low limit values for pollutants in sludge) do not necessarily imply a greater acceptance of the use of sludge in agriculture. The Swedish example demonstrates this best.

Finally, a major trend in the current debate on the use of sludge is clearly the increasing number of agreements regulating the use of sludge. However, whereas voluntary agreements have proven to be successful in the UK, they did not prevent the current crisis in Sweden. In the City of Toulouse (France), our enquiry shows that the national agreement will possibly not allay opponents’ fears related to sanitary risks or appease all of the local opposition: the debate largely rests on political and sociological grounds.

Analysis by stakeholder

Identifying the main positions, attitudes and constraints on the use of sludge by type of stakeholder is difficult mainly because of the various possible attitudes within one category (see case studies in chapter 5.9), and because of the possible differences from one country to another. However, on the basis of the information collected in the course of this study, it is possible to give the following summary of the main stakeholders’ positions (more details on the various possible attitudes within one category of stakeholder are set out in the body of the report):

- For farmers, the main motivation for the use of sludge in agriculture is the supply of organic fertiliser at a low cost. Their main constraints come from their customers, either food industries or retailers, who have specific quality requirements. In a growing number of cases, these quality requirements include restrictions on, and sometimes the prohibition of, the use of sludge in agriculture. In this context, the main consequences for farmers associated with the use of sludge in agriculture could be a reduction in their market share and a drop in profits, as well as additional liability costs in the event of an accident. In this context, farmers require (in countries
where the debate is heated) that a **guarantee system** be set up, which would cover them against both possible risks, in order to continue using sludge.

- **Landowners** are generally hostile to the agricultural use of sludge. Their attitude is **based on two major concerns**: liability and land value. Landowners do not want to be held liable in the event of an accident (harm to humans, animals and ecosystems) caused by the use of sludge and wish to prevent any loss in the value of their land. The European Landowners’ Organisation (ELO) adopted an official position concerning sludge recycling in agriculture in January 1999, which provides safeguards for the use of sludge. In particular, the findings of the ELO focus especially on the need to strengthen legislation, the need to "ensure that suppliers accept liability for any economic loss or damage associated with spreading sludge on their land", for instance by drawing up a pan-European model contract similar to the model contract developed by the Country Landowner’s Association (CLA) in the UK.

- The main influences on the agrifood industry are **marketing and public health concerns**. The industry's **brand image** is one of its most valuable assets and its primary concern is therefore to protect its image from being tarnished. In this sense, the industry's attitude is mainly influenced by the way in which the general public perceives the potential risks of using sludge in agriculture. As most of the members of this industry are sludge producers as well, professional associations of food industries are, in most cases, officially in favour of maintaining the use of sludge in agriculture if the quality of sludge can be guaranteed. As sludge producers, these companies are obviously seeking **low-cost sludge disposal routes**.

- The main motivation for food retailers is to be able to purchase **agricultural products at a low cost** and to secure their market share by maintaining or improving the **image of the quality and safety** of their products. In this context, as there is still a great deal of scientific debate on the potential risks of the use of sludge in agriculture, land spreading could be perceived as a potential threat to their image. The main concern for food retailers involves the **marketing stakes** regarding product quality and, therefore, the extent to which the use of sludge may have an impact, whether **real or perceived**, on the quality of agricultural products.

- The main motivation for waste-water treatment companies is to **maintain long-term disposal and recycling routes** for the sludge produced at the lowest possible cost. These companies are therefore aware of the **need to maintain agricultural land spreading as a major recycling route** for sewage sludge, mainly for economic reasons. In this context, these companies are willing to improve their performance beyond that required by the regulations in order to protect the existing routes for sewage sludge. They are also aware of the need to improve practices, and also insist on the need to introduce national policies aimed at improving and controlling the quality of waste water entering the sewers.

- The main waste management companies do not exclusively focus their business on sludge recycling. However, the main **economic driver** behind their subsidiaries specialised in organic waste management has led them to increase awareness of the importance of sludge quality control and of improving land spreading processes. In this respect, **service quality assurance** could become standard practice in Europe. In addition, waste management companies are increasingly developing the use of composted sludge, as compost has the advantage of reducing odours and of being a commercially viable product.

- 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. In addition, communities are subject to strong pressure from their voters and are therefore concerned about limiting the "water bill". The "NIMBY" factor is also an important element which makes a difference between acceptance in rural and in urban communities.

- 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. In this context, national authorities are seeking to increase confidence in the quality and safety of products cultivated on sludge fertilised soils.
Consumer associations and nature protection associations have both played only a minor role in national debates on sludge recycling. Most consumer organisations involved in the debate on the use of sludge in agriculture have been largely preoccupied with food safety. In this respect, some consumer associations are concerned that the use of sludge in agriculture does not offer sufficient guarantees. 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.

The analysis of the stakeholders’ positions shows that the main areas of consensus on sludge disposal and recycling routes are that the growing quantities of sludge must be treated in the aims of keeping both environmental and economic costs as low as possible. Similarly, improving practices, both with regard to the treatment and the use of sludge, is now considered as essential. In the context of uncertainties concerning the potential impacts on human health and the environment of the various disposal and recycling routes, all stakeholders are calling for additional research, in order to increase confidence in the use of sludge in agriculture.

Reducing constraints and encouraging the recycling of sludge
In order to encourage the recycling of sludge, the following should be taken into account:

- The development of agricultural recycling depends largely on the possibilities to improve the quality of the sludge itself and increase confidence in sludge quality. This implies the prevention of pollution of the waste water at source by reducing the possibilities for heavy metals and organic compounds to enter the waste water sewage system and improving sludge treatment as well as ensuring the monitoring of sludge quality. These technical solutions however require major investment from the water companies or local authorities in charge of treating the waste water. The possibility to certify the treatment processes involved and the quality of sludge, either through independent "sewage sludge audits” or by the certification of sludge production and treatment processes, could help to increase confidence in sludge quality. Similarly, the quality standards of sludge recycling practices also need to be guaranteed, especially for agricultural recycling.

- One of the main issues with regard to sludge recycling in agriculture is the setting up of guarantee funds or insurance systems in order to cover any loss of profits, damages or other costs related to the use of sludge in agriculture. This would partially address the issue of liability, which is a vital concern for farmers and landowners in the debate over the use of sludge. In addition to economic instruments, legal provisions could be introduced to regulate producer liability. However, according to the City of Düsseldorf officials, the guarantee fund was not considered as a decisive argument leading the City to privilege the use of sludge in agriculture, and has even had negative consequences on the economic conditions of this route.

- National regulatory requirements vary greatly from one country to another. In this area, national regulations, based on the same scientific grounds, should be considerably improved by the next Directive on sludge use, in order to provide long-term perspectives for the use of sludge. With regard to increasing confidence in the use of sludge, standardisation initiatives (continuation and completion of CEN TC 308 work on the production and disposal of sewage sludge) have a major role to play.

- The evolution of the debate on sludge disposal and recycling in Europe shows that the relationship between farmers and their customers (food industry and retailers) is crucial for the acceptance of the use of sludge in agriculture. Examples at national level show that an agreement at European level between representatives of food industries, retailers, farmers and sludge producers could enhance mutual confidence and information transfer. In this respect, efforts could be made to improve communication between the major stakeholders, for example by creating "contact points” similar to the national committees on sludge set up in several Member States.
The current state of the debate on sludge recycling and disposal routes clearly shows that the current uncertainties over possible risks for human health and for the environment play a major part in the resistance against expanding various sludge recycling routes. The areas where scientific results are the most expected by the stakeholders contacted in the course of this study are possible effects of organic pollutants and pathogens in sludge. Progress in the social and political acceptance of sludge recycling could therefore be made by promoting research on these specific aspects, publishing the research results and making them widely available. In particular, there should be better dissemination of the results of current national research programmes on the effects of the agricultural recycling of sludge on health.

In addition to the dissemination of research results, an important effort of communication on sludge use should be carried out. In particular, tools such as codes of practice for the recycling of sludge implemented on a voluntary basis should be considered. Communication should especially aim to promote high-quality sludge (with low levels of contaminants), which could be recognised as fertilisers (or as a component of fertiliser products) at European level. The development of labels at European level would enable users to identify high-quality sludge and to distinguish it from other types of sludge or waste, thus improving the image of sewage sludge itself. Therefore, labels on products could be a useful additional tool to labels on quality assurance, for encouraging the use of sludge in agriculture. The possibilities for providing more training opportunities to specific categories of stakeholders (farmers, for example) should also be examined.
2. Introduction

2.1 Objectives of the sub-component report

The objective of this report is to investigate the main factors that limit the recycling and disposal of sludge, and in particular:

- to identify the constraints on the various players involved in the "sludge system";
- to assess the technical, regulatory and socio-economic constraints on the various players;
- to investigate the role and importance of each player's position;
- to identify the different options that would reduce/remove/minimise these constraints and enhance the use of sewage sludge.

The sub-component report's main focus is on the use of sludge in agriculture, silviculture, land reclamation and green areas. It is limited to the analysis of the situation in Member States. The positions of the various stakeholders as well as the state of the debate in the Accession Countries have not been investigated as for the moment the debate remains limited or inexistent in these countries.

2.2 Methodological approach

This report is based mainly on an analysis of material collected through a literature review, a press review, a questionnaire which was sent to approximately 150 players throughout Europe (and sometimes submitted by telephone), as well as direct contacts with more than 20 informants (who provided us with additional literature and surveys). Appendix 1 presents the full list of organisations contacted, and Appendix 5 provides a statistical analysis of the questionnaires received.

Material collected from more than 100 contacts made for previous sludge-related Andersen assignments has also been updated and analysed.

Section 3 and 4 provide an overview of the stakeholders involved in the debate over sludge recycling and describe the situation of the debate by country. Section 5 is a synthesis of each stakeholder’s position, motivations and constraints concerning sludge recycling and disposal, while section 6 provides recommendations to increase sludge recycling.
3. Overview of the main players involved and of the current debate

In this section, we will describe the main stakeholders involved in the debate over sludge disposal and recycling. These stakeholders form the basis for our analysis of the main factors that limit the use of sludge in the different disposal and recycling routes. The analysis of the positions, motivations and constraints of these actors concerning sludge disposal and recycling routes will be presented in the next sections of the report, by country (section 4) and by stakeholder category (section 5).

The production, treatment, disposal and recycling of sludge involves an important number of actors, which can be classified into six major categories:

- the farming community,
- industry,
- water and waste industry,
- local authorities,
- national authorities,
- citizens.

The figure below presents these six categories:
Inside of each category, several groups of actors can be identified, according to the nature of their activity and to shared interests regarding sludge recycling and disposal routes:

- The category defined as the "farming community" essentially regroups landowners and their representative organisations (we will see how their motivations can be different than the farmers’), the farmers professional representatives (farmers unions, for instance), as well as individual farmers (who can have different motivations and constraints than their representative organisations).

- The industries mostly involved in the debate over sludge disposal and recycling are the food companies, which purchase and process all food products, and the retail companies which sell these food products to the consumer.

- The water and waste industry is also an important stakeholder in the sludge system, as water companies can be in charge of collection and treatment of waste water, sludge production and treatment, while waste management companies recycle (land spreading companies in particular) or eliminate sludge.

- The local authorities involved in the debate can be either local communities, towns and cities which usually have the responsibility for waste water collection and treatment, or regions which can have specific competencies in the field of environmental monitoring and control. In some cases, these local communities have delegated the waste water treatment service to private operators, however in other cases the local authorities are directly in charge of waste water and sludge treatment.

- The national authorities, which have essentially the role of defining the official policy concerning sludge disposal and recycling.

- The "citizens" or civil society, which designates mostly consumer organisations, nature protection organisations, as well as associations of local inhabitants.
4. Description of the stakeholders' position by country

This chapter summarises the current sludge management position of each European country and focuses on the acceptance of sludge recycling in agriculture by each type of stakeholder.

Austria

In Austria, the use of sludge in agriculture concerns approximately 20% of the sludge produced, while another 32% is incinerated\(^1\). The Directive 86/278/EEC was given effect in each Land by a specific regional legislation\(^2\).

**Working groups** were set up in 1999 within the framework of the water and waste professional association (Wasser & Abfallverband), bringing together all players concerned by sludge management in Austria, as well as the Ministry of the Environment. These working groups are discussing several issues:

- **Liability**: some stakeholders want 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 for any problems due to the use of sludge, in the face of increasing worries over food safety in Austria. A compensation fund, based on the current fund in Germany, could be created and has already been tested in Lower Austria.

- **Legislation**: there are some incompatibilities between the use of sewage sludge in agriculture and the Austrian regulatory framework for the environment (Nationaler Umweltplan). Therefore, this working group is currently establishing a list of crops on which sludge could be spread.

Other issues currently under discussion include the establishment of a code of good practices, the identification of limit values for pollutants in sludge and soil, the practical organisation of the routes and organic food production. These developments show that the position of the various players is currently changing\(^3\). To date, the above-mentioned working groups have not published any documents or stated an official position.

There are several positions among the farmers, some showing strong interest in use of sludge\(^4\). However, it seems that the main issue of concern for farmers is a clear definition of liability in the event of an accident due to the use of sludge. According to various farmers’ representatives, metal accumulation in soil is still possible even under current legislation and other pollutants (especially organic pollutants) should also be taken into consideration. Therefore, the Austrian Association of the Agricultural Chambers (Präsidentenkonferenz der Landwirtschaftskammern Österreichs), considers that the risk is still too high to recommend use of sludge in agriculture\(^5\). Agricultural use of sludge is considered as less acceptable than other organic fertilisers and the aforementioned association favours incineration or the use of sludge in green areas. It should also be recalled that, in 1996, the Austrian Association of the Agricultural Chambers was in favour of a ban on the use of sewage sludge in agriculture.

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

**Sewage sludge labelling** was tested in four districts in Lower Austria. Consequently, agricultural recycling increased and the labelled sludge was recognised as high-quality fertiliser.

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1 These data are presented in the scientific and technical sub-component report.
2 8 of 9 Länder have adopted such regulations (see regulatory sub-component report for more details).
3 Source: Präsidentenkonferenz der Landwirtschaftskammern Österreichs.
4 Source: Müller Abfallprojekte GmbH (MAP).
5 Source: Präsidentenkonferenz der Landwirtschaftskammern Österreichs.
Environment protection associations have not yet taken a clear position in the debate. Food companies remain reluctant about the use of sewage sludge in agriculture, especially for integrated and organic food production.

Belgium (Flanders)

In Flanders, there is almost no debate on the use of sludge in agriculture, as the regulatory requirements have prevented almost all use of sewage sludge in agriculture since December 1, 1999. Article 4.2.1.2 of the Decree of April 16, 1998 limits the use of urban sewage sludge for land spreading to "sewage sludge treated to reduce its content of hydrosoluble forms of the trace elements hydrogen and phosphorus by at least 85 %, when compared to untreated sludge, so that it can be used in soil with a pH of 7.0". However, this only concerns a negligible quantity of sewage sludge (only 5 % of the sludge produced can meet the regulatory requirements). As there are very little other alternatives, sludge is still mostly disposed of in landfills (60% in 1999).

The percentage of sludge incinerated is therefore expected to increase markedly. However, legislation on emissions due to waste incineration will also act as a constraint limiting the quantities of sludge incinerated. In particular, the VLAREM II legislation (June 1, 1995) sets limiting standards for the co-incineration of sludge, thus encouraging the mono-incineration of low-quality sludge. At the moment, the incineration capacity of Flanders is low: the existing sludge incinerator in Bruges has a capacity of 14 000 tonnes of DM, while the Flemish urban sludge production reaches 45 000 tonnes of DM. The incineration capacity is expected to increase to approximately 90 000 tonnes of dry solids in 2002 (42 000 tonnes for mono-incineration, 45 000 tonnes for co-incineration).6

The strict restrictions on the agricultural use of sludge is in fact seen by several players as a political decision based on strong pressure to use animal manure in Flanders.7 In particular, water and waste management companies consider that use of sludge in agriculture is equally or more acceptable than use of animal manure.8 It should be mentioned here that use of sludge in agriculture is disadvantaged by the existing surplus of animal manure:9 the annual quantities of animal manure produced are above the acceptable quantities which could be used on soil in Flanders, taking account of existing regulatory limits on nitrates and phosphorous levels.

Farmers' organisations such as Boerenbond took strong positions against the use of sludge in agriculture several years ago. In their opinion, the agricultural recycling of sludge was favoured by the federal authorities because it is cheaper and simpler than to establish a "real" recycling policy.10 In addition, agricultural use of sludge has suffered from bad publicity in the farmers' specialised press.11 The public as well as the national authorities have also developed a negative perception of the agricultural use of sludge.12 In this context, solutions suggested in order to develop the use of sludge in agriculture mainly concern better information to farmers on the advantages of sludge, better communication on the safe use of sludge in agriculture, as well as normative options for wastes to be used on land.13

7 Source: Examen de la situation de la filière de recyclage agricole des boues d’épuration urbaines en Europe et dans divers autres pays du monde, ADEME, 1999.
8 Source: AQUAFIN N.V.
9 Source: Vlaamse Landmaatschappij afdeling Mestbank
10 Source: Boerenbond, quoted by Agence Belga, September 1999
11 Sources: AQUAFIN NV, Examen de la situation de la filière de recyclage agricole des boues d’épuration urbaines en Europe et dans divers autres pays du monde, ADEME, 1999.
12 Source: AQUAFIN NV
13 Source: Vlaamse Landmaatschappij afdeling Mestbank
Belgium (Walloon)

The production of urban sludge (approximately 15 000 tonnes of dry matter today) should increase markedly over the next few years, due to a major water treatment plant construction programme (both in Brussels and in the Walloon region). However there is only limited debate on sludge recycling in agriculture in the Walloon region. The Walloon Government Order of 12 January 1995 concerning the use of sewage sludge in and on the soils regulates the landspreading of both industrial sludge and urban sludge in the Walloon region.

A sludge agreement is currently being drawn up at regional level, which focuses on the agricultural recycling of urban and industrial sludge, which is by far the main outlet for urban sludge (80 to 90% of which is used on land). In order to draw up this agreement, a working group has been set up, consisting mainly of representatives from waste water treatment organisations, agricultural recycling companies, the food industry and farmers representatives.

This draft agreement, which has received no comments from the regional authorities for the moment, aims to improve both the monitoring and the quality of sludge used in agriculture (in particular by developing codes of good practice, as well as regional approval procedures for land spreading companies). In addition, the setting up of a guarantee fund for farmers (to cover against soil contamination as a result of the agricultural use of sludge) is also provided for in the agreement, although the food industry representatives have not yet agreed to the setting up of the aforementioned fund.

The main difficulties still to be solved within the framework of the agreement are the options available to waste water treatment companies for the control of the quality of waste water entering the sewers ("police des réseaux"), as well as the production of quality charters by the food industry which are considered by the waste water companies to limit the use of sludge in agriculture and to increase the farmers' hostility towards agricultural recycling.

For the moment, sludge disposal in landfills is the least favoured option among most players, as it is considered to be a loss in terms of organic matter and potential fertilising value. In addition, regulations on landfills will prohibit the use of sludge for landfilling by 2010 (Government Order of 23 July 1987). The percentage of sludge incinerated is expected to increase markedly. However, similarly to Flanders, the sludge incineration capacities are for the moment very limited in the Walloon region.

Farmers' representatives call for a long-term position on the agricultural recycling of sludge but, for the moment, no clear position has been adopted at national or regional level. The use of sludge in agriculture and in silviculture is not supported or rejected by the farming community. Concerning the use of sludge in agriculture, the main advantages are considered to be its fertilising value and a supply of organic matter and lime (for lime-treated sludge). In this respect, the use of sludge is seen as providing a short-term economic advantage for the farming community but with a risk of long-term economic losses if the soil is damaged by the introduction of pollutants by sludge. In addition, farmers' representatives consider that animal manure should always be given priority over sewage sludge for land spreading.

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14 Sources: SEDE Benelux, FEVIA, Entente Syndicale UPA-UDEF
15 Source: Note de synthèse du groupe de travail “valorisation agricole des boues d’épuration industrielles et urbaines”, AQUAWAL (Association Régionale Wallone de l’Eau), July 2000
16 Sources: Id, SEDE Benelux
17 Sources: SEDE Benelux, FEVIA, Entente Syndicale UPA-UDEF, Examen de la situation de la filière de recyclage agricole des boues d’épuration urbaines en Europe et dans divers autres pays du monde, ADEME, 1999.
18 Source: SEDE Benelux
19 Sources: Entente Syndicale UPA-UDEF, Note de synthèse du groupe de travail “valorisation agricole des boues d’épuration industrielles et urbaines”, AQUAWAL (Association Régionale Wallone de l’Eau), July 2000
20 Source: Entente Syndicale UPA-UDEF
The sludge producers ("intercommunales") responsible for waste water treatment support the use of sludge in agriculture and are trying to maintain this recycling route, as well as to develop the use of sludge in green areas, land reclamation and silviculture (but not in natural forests)\textsuperscript{21}. However, at present these routes remain experimental.

The food industry associations are also in favour of maintaining the use of sludge in agriculture if the quality of sludge can be guaranteed\textsuperscript{22}, as most of their members are also sludge producers. The aforementioned associations consider that the cost, as well as the impacts on the environment of the use of sludge in agriculture, explain why this recycling route should be supported, if the quality of the sludge can be guaranteed.

The public’s growing concern over food safety (due in particular to the recent dioxin crisis in Belgium) does not bode well for the use of sludge in agriculture, although the public’s awareness of this practice remains very limited\textsuperscript{23}.

**Denmark**

In Denmark, the debate is over. New regulations on the use of sludge in agriculture (Statutory Order no. 49 of January 20, 2000 on Application of Waste Products for Agricultural Purposes) have contributed a great deal to the closing of the debate, as they are considered sufficiently strict to reduce risks to an acceptable level: in fact, Danish legislation is one of the strictest in the European Union regarding limit values for heavy metals in sludge\textsuperscript{24}. Today, most experts believe that the use of sludge in agriculture (which concerns 62\% of sludge production) will remain stable, as well as its incineration (21\% of sludge production).

Farmers’ associations consider that the quality of sludge is difficult to guarantee without setting up costly control measures\textsuperscript{25}. In comparison, animal manure appears to be less harmful for soil, as the farmers who use their own manure have more control on its quality\textsuperscript{26}. The quality of industrial sludge is seen as easier to control and more stable\textsuperscript{27}. However, the only industrial sludge accepted for use on agriculture is sludge which contains nutrients necessary for crops (thus excluding sludge from the paper and leather and tanning industries). Farmers are, in some cases, relatively hostile to the agricultural use of sludge, more from concerns regarding image and commercial consequences than any real health factors\textsuperscript{28}. They were responsible for the tightening of legislation in 1995 following a boycott of land spreading\textsuperscript{29}. According to other players, farmers often use the boycotting of sludge as a means of political pressure\textsuperscript{30}. Nevertheless, some farmers associations are now in favour of agricultural use of landspreading, considering that the national legislation in Denmark is now sufficiently strict to reduce risks to an acceptable level\textsuperscript{31}.

Regarding the food industry, the preferred disposal and recycling routes for sludge are silviculture and land reclamation, for economic (low cost) and sanitary reasons (mainly lower potential risks on

\textsuperscript{21} Sources: SEDE Benelux, FEVIA, Note de synthèse du groupe de travail “valorisation agricole des boues d’épuration industrielles et urbaines”, AQUAWAL (Association Régionale Wallone de l’Eau), July 2000

\textsuperscript{22} Source: FEVIA

\textsuperscript{23} Source: FEVIA

\textsuperscript{24} These elements are described in the regulatory sub-component report.

\textsuperscript{25} Source: Landboforeningerne

\textsuperscript{26} Source: Krüger A/S

\textsuperscript{27} Sources: Krüger A/S, Landboforeningerne, Landbrugsraadet, Dansk Familielandbrug

\textsuperscript{28} Source: Examen de la situation de la filière de recyclage agricole des boues d’épuration urbaines en Europe et dans divers autres pays du monde, ADEME, 1999

\textsuperscript{29} Source: Examen de la situation de la filière de recyclage agricole des boues d’épuration urbaines en Europe et dans divers autres pays du monde, ADEME, 1999, Landboforeningerne

\textsuperscript{30} Source: Krüger A/S

\textsuperscript{31} Sources: Landboforeningerne, Landbrugsraadet, Dansk Familielandbrug
human health). The use of sludge in agriculture is rejected by some companies, which have set up special regulations to guarantee the quality of their products (by setting additional requirements, such as the prohibition of the use of sludge on land 4 years before growing vegetables and 1.5 years before growing sugar beets)\(^{33}\). In fact, the agricultural use of sewage sludge is perceived differently by different players in the food industry: some are extremely hostile to it; some consider that sludge can be a well-defined product, with a low content of heavy metals. In addition, some companies advertise the fact that the products they sell are grown on sludge-free land\(^{34}\).

Many players in the food industry do however agree that industrial sludge is better for agricultural use, as it is more stable in composition and easier to control, and show no reluctance in buying products cultivated on soil fertilised with industrial sludge. Interestingly, incineration is rejected by many players in the food industry as being too costly\(^ {35}\).

The local authorities of small towns mostly support the use of sludge for land spreading but bigger cities are more reluctant\(^ {36}\). In addition, the growing concern regarding this sludge recycling route in the farming community encourages the local authorities to consider incineration as an option.

The general public is increasingly concerned by the health incidents reported in the press\(^ {37}\). However, as some studies have concluded that risks from sludge are no greater than those from chemical fertilisers, consumers seem mostly to support the use of sludge in land spreading. This attitude clearly reflects the strong marketing policy of the government regarding the fertilising value of sludge and the principles behind waste recycling\(^ {38}\).

**Finland**

Urban sludge production in Finland reaches approximately 150 000 tonnes of dry matter, of which 31% is used in agriculture. As early as the mid-1980s, farmers’ associations expressed their growing hostility towards the agricultural use of urban sewage sludge\(^ {39}\). In spring 1990, the Finnish Union of Agricultural Producers even asked for a ban on the use of sewage sludge for land spreading. The Finnish authorities introduced new guidelines in 1991 to regulate the agricultural recycling of urban sewage sludge in order to guarantee the quality of farming crops and therefore to satisfy farmers as well. Anxiety in agricultural circles regarding land spreading is based more on a concern that this practice could tarnish the Finnish agriculture’s image of high quality than on health risk issues\(^ {40}\). 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\(^ {41}\).

Despite the new legislation introduced in 1994 (Council of State Decision on the Use of Sewage Sludge in Agriculture, of December 5, 1994 which defines limit values for heavy metals in sludge among the strictest in the European Union, with Denmark and Sweden\(^ {42}\)), farmers’ perception of land spreading remains negative, as the Central Union of Agricultural Producers and Forest

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\(^{32}\) Source: The Confederation of Danish Industries  
\(^{33}\) Source: The Confederation of Danish Industries  
\(^{34}\) Source: Krüger A/S  
\(^{35}\) Source: The Confederation of Danish Industries  
\(^{36}\) Source: Krüger A/S  
\(^{37}\) Source: Krüger A/S  
\(^{38}\) Source: Examen de la situation de la filière de recyclage agricole des boues d’épuration urbaines en Europe et dans divers autres pays du monde, ADEME, 1999.  
\(^{39}\) Source: Central Union of Agricultural Producers and Forest Owners (Maa-ja Metsatalous Tuottajain Keskusliitto - M.T.K.).  
\(^{40}\) Source: Central Union of Agricultural Producers and Forest Owners (M.T.K.).  
\(^{41}\) Source: Finnish Landowners’ Organisation  
\(^{42}\) These elements are described in the regulatory sub-component report.
Owners (M.T.K.) has in 2001 renewed its stand against the use of sludge in agriculture. In addition, there is less land suitable (in comparison to regulatory requirements) for land spreading of urban sewage sludge. Agricultural land spreading has therefore become more difficult and more expensive, which has led sewage-sludge producers and the public authorities to turn towards other disposal routes. The use of land spreading should therefore fall in future, despite improvements in the quality of the sewage sludge. On the other hand, the growth in land reclamation should continue, basically using composted sewage sludge. Use of sludge in silviculture is not practised in Finland, mainly for technical reasons. Finally, the percentage of sewage sludge disposed of in landfills should slowly decrease. It should also be noted that there is no dedicated incineration of sludge in Finland.

Consumers remain indifferent to the issue of agricultural use of sewage sludge and, therefore, the food industry has also expressed little concern. However, in western Finland some players in the food industry insist on contracts with farmers which guarantee that their crops have been grown without using sewage sludge as fertiliser.

France

In France, urban sludge production reaches approximately 850,000 tonnes of dry matter, 60% of which is spread on land. Agricultural use of urban sludge is regulated by the Decree n° 1133 of December 8, 1997 and by the Enforcement Order dated January 8, 1998.

From 2002 onwards, the disposal of sewage sludge by landfilling (which amounts for 25% of urban sludge production) will be greatly restricted in France, by application of the 1992 Waste Act. In light of the expected increase in sludge production (50% increase in 2005, as compared to 1998) and the costs of incineration, the safe agricultural use of sludge is considered to be a preferred route. In this respect, the Ministry of the Environment and the Ministry of Agriculture set up a national committee on sludge (Comité National sur les Boues - CNB) in 1998, in order to facilitate joint projects between the parties involved in sludge production, treatment, recycling and disposal.

The debate in France on sludge disposal and recycling is therefore currently quite heated, as the national agreement on the use of sewage sludge for land spreading is still under discussion, although this agreement should have been signed during the summer of the year 2000. The issues which still need to be resolved before the agreement can be signed are mainly the following ones:

- The draft agreement includes an insurance scheme in order to cover the farmers using sludge against any risks - including both known and unknown risks - relating to this practice. Sludge producers would then subscribe to insurance contracts. However, at the moment, many details on the cost of potential damages are unknown, thereby preventing the finalisation of the insurance scheme. The insurance contracts will be guaranteed by the national authorities.

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43 Source: Central Union of Agricultural Producers and Forest Owners (M.T.K.).
44 Sources: Central Union of Agricultural Producers and Forest Owners (M.T.K.), Finnish Landowners’ Organisation.
45 Sources: Kuluttajat Konsumenterna ry, Suomen Kuluttajaliitto (consumer organisations).
47 Members of this Committee are representatives of the relevant ministries, local authorities, water treatment professionals, farmers, landowners, food industry, consumers, Environment Protection Agency, as well as experts from public or private research bodies.
although representatives of the farming community originally asked for the setting up of a guarantee fund.

- Landowners have insisted on including in the draft "sludge agreement" an article which specifies that the farmer has to obtain the landowner's prior agreement before using sludge for land spreading. To date, it is unclear how landowners can be identified by sludge producers in a cost-effective way.

- Professional associations for the food industry and food retailers must prevent any discrimination against products grown on sludge fertilised soils. However, at the moment, food retailers remain difficult to convince, as they consider that they have the right to take any measures necessary to ensure food safety, including specific marketing policies aimed at identifying products grown on sludge fertilised soil.

Most farming community representatives supported sludge use in agriculture in the past, mainly for economic and environmental reasons, and considered that farmers were in fact serving society by recycling waste. However, this situation changed recently, as two major farmers’ unions called for a boycott of the use of sludge in June 1999, officially because current legislation is not sufficiently precise in defining potential risks. According to some experts, the farmers’ unions’ position on sludge use was also a political tool to apply pressure in the context of current negotiations with the government on the levying of environmental taxes on agricultural activities.

Some agricultural producers are openly hostile to the agricultural use of sewage sludge on land, as they are concerned about the acceptance of their products and/or, when they own the land, about the future value of land that has been fertilised by sludge. For example, in May 2000, the producers of wines and liqueurs signed a charter for the preservation of soil quality which includes a ban on the use of sewage sludge for land spreading. Other local cases of farmers taking action against the use of sludge for land spreading have been reported by the press. For instance, in June 2000, some pollutants were purposely added to stocks of sludge at a waste water treatment plant in order to make it unfit for agriculture use.

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.

It should be noted that, although the French government is willing to promote the use of sludge for land spreading, the INAO (Institut National des Appellations d'Origine - French institute issuing agricultural quality labels, related to the Ministry of Agriculture), is against the use of sewage sludge for land spreading, mainly because the use of sludge is considered to damage the products' image of high quality, although it recognises that sludge which complies with the regulations is as acceptable as animal manure or mineral fertilisers.

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51 Source: SEDE
52 Source: "Projet de charte pour la préservation du terroir et de l'environnement dans l'élaboration des vins à Appellation d'Origine", Comité National des Vins et Eaux de Vie, May 2000
53 Source: Institut National des Appellations d’Origine (INAO),
54 Source: Agence France Presse (AFP)
55 Source: Assemblée Permanente des Chambres d’Agriculture (APCA), FDSEA
56 Source: Institut National des Appellations d’Origine (INAO)
Landowners have made a stand against the agricultural recycling of sewage sludge. Their main aim is to protect the value of land. In particular, landowners have insisted on including in the draft “sludge agreement” an article which specifies that the farmer has to obtain the landowner’s prior agreement before using sludge on land. This article helps to clearly define liability and set indemnities in the event of an accident. This indirectly involves a change to the tenant farming system, giving landowners increased control over soil treatment. The farmers’ representatives consider that simply informing the landowner should be sufficient. However, whereas some landowners agree to accept the agricultural use of sludge under the conditions set out in the agreement, other landowners consider that the sludge agreement, including the liability scheme, will not change their attitude towards the use of sludge, which is based on the fact that the safety of this recycling route for sludge has not yet been scientifically proven.

Waste water treatment professionals and the local authorities support the use of sewage sludge for land spreading in order to maintain cost-effective disposal and recycling routes for sewage sludge, while ensuring that the health risks are reduced as much as possible. For waste management companies, composted sludge could become an important route, as composted sludge has the advantages of reducing odours and being commercially viable (several sludge-composting projects were launched in 2000, with a treatment capacity of almost 100,000 tonnes of domestic and industrial sludge). In order to increase confidence in the agricultural use of sludge, waste management companies have established a certification framework for land spreading practices, in collaboration with the French environmental agency (ADEME) and representatives from the farming community (APCA). Recently, the professional association of agricultural recycling companies (Syndicat des professionnels du recyclage en agriculture - SYPREA) has launched the procedures to obtain this service quality assurance. Obtaining this certification is considered to increase the cost of sludge treatment by 10% to 15%. A similar certification process for sludge production and treatment should also be established.

The national representatives for the food industry officially support the use of sewage sludge for land spreading. In particular, the French association of food industries (Association Nationale des Industries Alimentaires - ANIA) states in its position paper that the agricultural recycling of industrial and sewage sludge, if in compliance with the French regulations, does not have any measurable impact on food safety. However, the members of these associations often impose on their suppliers requirements which are stricter than the regulations. Some companies (such as Bonduelle, Moulins de Savoie and Vico) took measures as early as 1996 to reduce or eliminate the use of sludge by their suppliers. For example, Bonduelle has laid down additional requirements for the use of sludge to cultivate vegetables within the framework of its internal quality charter. Some sugar producers have declared they would not purchase sugar beet fertilised with sludge. Those stricter positions could be explained by the fact that some products are considered to be more exposed to the effects of sludge.

Food Retailers have also started to impose additional requirements on farmers: Carrefour has entered into an agreement with potato producers whereby no sewage sludge can have been used to

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57 Source: Fédération Nationale de la Propriété Agricole (FNPA)
58 Source: Assemblée Permanente des Chambres d’Agriculture (APCA)
59 Source: Assemblée Permanente des Chambres d’Agriculture (APCA)
60 Source: Fédération Nationale de la Propriété Agricole (FNPA)
61 Sources: Ville de Besançon, Institut National des Appellations d’Origine (INAO), Fédération Nationale de la Propriété Agricole (FNPA), Syndicats des Professionnels du Recyclage Agricole (SYPREA)
62 Source: SEDE
63 Source: Syndicats des Professionnels du Recyclage Agricole (SYPREA)
65 Source: Assemblée Permanente des Chambres d’Agriculture (APCA)
66 Source: SEDE
68 Source: ANIA
fertilise the soil over the past ten years. In general, food retailers appear to be increasingly reluctant to purchase products grown in sludge fertilised soil, in light of the recent concerns regarding food safety in France.\(^9\)

The general public is not sufficiently informed to have a particular position on the use of sludge for land spreading, although it has expressed growing concern regarding food safety in general.\(^0\) In particular, the press reported in August 1999 the use of sewage sludge in the production of animal feed, which has had a negative impact on the public’s perception of the agricultural use of sewage sludge. Consumer associations (UFC-Que Choisir, Familles Rurales, UNAF) and environmental associations support the agricultural recycling of sludge, if regulatory conditions are met and if the consumer is properly informed.\(^1\)

Growing hostility towards sludge recycling in agriculture is progressively encouraging the sludge producers to investigate possibilities for recycling sludge on forest soils. In this context, the Ministry of Agriculture and Fisheries set up in 1998 a national committee on sludge and forests (Comité National Boues et Forêts)\(^2\), which regroups research bodies and national authorities involved in forest management. One of the objectives of this committee is to produce a "guide for experimental landspreading on forest soil"\(^3\) in 2001.

However, this recycling route remains limited in France for the moment to experimental projects. This explains why only few positions are expressed concerning sludge use on forest soil. Most of the parties involved in forest management consider that the risk of soil and groundwater contamination, as well as the contamination of the ecosystem need to be assessed before any position is adopted.\(^4\)

Several factors contribute to limiting the development of sludge use in forests: the public acceptance of sludge recycling on forest soil is low (the "Collambolle" project in the south-west of France, where sludge was spread on forest soil, has met with strong hostility from the neighbouring inhabitants), and forest owners find little interest in using sludge both for economic reasons (only small quantities of fertilisers are used in silviculture) and technical reasons (insufficient spacing between trees, soil quality). In addition, the French Forest Administration (Office National des Forêts - ONF) remains strongly opposed to the use of sludge on forest soil, mainly because of the possible effects of slugs on the forest ecosystems. However, this organisation accepts the use of sludge on energy coppices (currently under test in the area of Lille).\(^5\)

**Germany**

The agricultural use of sludge is regulated in Germany by the Ordinance of April 15, 1992 modified by the Ordinance of March 6, 1997. In the 1970s and 1980s, analyses carried out on cadmium and dioxin levels in sludge had a negative impact on the acceptance of sludge. Consequently, the agricultural use of urban sewage sludge decreased to 40% of the total production, and the German authorities introduced several measures to improve the acceptance of the use of sludge for land spreading.

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\(^0\) Source: Assemblée Permanente des Chambres d’Agriculture (APCA)


\(^2\) This committee is not to be mistaken with the national committee on sludge (Comité National sur les Boues).

\(^3\) Source : Institut pour le Développement Forestier

For example, a **working group on sewage sludge acceptance** (Akzeptanz-AG) was set up in June 1996 by the German Federal Ministry of the Environment. On behalf of this working group, the German Federal Environment Protection Agency (*Umweltbundesamt*) published a study in February 1999 summarising the state of the debate on this issue and putting forward several proposals to encourage the agricultural use of sewage sludge such as 76:

- 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,
- analysing 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 have also made mandatory the guarantee fund, originally created in 1990 by 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 this practice. However this fund also increases the costs of sludge landspreading (the fund being financed by the waste water treatment plants operators), and therefore contributes to limiting the economic advantages of this route 77.

**Farmers’ associations** were not united in 1999 on this issue: although the national farmers’ union supported land spreading at federal level, the opposite was true at regional level. Since then, this situation has been resolved in favour of land spreading, mainly because this practice is economically viable 78. According to the German Technical Association for Wastewater (*ATV*), there is currently not enough sludge which meets the quality criteria for land spreading to match farmers’ requirements 79. However, recent developments (beginning of year 2001) include growing pressure in the *Bundesrat* from several Länder (such as Bayern) to increase regulatory constraints on the use of sludge in agriculture. In this unstable political context, farmers are increasingly worried and reluctant to pursue sludge landspreading 80.

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76 Source: *Examen de la situation de la filière de recyclage agricole des boues d’épuration urbaines en Europe et dans divers autres pays du monde*, ADEME, 1999.
77 Source: Kanal- und Wasserbauamt, Düsseldorf
78 Sources: Ingenieur Gesellschaft für Abfall und Abwasser (IAA), Herr Loll (expert, in charge of the study on acceptance)
79 Source: Abwassertechnische Vereinigung e.V. (ATV)
80 Source: Rethmann Wasserwirtschaft GmbH
Landowners did not seem to have reached a consensus in 1999. Since then, the German Union of Landowners (Arbeitsgemeinschaft der Grundbesitzverbände e. V.) has swung towards supporting land spreading, as it considers that uncontaminated sludge can improve the quality of the soil and that current legislation sufficiently reduces risks. However, land spreading is considered to be less acceptable than other forms of organic waste fertilisation. 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. The German Church is also a major landowner which in the past refused to permit the use of sludge for land spreading. However, this situation has changed at local level: sludge spreading is accepted if the sludge is considered to be of good quality and originates from the region.

In the past, the food industry was hostile to land spreading, and some firms even marketed products under a “sludge-free” label. It seems that agricultural products grown on sludge fertilised soil are no longer discriminated against if the sludge quality is good enough. “Sludge-free” labels are also no longer found in shops, in particular because the labels did not seem to have any impact on sales. However, the German Association of Industrial Bakeries (Verband des Deutschen Grossbäckereien) officially seeks to purchase cereals which have been grown without sludge fertilisers. In addition, the food industry is said to prepare for the end of year 2001 a "Klärschlammverbot", which would prohibit use of sludge on the products purchased by the food industry (although this information needs to be confirmed), and would therefore considerably reduce use of sludge in agriculture.

Environment protection associations have not expressed any point of view to date on this issue, with the exception of Greenpeace which does not object to land spreading.

Consumer associations seem to be the only organisations which are officially against the use of sludge for land spreading. The German Association of Consumer Bodies (Arbeitsgemeinschaft der Verbraucherverbände) considers that the risks are too high to use sludge for agricultural purposes and that current legislation does not ensure that risks are reduced to an acceptable level, in particular because there are no limits set on organic pollutant levels. According to this association, the only acceptable disposal and recycling route is sludge incineration.

Greece

In Greece, the main regulation concerning the use of sludge in agriculture is the Ministers' Decision of 1991 n°80568/4225/91, which sets limit values identical to those provided by Directive 86/278/EEC. However, agricultural recycling of sewage sludge accounts for only 10% of the total sludge produced.

In Greece the sludge management policy is based mostly on disposal through landfilling (more than 90% of treated sludge is currently disposed of in this way). As atmospheric pollution is already a serious problem in Greece, the authorities are not considering incineration as an option. Land spreading is therefore a viable alternative which authorities and waste water treatment plants would like to develop. However, at the moment, only very small quantities of sludge (approximately

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81 Source: Arbeitsgemeinschaft Der Grundbesitzverbände E.V.
82 Sources: Abwassertechnische Vereinigung e.V. (ATV), Herr Loll
83 Source: Bundesvereinigung Der Deutschen Ernahrungsindustrien (BVE)
84 Sources: Abwassertechnische Vereinigung e.V. (ATV), Herr Loll
85 Source: Agrarumwelt
86 Source: Abwassertechnische Vereinigung e.V. (ATV)
87 Source: Arbeitsgemeinschaft der Verbraucherverbände
88 These elements are described in the regulatory sub-component report.
89 Sources: REI, Examen de la situation de la filière de recyclage agricole des boues d’épuration urbaines en Europe et dans divers autres pays du monde, ADEME, 1999.
10%) are used in agricultural recycling. This explains why there has not been any public debate on the issue yet, and why most players have not yet developed an official position on sludge recycling. At present, sludge is not used on forest soil in Greece.

Ireland

The use of urban sewage sludge seems to be too recent an issue to generate public debate. Land spreading using sewage sludge remains limited in Ireland today (11% of total urban sludge production, which reaches 43 000 tonnes of dry matter) and represents very small quantities, as compared to land spreading of animal manure. The use of sludge is regulated by the Waste Management (use of sewage sludge in Agriculture) Regulations and by the Waste Management Regulations. These regulations provide requirements which are close to the ones specified in Council Directive 86/278/EEC.

The quantities of sludge recycled in agriculture are expected to rise in the near future, as sludge production is set to increase due to Directive 91/271 on Urban Waste Water Treatment. The construction and rehabilitation of several waste treatment plants and the prohibition of disposal of sludge at sea should cause the national production of sewage sludge to triple in the next ten years.

In this context, land spreading is supported by the national authorities, as this recycling route appears to be the most likely long-term solution, given the public resistance to incineration (in addition there are no incinerators at present in Ireland) and the restrictions on landfilling (lack of suitable areas, higher prices for sludge disposal in landfills and stricter legislation). The national authorities have also introduced a Code of Good Practices for the use of sewage sludge for land spreading, which sets out very strict requirements, although they are not compulsory.

Among farmers, the debate on land spreading focuses more on the use of animal waste than the use of sewage sludge. The recycling of treated sewage sludge is seen as a secondary issue. Farmers’ attitudes towards sludge use in agriculture can vary greatly: if some farmers are rather negative, due to the fact that there is already too much animal waste for spread on land and that sewage sludge is said to have a bad image in the opinion of the consumer, the majority of farmers have been reported to be very positive about land spreading using thermally dried sludge originating from Dublin.

The food industry has not expressed any concerns regarding sludge recycling in agriculture at the moment, although some producers of dairy products are said to be particularly hostile towards land spreading.

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90 These elements are described in the scientific and technical sub-component report.
91 Source: Rural Owners Association, REI
92 Source: Forest Owners Association
93 Sources: SEDE Ireland, Irish Landowners Association
94 Sources: SEDE Ireland, Examen de la situation de la filière de recyclage agricole des boues d’épuration urbaines en Europe et dans divers autres pays du monde, ADEME, 1999.
95 These elements are detailed in the regulatory sub-component report.
96 Source: id
97 Source: id
98 Source: SEDE Ireland, Irish Landowners Association
99 Sources: SEDE Ireland, Examen de la situation de la filière de recyclage agricole des boues d’épuration urbaines en Europe et dans divers autres pays du monde, ADEME, 1999.
Italy

There has been no real debate on the agricultural recycling of sludge in Italy yet. This is mostly due to the fact that this recycling route for sewage sludge is as yet very limited (18% of the total sludge produced), as it is only used in northern and central Italy (Lazio, Toscana). The use of sludge is mainly regulated in Italy by the Decree 99/92 of January 27, 1992 concerning the disposal on land of sewage sludge, which sets requirements which are similar to those specified in Directive 86/278/EEC.

Landfilling is still the main disposal route for urban sludge (81% of treated sewage sludge is placed in landfills). However, both regulatory restrictions (deliberation of 27 July 1984) and limited space for landfill sites contribute to reducing the importance of this route. Only very small quantities of sludge are incinerated in Italy (1% of sludge production) due to strong public hostility to incineration. Public opinion associates incineration with the accident in Seveso which resulted in a dioxin leak. In this context, significant problems have been encountered in the construction of new incineration plants and long delays in the activation of incinerators, in comparison to other countries.

The sharp increase in sewage sludge production expected in the next few years should change this situation in Italy. The agricultural recycling of sewage sludge therefore appears to be an interesting alternative for the national authorities, although an increase in the importance of this disposal route is expected to be limited in the coming years. One of the main limiting factors appears to be the size of farms in Italy which, with an average area of 5.9 ha (against 35 ha in France), are rather small, and this limits the development of land spreading for technical reasons.

According to available information, farmers are not opposed to the development of agricultural recycling of sludge. The food industry has not yet adopted any position on sludge recycling and no hostility has been reported towards products grown on sludge fertilised soil. Apart from local inhabitants complaining about odours, consumer associations have no opinion on the issue.

Environment protection associations have declared that they agree with the principle of recycling sludge on land.

Luxembourg

In Luxembourg, total urban sludge production reaches 7500 tonnes of dry matter, of which 70% is used on land. The agricultural use of sludge was widely debated in the early 1990’s, due to the recording of high heavy-metal levels in sludge, mainly in industrial or mining areas. The national policy has since supported the development of the agricultural recycling of sludge (including composted sludge). In the 1990s, regulations were introduced to improve the quality of slugs recycled to land: the Grand Ducal Regulations of 14 April 1990 concerning sewage sludge, giving effect to the Council Directive 86/278/EEC, amended by the Grand Ducal Regulation of 20 September 1994.

100 Source: REI
102 Source: id
103 Source: REI
104 Source: REI, Agreco
105 Source: Comitato Consumatori Altroconsumo (CCA)
107 These elements are detailed in the regulatory sub-component report.
In most cases, farmers appear reluctant to sludge recycling to agriculture, as large quantities of animal manure are already used in agriculture. Several factors limiting the use of sludge in agriculture have been identified, including:

- local subsidies for the preservation of the natural environment (prime à l’entretien de l’espace naturel) are not granted to farmers if sludge has been spread on pasture land.
- the national programme ("produits du terroir") 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.

Local food industries have not taken up a specific position on the agricultural recycling of sludge, as both the dairy and bread-making industries agree with the above-mentioned requirements of the local subsidy for the preservation of the natural environment and of the "produits du terroir" programme.

**Netherlands**

The Dutch Decree of November 20, 1991 established limit values so strict that the use of sludge in agriculture is only possible for a very limited share of the national production of sewage sludge (approximately 4% of urban sludge). In this context, the debate on the agricultural recycling of sludge ended a few years ago. The strict restrictions on the use of sludge in agriculture are largely explained by the strong support of animal manure in the Netherlands (animal manure represents 73% of the Netherlands’ input in phosphorus). The government did not go as far as banning the use of sewage sludge in land spreading but the strict requirements of the Decree of November 20, 1991 make its use virtually impossible (this decree applies both to domestic and industrial sludge). Moreover, farmer organisations consider sewage sludge to have a higher heavy-metal content than animal manure or mineral fertilisers. Because of existing regulatory restrictions on landfilling, the only viable option remaining for sludge appears to be incineration.

**Portugal**

At the moment, there is very little available information concerning the social acceptance of sludge recycling in Portugal. Use in agriculture at present amounts for approximately 11% of the urban sludge produced. The use of sludge in agriculture is regulated by the Decree 446/91 and by Regulations 176/96 and 177/96, established in 1991. These regulations provide requirements which are the same as the ones provided by Directive 86/278/EEC.

It seems that, in most cases, farmers support the agricultural recycling of sewage sludge, mainly because of its fertilising value and organic matter content. According to some local sludge producers, the demand for sludge is higher than supply at various points of the year.

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108 Source: Chambre Professionnelle des Agriculteurs, Viticulteurs et Horticulteurs Luxembourgeois
109 Source: Chambre Professionnelle des Agriculteurs, Viticulteurs et Horticulteurs Luxembourgeois
110 Source: Fédération des Industries Agro-Alimentaires Luxembourgéises (FIAL), Chambre Professionnelle des Agriculteurs, Viticulteurs et Horticulteurs Luxembourgéises
111 These elements are detailed in the regulatory sub-component report.
112 Sources: CRSH Zulveringsslub N.V., Land-En Tuinbouw Organisatie Nederland (LTO-Nederland)
113 Source: Land-En Tuinbouw Organisatie Nederland (LTO-Nederland)
114 Source: Land-En Tuinbouw Organisatie Nederland (LTO-Nederland)
116 These aspects are further developed in the regulatory sub-component report.
117 Source: Confederaçao Nacional das Cooperativas Agrícolas e do Credito Agrícola do Portugal (CONFAGRI), Instituto Superior de Agronomia
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 ineffective against most farmers, who are more interested in obtaining cheap fertilisers than in the quality of these fertilisers. Similarly, some players consider that it would be useless to draw up additional quality requirements for sludge, as they would probably be very difficult to implement. Some players are also against the development of agricultural use of industrial sludge.

In this context, there is currently very little debate in Portugal on the agricultural recycling of sewage sludge. An increase in supply is expected to lead to more concern about quality control. It seems that some large foreign companies involved in the food industry are starting to ask farmers what fertilisers they use on their fresh products and are proving to be more cautious when buying vegetables grown using sewage sludge.

Spain

The national authorities in Spain are in favour of the development of the use of sewage sludge for land spreading, as this recycling route could handle the increasing quantities of sludge produced over the last 15 years (700 000 tonnes of dry matter in 1997). Already, 46 % of the production of urban sewage sludge is recycled to land and is regulated by the Royal Decree 1310/1990 of 29 October 1990.

In this context, the Spanish Plan for the purification and treatment of sludge (Plan Nacional de Saneamiento y depuración de Aguas Residuales), which was approved by the Decision of February 17, 1995, reflects the government’s decision to improve the quality of sludge and develop the agricultural recycling of sludge. The purpose of this plan was to outline the measures to be taken for the purification and treatment of sludge. In this context, the plan considers the composting of sludge a major recycling route for sewage sludge. In this respect, it is important to note that the Enforcement Order of May 28, 1998 (Orden sobre fertilizantes y afines) lays down specific rules regarding fertilisers and specifies in particular that, when sludge represents less than 35% of DM, composted sludge will come under the 1998 Order on Fertilisers.

This explains why, according to some players, large quantities of sludge are now composted and then sold. In addition, it has been reported that controls on the composition of composted sludge are not carried out as often as they should be in some regions, which allows compost producers to increase the share of sludge sometimes above 35% of DM. This type of sludge compost is currently produced in large quantities in the Madrid region as well as in Andalusia. 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.

118 Source: Compagnie Générale des Eaux (CGE) Portugal
119 Source: SEDE, Compagnie Générale des Eaux (CGE) Portugal
120 Source: Instituto Superior de Agronomia
121 Source: Confederacao Nacional das Cooperativas Agricolas e do Credito Agricola do Portugal (CONFAGRI)
122 Source: SEDE, Compagnie Générale des Eaux (CGE) Portugal
123 Source: Examen de la situation de la filière de recyclage agricole des boues d’épuration urbaines en Europe et dans divers autres pays du monde. ADEME, 1999
124 Source: SEDE
125 Source: SEDE
126 Source: Junta de Residus, Departament de Mediambient, Generalitat de Catalunya
127 Source: Coordinadora de Organizacion de Agricultores Y Ganaderos (COAG)
The local authorities in regions such as Catalunya support the use of sludge in agriculture but with stricter requirements and controls than those currently imposed by federal regulations. At the moment, no real debate has taken place in Spain on sludge recycling. The farmers’ unions, federation of food industries and consumer associations have not taken a position on the issue. In some cases, the farmers’ unions support the use of sludge not only because of its fertiliser value but also because it is a supply of additional organic matter. With the exception of some farmers who have expressed their concern regarding soil contamination with metals, and some complaints from citizens regarding odours, the use of sewage sludge in agriculture seems to be well accepted.

The general public is poorly informed on the agricultural recycling of sewage sludge and has kept its very negative image of industrial sludge following the accidental leaking of thousands of cubic meters of contaminated industrial sludge in the Guadiamar nature reserve in 1998 reported by the press. General public hostility towards incineration is also stated as an important factor having limited the development of this disposal route.

Sweden

The debate on the agricultural use of sewage sludge in Sweden was heated in the early 1990s. Farmers were hostile to the government policy of developing the use of land spreading in agriculture, as they were concerned that this practice would harm the image of Swedish food products. Their demands, involving greater controls at source, were recognised in 1994 by the signature of a voluntary agreement between the Swedish Environmental Protection Agency (SEPA), the Swedish Federation of Farmers (LRF) and the Swedish Water and Waste Water Association (VAV) concerning quality assurances relating to the use of sludge in agriculture. In addition, the SEPA, LRF and VAV have issued guidelines on additional quality requirements for the agricultural recycling of sludge. Among other things, they contain recommended maximum levels of certain micro-pollutants in sludge for use in agriculture. In addition, a national consultative group has been set up in order to further develop the measures agreed upon within the framework of this agreement. Consultative groups have also been set up at local level to work on possibilities for improving sewage sludge quality and to conducting sewage sludge audits.

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128 Source: Junta de Residus, Departament de Mediambient, Generalitat de Catalunya
129 Source: Swedish Federation of Farmers (LRF)
130 Source: "The Use of Sewage Sludge in Agriculture in Sweden", Swedish Federation of Farmers (LRF), the Swedish Environmental Protection Agency (SEPA), Swedish Water and Waste Water Association (VAV), 1995.
131 Source: Examen de la situation de la filière de recyclage agricole des boues d’épuration urbaines en Europe et dans divers autres pays du monde, ADEME, 1999
Until recently, most players were in agreement that the use of sewage sludge in agriculture was no longer a major concern for farmers, although the farming community continued to demand tighter controls and maintained that the “sludge agreement” was not sufficient. This situation changed in October 1999 when farmers’ unions recommended that their members stop using sludge because of reports of traces of chemicals (brominated flame retardants) in sludge. The Federation of Swedish Farmers (LRF) now considers that the ban must be maintained for three main reasons:

- the overall quality of Swedish sludge is considered to be poor and there are potential risks, due to the presence of pathogens or a high metal content (silver, platinum), which are not addressed by current legislation;
- lack of commitment from water treatment plant managers (according to the LRF) who do not control the sludge quality sufficiently;
- farmers have no confidence in the controls on waste water entering the sewage system.

The LRF plans to maintain this ban until these issues have been properly addressed. However, the ban does not apply to industrial sludge and sludge used for spreading on energetic crops. In addition, about 20% of Swedish farmers are not members of the LRF and still use sewage sludge on their land.

In order to maintain this disposal route (as large quantities of sludge are currently stored or placed in landfills), the national authorities have launched a study on the elements present in sewage sludge.

The food industry in Sweden has become increasingly hostile to the use of sludge during the last decade and, in certain cases, it has insisted that farmers who supply them sign contracts guaranteeing that their products were grown without sewage sludge fertiliser. Some food industries, such as the dairy industry, have clearly expressed their hostility to the agricultural recycling of sludge. As most farmers have not used sludge for land spreading since October 1999, the use of sludge in agriculture is no longer an issue for food companies.

Some surveys have shown that between 60 and 70% of the general public supports the agricultural recycling of urban sludge. However, consumer and environment protection associations are still against this recycling route.

Debate has mainly focused on the use of sludge in agriculture. Therefore, Environment protection associations, consumers and farmers have not expressed official positions concerning land reclamation or revegetation. Landfill owners seem however to show interest in using sludge for aftercare purpose. Farmers organisations are not opposed to the use of sludge in forest. This route also seems to interest landowners and large paper companies. However for the moment, use of sludge on forest soil remains limited to silviculture and precisely to energy coppices (willow).

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132 Source: Swedish Federation of Farmers (LRF)
133 This is all the more surprising as Swedish regulatory requirements on the quality of sludge for agricultural use are among the strictest in Europe.
134 Source: Swedish Federation of Farmers (LRF)
135 Source: Swedish Federation of Farmers (LRF)
136 Source: Federation of Swedish Food Industries
137 Source: Swedish Federation of Farmers (LRF)
138 Source: Examen de la situation de la filière de recyclage agricole des boues d’épuration urbaines en Europe et dans divers autres pays du monde, ADEME, 1999
139 Source: Swedish Federation of Farmers (LRF) - Forestry Division
140 Source: Swedish EPA
United Kingdom

The debate on sludge recycling in the United Kingdom 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. Initially, the BRC adopted a very strong position against sludge recycling on agricultural land, arguing that this practice could not guarantee food safety, mostly because of pathogens and heavy metals potentially present in sludge. The agreement was entered into between Water UK and the BRC but it 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 Landowner’s Association (CLA) also participated in discussions. This agreement led to the joint adoption of a "safe sludge matrix" by the UK water industry and the British Retailer Consortium (BRC). This "safe sludge matrix" (set out below) provides for additional restrictions on the use of sewage sludge on agricultural land, as well as the categories of crops on which sludge may not be used. The main impacts of the sewage sludge agreement are:

- **The phasing out of untreated sludge use on agricultural land**, with the exception of non-food industrial crops (such as willow and poplar for coppicing) on which untreated sludge may be used until 31 December 2005.

- 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.

This agreement is considered a satisfactory solution by some players, as it lays down the conditions for the maintenance of the agricultural recycling of sewage sludge in the long-term. However, the CLA considers that this agreement is non-binding, informal and subject to change in light of both future research and attitudes towards sludge recycling. In addition, the Soil Association, which certifies organic farmers, has banned the use of sewage sludge on land.

Farmers in the UK are usually aware of the agricultural value of sewage sludge (organic matter, phosphorus, nitrogen). The sludge agreement has, from the point-of-view of the farmers’ representatives, the main advantage of clarifying the retailers’ position and requirements and, in this respect, has reassured the farming community regarding the use of sludge. On the whole, farmers mostly support the use of sludge but on the 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.

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141 Source: Examen de la situation de la filière de recyclage agricole des boues d’épuration urbaines en Europe et dans divers autres pays du monde, ADEME, 1999
142 Sources: Department of the Environment, Transport and the Regions (DETR), ADAS Land Research Center
143 Source: ADAS Land Research Center, British Retailer Consortium (BRC), Thames Water
144 Source: Country Landowner's Association (CLA)
145 Source: Sunday Times, October 1999
146 Source: ADAS Land Research Center
The SAFE SLUDGE MATRIX

<table>
<thead>
<tr>
<th>CROP GROUP</th>
<th>UNTREATED SLUDGES</th>
<th>CONVENTIONALLY TREATED SLUDGES</th>
<th>ENHANCED TREATED SLUDGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruit</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>Salads</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>Vegetables</td>
<td>✗</td>
<td>✗</td>
<td>10 month harvest interval applies</td>
</tr>
<tr>
<td>Horticulture</td>
<td>✗</td>
<td>✗</td>
<td>12 month harvest interval applies</td>
</tr>
<tr>
<td>Combinable &amp; animal feed crops</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>Grass and Forage</td>
<td>✗</td>
<td>✗</td>
<td>3 week no grazing and harvest interval applies</td>
</tr>
<tr>
<td>- Grazed</td>
<td>✗</td>
<td>(Deep injection or ploughed down only)</td>
<td>✗</td>
</tr>
<tr>
<td>- Harvested</td>
<td>✗</td>
<td>(No grazing in season of application)</td>
<td>✗</td>
</tr>
</tbody>
</table>

* All applications must comply with the 1989 Sludge (Use in Agriculture) Regulations and the 1996 DETR Code of Practice for Agricultural Use of Sewage Sludge (to be revised during 2001).
* Applications not allowed (except where stated conditions apply)

The Country Landowner’s Association (CLA) is mainly concerned with the contamination and liability issues that could arise from land spreading. The CLA is currently in the process of finalising a "Model Sludge Agreement" (MSA) with Water UK. This document is in fact a model contract for the use of sewage sludge for land spreading, to be used by water companies and landowners. The main advantages of this MSA for the landowners are the coverage of potential damages and the fact that the landowner should be made a party to any agreement between a water company and a tenant, enabling the landowner to benefit from the water company’s indemnity. The indemnity covers losses, which are defined as "damages, loss of profits, cost of handling third-party claims or enforcement actions by authorities". However the indemnity only applies if the water company or its contractor have been negligent or have breached their obligations under the MSA.

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148 “Conventionally treated sludge” has been subjected to defined treatment processes and standards that ensure at least 99% of pathogens have been destroyed.
149 “Enhanced treated sludge” covers processes which are capable of virtually eliminating all pathogens (99,9999%) which may be present in the original sludge.
150 Source: Country Landowners Association (CLA)
The water companies are conscious of the need to maintain agricultural land spreading as a main recycling route for sewage sludge, particularly in the context of the prohibition of the discharging of sludge into the sea since the end of 1998. For this reason, these companies are willing to go beyond regulatory requirements in order to protect existing recycling routes for sewage sludge. In particular, the agreement signed with the BRC implies major investments for the water companies (approximately 500 million euros, according to some estimates), in order to comply with the new quality requirements.

The companies which have actively participated in this debate are mainly the food retailers, represented by the BRC. The strategy followed by these companies has been mostly to protect their market to avoid any major problems. The negotiations with Water UK have demonstrated the weight of the retailers in the debate over the use of sludge use for land spreading and has enabled the retailers to improve their understanding of sewage sludge. In particular, the negotiations on the safe sludge matrix with Water UK are an ongoing process: the matrix was updated in April 2000 and in April 2001. The ongoing negotiations concern in particular the processes which can be audited and agreed product standards. The retailers’ current main concerns are whether the water companies will be able to meet the requirements of the agreement in terms of sludge treatment and if the current sludge treatment processes offer sufficient guarantees against pathogens. The results of ongoing research on pathogens may encourage the BRC to amend the agreement in order to strengthen constraints on land spreading of digested sludge. In addition, the BRC is increasingly promoting land spreading using other organic waste, animal manure and abattoir waste in particular. Some food companies are reported to have asked for assurances that sludge is not being used as a fertiliser for land on which potato crops are being grown.

Environment protection associations (Friends of the Earth, Scottish Wildlife Trust) have repeatedly expressed their hostility towards incineration and consider that the agricultural use of sludge is environmentally preferable.

With the exception of local complaints from residents regarding the smell caused by sludge used for land spreading, the general public has not actively participated in the debate on sludge recycling. Similarly, consumer associations consider that sludge recycling and disposal is not a priority issue and have little information on this topic.

In the UK the effects of sludge use in forests have been investigated for almost twenty years. The subject became increasingly important when disposal of sludge to sea became prohibited. Originally liquid sludge was sprayed but this involved hostility from local inhabitants. Currently a dried format is preferred (cake or granule) which is distributed by a wheeled spreader or helicopter. This practice reduces run-off risk, has no smell and has a longer term nutritional effect, but induces greater processing cost. Past experience has shown positive effects on impoverished soils, and no problems related to heavy metals were reported. Most private woodland owners therefore consider that any further regulation should not hinder the development of this route. The Forestry Commission also accepts the use of sewage-derived products.

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152 Source: Thames Water
153 Source: Water UK
154 Source: British Retailer Consortium (BRC)
155 Source: British Retailer Consortium (BRC)
156 Source: British Retailer Consortium (BRC)
157 Sources: The Herald, May 1999, Examen de la situation de la filière de recyclage agricole des boues d’épuration urbaines en Europe et dans divers autres pays du monde, ADEME, 1999
158 Source: Thames Water
159 Source: Examen de la situation de la filière de recyclage agricole des boues d’épuration urbaines en Europe et dans divers autres pays du monde, ADEME, 1999
160 Source: Timber Growers' Association
161 Source: Timber Growers' Association
162 The Forestry Commission is the government department responsible for the protection and expansion of Britain's forests and woodlands.
providing the current guidelines are followed\textsuperscript{163} (a site by site environmental assessment is required prior to application). However, the use of sludge on forest soils remains extremely limited for the moment. The factors explaining this situation are mostly negative public perception and technical factors (location of many forests relative to suitable sources of product, and the availability of suitable equipment to apply sludge on forest)\textsuperscript{164}. In this context, use of sludge on forest soils should not significantly increase in the UK, although use of sewage products on reclamation sites where trees are to be planted is developing\textsuperscript{165}.

\textsuperscript{163} Source: The Forestry Commission
\textsuperscript{164} Source: The Forestry Commission
\textsuperscript{165} Source: The Forestry Commission