ANNEXES

ANNEX 1: Brief description of QA Systems of Austria, Belgium (Flanders), Germany, Hungary, Sweden

1 Austria

In Austria recently s series of standards and technical guidelines have been published which establish common requirements for an external quality assurance scheme. These are:

ÖNORM S 2206-1: Requirements for a quality assurance system for the production of composts – Part 1: Principles for quality assurance of a company and of the internal technical processes

ÖNORM S 2206-1: Requirements for a quality assurance system for composts – Part 2: Determination of tasks and conditions for a quality assurance organisation

ONR 192206 Technical Giudeline: Implementation of quality assurance on composting plants

Up to now two non-profit association have adopted these stabndards for granting a compliance certification with the QAS. :

⇒ the ***COMPOST QUALITY SOCIETY OF AUSTRIA (KGVÖ)***

⇒ the ***COMPOST & BIOGAS ASSOCIATION – AUSTRIA (ARGE KOMPOST & BIOGAS – ÖSTERREICH)***

Under the roof of ***COMPOST QUALITY SOCIETY OF AUSTRIA (KGVÖ)*** large scale compost producers supplemented by experts, related companies and organisations are associated with the aim, to establish a quality seal for the marketing of composts on the basis on a officially acknowledged quality assurance system.

Table A– 1: Compost plants an through put associated in the Austrian Compost Quality Society

Number of Composting plants	16

Total Throughput *	Tonnes / y	300 000
Mean throughput (without Vienna)	Tonnes / y	18 000
Composting Plants with Quality Label	Nr. (input)	9 (160 000 t)
Compost Produced with Quality Label	Tonnes / y	ca. 52 000

The ***AGRICULTURAL COMPOSTING ASSOCIATIONS*** were in a first step founded as working groups in 4 federal provinces with the aim to establish the decentralised composting of separately collected biowaste in cooperation with agriculture level (on-farm composting) and representing the interests vis-à-vis involved parties, responsible authorities and the public. Nowadays the association has grown towards a full-scale Quality assurance organisation on the basis of the common Austrian standards.

Table A– 2: Figures on agricultural composting of source separated biowaste in Austria

Number of composting plants		280
Number of biogas plants		88
Total throughput (composting)	Tonnes / y	300 000
Mean throughput (composting)	Tonnes / y	1 000
Compost Produced	Tonnes / y	ca. 110.000

The certification schemes comprise both, operational process and quality management and final product approval. Thereby the most important reference are the requirements set by the Austrian Compost Ordinance which provides for a comprehensive documentation and monitoring programme.
The general scheme for awarding the certification and the quality seal is summarised in the following figure:

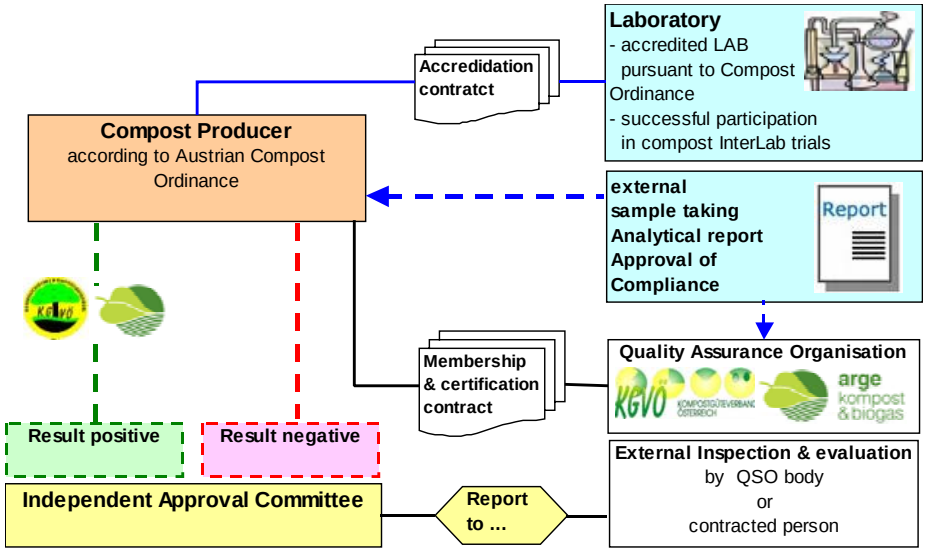

Fig. A– 1: Flowchart for the QA and certification scheme based on the Austrian Standard ON S 2206 part 1 and part 2.

The system for the quality assurance consists of measures relay on the Austrian Compost Ordinance as well as the Austrian Guideline *State of the Art of Composting* issued by the Ministry of Environment.
The external sample taking and approval of the compost product is performed by an independent authorised or accredited laboratory which must comply with the requirements of *Annex 5 of the Austrian Compost Ordinance* regarding its competence and experience in compost analyses and sampling procedures.

Above all, the composting plants are undergoing a regular inspection on behalf if the QAO. The control system is based on several levels:

Documentation
All the members are obliged to maintain their own records (operation book). The book should contain

- type and quantities of the material received
- quantity of sorted waste (impurities) that is excluded from composting during the input control and after screening
- exact documentation of the rotting process (temperature, moisture etc.) - measurements to be taken at least once a week
- amount of compost produced
- quantities of compost as applied on single plots of the agricultural land

Inspection
At least four times a year an unannounced inspection by one of the Compost Association's control bodies takes place. In addition regional control staff were instructed to visit and check each farm at least once per month. All the personnel in charge of the different regions are trained to carry out the inspection. In addition there is a quarterly meeting for the inspection persons in order to undergo additional training and for sharing experience.
In the course of the inspection the authorised control bodies are responsible for taking samples at least once a year and deliver them to the contracted laboratory in order to perform the full scale analyses and quality approval in accordance with the *Austrian Compost Ordinance*.
All composts have to meet the quality requirements for the use in Agriculture. Experience over the last few years showed that this class of quality is almost always attained.

Control sheet
The control sheet prescribes checks on the following areas:

- the storage facilities for material before and during composting
- composting area as related to licensing papers
- type of materials and quantities
- compost testing and technology
- results of analyses and quality approvals

Sanctions
The regional representatives have the authorisation to impose a stop of delivery to the farm if the operation is found to be seriously violating the CA's guidelines or legal regulations. They must also inform the relevant authorities. If regulations are repeatedly violated, the CA can close down a composting operation in conjunction with reporting to the Provincial Government and Local Authority of the county.

2 Belgium

Introduction

Flanders is one of the three regions (Flanders, Walloon and Brussels) in Belgium. As to waste management, they mainly have their own policy, with their own laws, rules and strategies. The Flemish Ministry of the Environment and the Public Waste Agency of Flanders (OVAM) are responsible for the policy in Flanders. In the early 90s, they initiated separate collection and composting of bio and green waste as a means to reduce the quantities to be landfilled or incinerated.

It was consequently forecasted that the composting business would gradually grow, and hence the production of compost. It was therefore felt necessary to have a strong and efficient promotion of compost use. This gave birth to the idea for the establishment of a separate, independent organisation, which became VLACO vzw, the Flemish Compost Organisation.

VLACO vzw is established as a cooperation between OVAM, the waste intercommunalities, private compost producers and some cities. VLACO vzw represents the composting sector in Flanders, with around 50 members and about 30 compost producers. Table A– 3 gives the number of plants and the annual tonnage of compost production for the different compost types in Flanders.

In order to fulfil the target of stimulating the use of compost efficiently, three main topics were considered necessary: quality assurance, research and marketing.

Table A– 3 Different compost types in Flanders.

	Greenwaste compost	Biowaste compost	Industrial biowaste compost	Digestate
Number of plants	24	9	1	In development
Annual production of compost (in tonnes)	230 000	125 000	3 000	In development
Market	Landscaping, potting soil, agriculture	Landscaping, agriculture	Landscaping, agriculture	Agriculture

Quality management, quality assurance, product certification in Flanders

The quality assurance of VLACO vzw is supportive to an efficient marketing strategy. It makes no good marketing if the product is bad. Flanders has learned this from the household compost (produced from household waste, before the starting of separate collection). The quality of this compost was very bad and it was very difficult to sell the product. For the greenwaste and biowastecompost VLACO vzw would develop a sustainable consumers acceptance. Therefore VLACO vzw developed a quality assurance system. The quality assurance system of VLACO vzw is a Total Quality Control System. The requirements are written down in a tender according to ISO 9000 guidelines. Basically, the (general) ISO 9000 standards have been transformed in (specific) requirements for the production of compost. Not only the end-product is controlled but the whole process is followed up. The input (the bio or greenwaste), the process and the output are monitored and analysed.

The reason to put standards on the input is not to allow dilution. If there are no standards for the input material, the most toxic waste can be the input of a composting or digestion plant. If you dilute enough, the compost will meet the standards for the output. But this can not be allowed. So VLACO vzw defined some standards for the input of composting/digestion.

The process follow up is necessary to guarantee the sanitation of the compost. Research has shown which temperature / time relation is necessary for the sanitation of the compost.

VLACO vzw organises regular plant visits with controls of input materials, process conditions and product quality. The standards for compost in Flanders are given in **Fehler! Verweisquelle konnte nicht gefunden werden.**.

For digestate standards for heavy metals, impurities, pH and weed seeds are in development. The quality assurance system is integrated in Flemish legislation through a control mark for compost or digestate from biowaste. The importance of quality is highlighted in the marketing actions.

Table A– 4: Compost standards in Flanders/Belgium

	Compost	Unit
GENERAL		
Sieving at 40 mm	**>99**	**%**
Dry matter	**>50**	**% by weight**
Organic matter	**>16**	**% by weight**
pH (water)	**6,5-9,5**	**-**
NO_3-N/NH_4-N(1,2)	**>1**	**-**
HEAVY METALS		
Cd	**<1,5**	**mg/kg DW**
Cr	**<70**	**mg/kg DW**
Cu	**<90**	**mg/kg DW**
Hg	**<1**	**mg/kg DW**
Pb	**<120**	**mg/kg DW**
Ni	**<20**	**mg/kg DW**
Zn	**<300**	**mg/kg DW**
IMPURITIES, WEED SEEDS, CRESS TEST		
Impurities >2mm	**<0,5**	**% by weight**
Stones >5mm	**<2**	**% by weight**
Weed seeds	**0**	**#/l**
Cress test(1,2)	**<10%**	**%**
SELF-HEATING TEST		
Temperature(2)	**< 40**	**°C**

(1) Only for greenwaste compost
(2) For greenwaste compost: two out of these three standards should be ok

Other activities of VLACO vzw

The **research** program considers both new and existing applications. It is investigated how and under which conditions different types of compost can be used for certain applications. There is a focus on the long-term effects of compost.

It is of no use to have selective collection and composting, if compost as the end-product, is not used efficiently. The **marketing** activities of VLACO vzw are therefore considered of major relevance. Much emphasis is put on the specific characteristics of compost as a soil improving product. The above mentioned activities are still of much importance. However from December 1998 on, VLACO vzw also covers **waste prevention and backyard composting** and these activities have been fully integrated within the structure and working programme of VLACO vzw. VLACO vzw is now the reference centre in Flanders in relation to composting and digestion, large and small scale and at home.

3 Germany

The BGK organisation is the carrier of the RAL compost quality label. It is recognised by RAL, the German Institute for Quality Assurance and Certification, as being the organisation to handle monitoring and controlling of the quality of compost in Germany.
In 1989, a range of relevant trade associations and institutes working together set up the German Compost Quality Assurance Organisation, BGK, and application was made for the RAL label of quality. The 'RAL Compost Quality Label'(RAL GZ 251) was awarded in January 1992. It was also registered in the trade mark register at the Federal Patent Office. In the year 2000 an additional quality assurance system for digestion residuals (RAL GZ 256) was introduced. With the revision in 2007 the digestate products are divided into two product groups for digestion residuals according to the input materials: the RAL GZ 245 for digestion products and the RAL GZ 246 for digestion products produced from renewable vegetable raw materials. The RAL GZ 258 for AS Humus (sewage sludge compost) was introduced in 2003.
The Compost Quality Assurance Organisation was founded in order to monitor the quality of compost. Through consistent quality control and support of the compost producers in the marketing and application sectors, the organisation aims to promote composting as a key element of modern recycling management.
The BGK works through regional compost quality assurance organisations. These regional quality assurance organisations are made up of ordinary members – the compost producers – and extraordinary members or promoters, amongst whom are those interested in composting, for example representatives from analytical laboratories, authorities, industry, science and local authorities. Today there are more than 500 members in these organisation, and 425 composting plants and 67 digestion plants and 13 composting plants for sewage sludge compost take part in the quality assurance system and have applied for the RAL quality label.
Besides the central office which oversees activities, a quality committee works as the main supervision and expert body in the quality assurance system. It controls the results of analysis and decides upon necessary measures. It is composed of representatives from research, laboratories, producers, compost users and authorities. The German quality assurance organsiation of compost (BGK) runs a database with all indicators of the composting plants and analyses results of the products. The database includes more than 35.000 data.

Product criteria are laid down in the BGK Quality Assurance System.
The BGK has defined a general quality standard (the RAL quality label for compost and for digestion residuals and sewage sludge compost) and established a nationwide system for external monitoring of composting and digestion plants and of compost and digestion products.
The quality assurance program contains the definition of quality requirements, enables quality monitoring, and can enforce quality standards or discipline plants for failure to meet regulations and the labelling of the quality standard. The type, extent and frequency of evaluations depends on the capacity of the composting or digestion plant. In order to guarantee an identical standard for the monitoring all over Germany, BGK established a central office where all results originated from external monitoring are evaluated and controlled.
The quality assurance system comprises the following elements:

- External monitoring: continuous and independent control of product quality;
- Internal monitoring: control and documentation of the decomposition respiratory digestion process by the plants;
- Quality criteria: standardisation of the product quality;
- Quality label: characterisation of the product quality;
- Compulsory declaration: description of the essential product characteristics and constituents;
- Application guidelines: information on correct application;
- Furnishing proof and the documents required by the plants to show treatment according to the Biowaste and Fertiliser Ordinance to the regional competent authorities.

Main elements of the BGK QAS are:

Suitable Input Materials
- in accordance with the biowaste ordinance and fertiliser regulation.
- operation control by plant visits of independent quality managers.
- control by independent sample takers and by declaration in analysis report.

Independent analysis and declaration of the product quality
- 4 - 12 times a year according to the quality guidelines, depends on the amount of input material.
- control and sanctions by an independent quality committee.
- certification with product declaration according to the fertiliser regulation

Application requirements
- application requirements based on the biowaste ordinance and fertiliser regulation.
- application requirements due to good practical use.

Positiv list of input materials

Suitable raw material is listed in Annex 1 of the Biowaste Ordinance and includes the following groups of organic waste materials: organic municipal waste, residues from the food and animal feed industry and organic industrial waste, and mineral composting additives. The positive list of input material for the quality label of compost (RAL-GZ 251) is laid down in the guidelines of the quality assurance for compost.

Types of compost

The label can be authorised for fresh compost (degree of decomposition II or III) and mature compost (degree of decomposition IV or V). The compost quality label also covers compost for potting soils with various contents of nutrients and salt (see table below).

Quality criteria for compost

The quality committee of the BGK has issued specifications for high-quality composts and the quality symbol represents these specifications. This allows a standardisation of compost quality and enhances the product's sales image. The symbol awarded by the BGK also means that there are regular checks by independent bodies to ensure that product quality is maintained after the label has been awarded. The up-to-date compost quality criteria and directives of the Bundesgütegemeinschaft Kompost are the basis for the awarding of the RAL compost quality label to compost producers. The RAL quality criteria are valid for the different product types of compost:

Table A– 5: Compost types and classes certified within the German QAS

Class designation/name	Description of the class
compost (product group with different product types)	additional criteria in respect to BioAbfV, declaration of total nutrient content (N, P_2O5, K_2O, MgO),soluble nutrient content (N), micro nutrient content, CaO, impurities: if the total content of impurities exceed 0.1 Mass % the visuable content of imupurites does not exceed 25 cm per liter fresh matter
1) fresh compost	organic matter content ≥ 30 Mass % of dry matter; water content ≤ 45 Mass %; maturity: stability class II or III determined by self heating test;
2) mature compost	organic matter content ≥ 15 Mass % of dry matter; water content ≤ 45 Mass % for bulk goods and ≤ 35 Mass % for bagged cargo; maturity: stability class IV or V determined by self heating test; soluble nutrient content P_2O_5, K_2O; parameter for plant response
3) compost for potting soils	organic matter content ≥ 15 Mass % of dry matter; water content ≤ 45 Mass % for bulk goods and ≤ 35 Mass % for bagged cargo; maturity: stability class V determined by self heating test; 3 parameters for plant response; impurities with a diameter > 2 mm 0.5 Mass % in dry matter, impurities with a diameter > 5 mm 0.1 Mass % in dry matter; stones with a diameter > 2 mm 5 Mass % and stones with a diameter > 10 mm 0.5 Mass %, Grade > 50 Vol % with particle sizes 0-5 mm; Grade ≤ 25 mm; carbonates < 10 % dry matter Type 1: up to 40 Vol % , recommended mixing component in the substrate nutrient content [mg/L]: < 300 NO_3-N+NH_4-N, < 1.200 P_2O_5, < 2.000 K_2O, < 500 Chlorid, < 250 Na; salt content ≤ 2.5 g/L Type 2: up to 20 Vol % , recommended mixing component in the substrate nutrient content [mg/L]: < 600 NO_3-N+NH_4-N, < 2.400 P_2O_5, < 4.000 K_2O, < 1.000 Chlorid, < 500 Na; salt content ≤.5 g/L

Hygiene requirements

In Germany considerable attention is directed towards the hygiene and sanitisation of compost. Harmful influences on human beings, animals and plants which may arise when compost is applied, should be eliminated during the biological treatment process. Three test methods are required by the Biowaste Ordinance for composting plants:

- The hygienic effectiveness of the individual composting procedure is determined by a process test. As an alternative a proof on conformity can be executed by the BGK and the modular hygiene test system (see below).
- Indirect test criteria on hygiene effectiveness for a plant in practical operation are the daily temperature recording and documentation (>55 °C for more than 2 weeks, > 65°C for more than one week) or for in-vessel plants (>60°C for more than one week).
- Saleable compost products are tested for phyto-pathogenic organisms and plant seeds.

Testing procedure for the RAL compost quality label

Authorisation to use the RAL compost quality label is granted in accordance with the quality and testing regulations of the German Compost Quality Assurance Organisation, BGK. The compost producer must demonstrate the quality of their products for every compost plant they have in operation, throughout the first year's recognition procedure and the following years' monitoring procedure.

Recognition and monitoring procedure

The frequency of the investigations during the one year recognition procedure and the subsequent ongoing monitoring procedure depends on the plant input capacity. At least four inspections should be carried out during the first year of operation – one for every season – to assess the essential quality characteristics over the course of the year. At least one sample should be taken every three months. In the following years, when the plant is working normally, it is possible to reduce the frequency and scale of inspection. Sampling and investigations should be done by an approved outside monitor –

usually a laboratory which does the sample taking and the analyses – in line with the procedures laid down by the Quality Committee of the BGK.

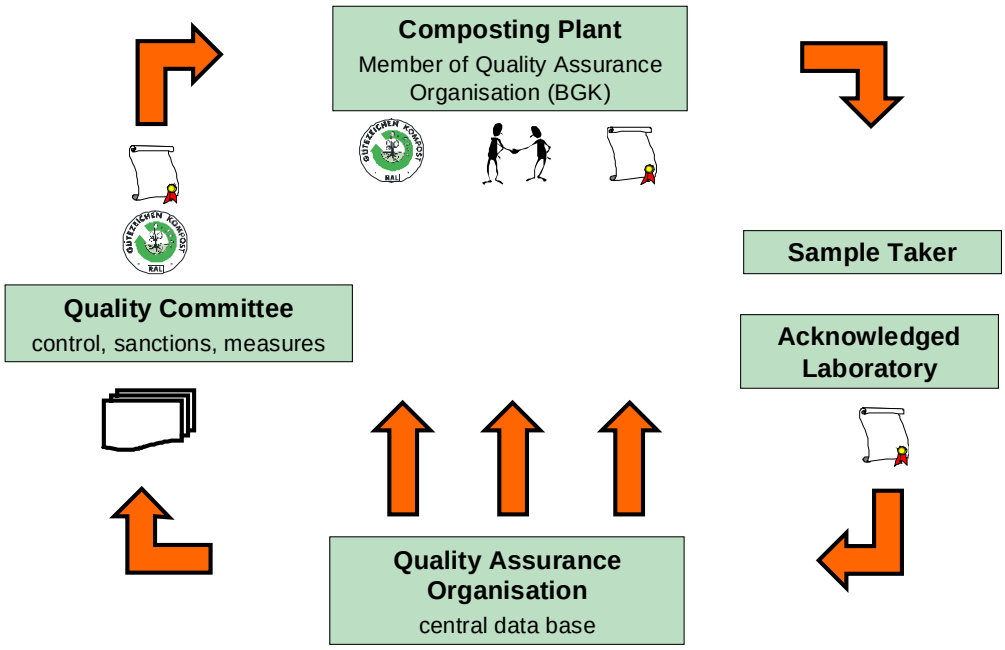

Fig. A– 2: Flow-chart of the quality assurance scheme in Germany

The state of composting in Germany

The numerical development from the years 1997 to 2006 of biowaste materials for composting in plants of the quality assurance system in Germany is shown in the figure below. It can be recognized that the amount of biowaste materials for composting is still increasing-

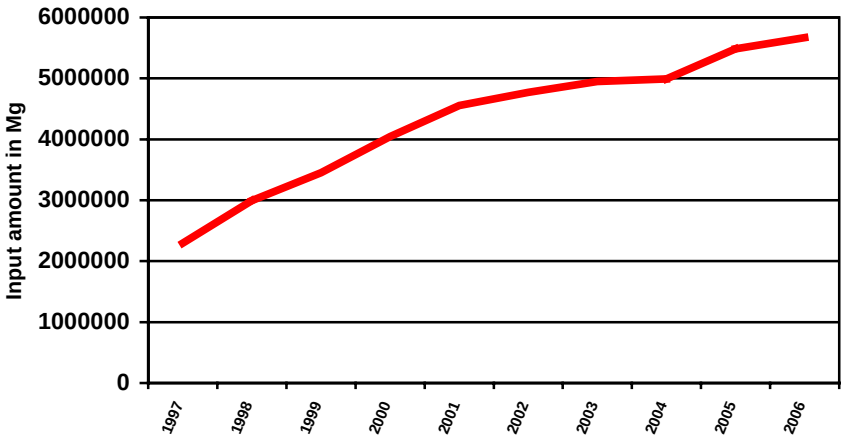

Fig. A– 3: Development of treated biowaste in organised composting plants in Germany from 1997 – 2006

The amount of biowastes from separate collection which can be used as compost raw materials is characterised as follows:

- Potential of biowastes that can be collected separately (estimated) 10 - 12 Mill. t,
- Real amount of biowaste to currently produced (estimated) 6 - 8 Mill. t.

Quantity of produced compost products

The amount of the produced compost products is derived from the input quantity. It is assumed that the decomposition of the organic substances and the loss of liquid during degradation results in a mass loss of approx. 50 %. Accordingly follows:

- A maximum amount of compost products
  (on utilizing the potential, estimated) 5 - 6 Mill. t,
- Actual amount of compost products for the time being
  (estimated) 3 - 4 Mill. t,
- thereof amount of compost products with RAL quality label
  (gathered) 2,1 – 2,8 Mill. t.

Marketing structure of composts

On account of the manifold applications compost products are used in quite different fields. Statistical numbers of 2006 show marketing outlets for RAL quality assured compost products:

A special field of the above mentioned application areas is agriculture. Round 60 % of the total area in Germany is used by agriculture. Just 3 to 4 % of the arable land could be served with the actually produced amount of compost. On account of this fact agriculture seems to be a potential customer for the recycling of composts and other secondary raw material fertilizers. The plant nutrients contained in composts and other secondary raw material fertilizers like humus and alkaline material show that agricultural utilization is not just possible but furthermore absolutely useful.

Agriculture as a competent consumer is momentarily rare. This depends on the fact that plant nutrients in form of mineral fertilizers and farm manure is available in a high amount. Thus it is not necessary to use fertilizers from secondary raw materials for the moment. However, there are developments and good reasons for a growing appreciation of compost as a soil improving agent in agriculture. Not only the organic substances in compost but also the considerable contents of alkaline material (lime) make compost use in agriculture an increasingly popular and effective means of soil cultivation. As it is postulated in the EU Soil strategy the decline of organic matter in European soils as well as the soil degradation by erosion become more and more important. To improve soil properties by using the stable organic matter of high quality composts is seen as a good way to solve these problems.

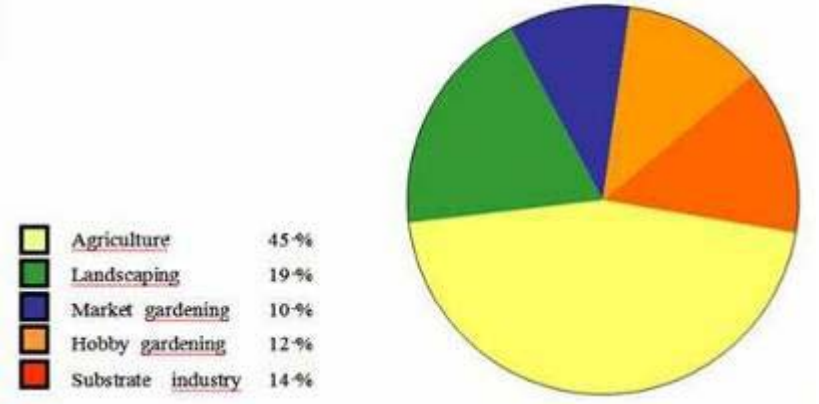

Fig. A– 4: Marketing structure for compost in 2005

Other areas of application show a more favourable market situation. Those fields compared with agriculture have distinctly smaller areas. But they are provided with a real demand in the sense of a free economy, based on the necessary use of humus which has to be bought as an additional means of soil improving. To be mentioned here especially is the branch of horticulture and landscaping.

Aspects for a further development of the compost industry

The deterioration of the increasing amount of biowastes resulting from waste management activities relieves under an economical point of view the existing surplus of compost products.
The further development of existing market potentials, above all in the horticulture and landscaping branch, will lead to a balance in supply and demand and in the long run to a shortage of supply.
The availability of a suitable product mix of qualitative highly classified compost products for regionally important target groups will lead together with a shortage of the supply to be foreseen to realistic and stable prices for such products.
The main points for a satisfied customer are:

- A high quality and stability of the compost product
- A product guarantee (with proof of ingredients and data for application)
- A guarantee of supply of the desired products, the quality and quantities
- Success of application.

The quality politics of the compost management and the German Quality Assurance Organization will succeed in a high quality standard in practical operation together with the quality assurance and market positioning of the products under consideration of the technical and legal requirements.

Quality Assurance as a marketing tool

The consumer demand for quality assured products is increased in the last ten years potentially. This is reflected in the high amount of product quality labels of the food processing industry. According to this development the demands on the input materials of the foodstuff industry or of agricultural systems growth up. The experience has shown that without a well-established and acknowledged quality assurance system for compost products the market for waste-derived products is turning down. Today in several cropping systems only quality assured compost products are allowed (for example in the sugar beet industry). Furthermore in environmental risk areas (like water protection areas) the demand on controlled fertilizers and soil improvers plays an important role.
In Germany we achieved successfully that the certified compost products which fulfill the requirements of the EU regulation on organic farming (EU Regulation N0. 2092/91) are listed in the official organic input material list of the research institute for organic farming (FiBL e.V.).
Finally it can be stated that the development of the German composting branch shows that a quality assurance system is a successful tool to places compost products in the market.

4 Hungary

At the moment there isn't any compost quality assurance ordinance in force in Hungary, although the basis of the sytem has already been established.
A quality assurance system designed by the Hungarian Compost Association is similar in many aspects to the german system of the Bundesgütegemeinschaft Kompost e.V. BGK and to the Compost Qulaity Society of Austria (KGVÖ).

At present two Hungarian statuory rules are being used for ensure the quality of composts:

- Statuory rule Nr. 36/2006 (V.18.) about licensing, storing, marketing and application of yield increaser products.
- Statuory rule Nr. 23/2003. (XII. 29.) about the treatment of biowastes and technical requirements of composting

The Hungarian Compost Association have completed the framework of the assurance system (2006) and now waiting for a new hungarian statuory rule about making, nominating, marketing and assurancing composts.

Possible basic elements of the future Hungarian Compost Assurance Systems according to the legal framework (2006):

Compost Classes
The ordinance will define three different quality classes for compost based on the contaminant content. Above of all will define ways of utilization.
The classes will be:

- Class A - top quality (suitable for organic use)
- Class B - high quality (suitable for agricultural use)
- Class C - minimum quality (not suitable for agricultural use)

Quality control
In the new assurance system there will be end-product controlling and process controlling.

Raw material list (permissive list)
The list will include the materials and their EWC codes what are legal to use as raw material in the composting process.

Implementation date
The estimated year of the implementation is 2009.

Contacts and source of country information
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5 Netherlands

In revision because of the new fertiliser law from 01/2008

6 Sweden

The voluntary Swedisch QAS is the only standard for compost production and anaerobic digestion in the country. Further regulations are missing. Therefore it includes the entire set of process, quality, documentation and approval requirements usally laid down in accomplishing standards or legal provisions.

Structure and outline of standards

For the moment Sweden has no statutory standard, but the necessity of standards is seen clearly by involved parties and the government. Producers and users are of the opinion that sustainable recycling of organic wastes demands clear regulations regarding what is suitable to be recycled and how it should be managed and controlled. A well-founded quality assurance programme would definitely increase sustainable recycling of organic wastes.

Thus, between 1996 and 1999 the National Swedish Waste Management Association Avfall Sverige and the Swedish Environment Protection Agency initiated a project in order to develop voluntary quality assurance systems for compost and digested residuals from organic wastes. The project is financed by the Association of Waste Management and the Swedish EPA. This system demands that input material should be of clean organic origin and source-separated.

Examination of the standards for compost and digestion residuals

Between February and April 1999 the voluntary certification system was tested in four composting and biogas plants and the results were evaluated with respect to the requirements and the control methods. The test suggested that the proposed control requirements in the certification system are on a sensible level. A continuously carried out assessment of the results of testing came to the conclusion that both a certification system and an official control group are necessary.

Studies for a selection of suitable labelling approaches were carried out alongside the test phase. The new label should have, in the long run, an independent 'owner', or it should be integrated into a system with regard to environmental labelling such as the Nordic environment label *Svanen* or the EU Eco-label. For the moment there is no independent organisation which can represent the present interests.

Existing environmental labels applied to other products are unable to integrate the certification system which has been developed in a short period of time. In order to begin certification in the year 1999, the SWEDISH WASTE MANAGEMENT ASSOCIATION, whose members initiated and forwarded the certifying process, has become the carrier of the scheme.

The certification service is normally put out to tender, but in this relatively limited project, Sweden's Testing and Research Institute (SP) was consulted. They have experience in the introduction of certification systems and were specialised on quality management systems.

The regulations for the voluntary certification of compost and digestion residues are based on purely source-separated organic waste, with special emphasis on the acceptability of raw materials for input, the suppliers, the collection and transportation, the intake, treatment processes, and the end product, together with the declaration of the products and recommendations for use.

Systems for the certification of compost and digestion residues

APPLICATION PHASE

The application procedure must be carried out as follows:

- **Application:** The producer sends an application to the certification organisation.
- **Pre-inspection:** The certification organisation carries out a pre-inspection at the plant and has a discussion with the producer. This is the start of the qualification year. The certification organisation establishes with the producer the criteria which the producer has to fulfil in order to acquire the label of the certification system.
- **Working documents and routine inspections:** The producer prepares the documents and ensures that information requirements are fully met.

- **Introductory inspection:** The certification organisation comes for another visit, a so-called 'introductory inspection'. During this visit the certification organisation monitors the fulfillment of the regulations. The impartial control of the end product during the qualification year can be achieved either during pre-inspection, at the introductory inspection or on both occasions depending on the plant's product volume.
- **Eventual completion:** Necessary completion must be carried out by the producer.
- **Certificate and agreement:** The certificate is issued by the certification organisation and an agreement about further and continuous controls and labelling is signed by both.

INTRODUCTION PHASE (QUALIFICATION YEAR)

The introduction of the certification system is realised after 1 year, the so-called qualification year. Before the label can be awarded an introductory judgement of the product, and a continuous monitoring during the year of qualification must be carried out. Included in the introductory judgements are the parameters investigated according to the regulations. As soon as the award of the label is assured and the reports of the applicant are approved, an independent laboratory examines the plant by carrying out independent sample taking and analysis, together with proof of the internal control.

All this must happen during the year of qualification with the required analysing frequency described in Table A– 6 below. Sample taking must be carried out with a saleable end product before mixing of other additions. Both the producer and the certification organisation must be informed at the same time about the analytical results in order to avoid the suspicion that the analyses have been changed or manipulated without the knowledge of the certification organisation.

In the case where both the internal control and the independent controls fulfil the requirements, a declaration is signed between producer and the certification office for a continuous control. Then the quality certificate/label is awarded.

Table A– 6: Sample taking and analysing frequency

	Internal control (analysis/year)		External control (analysis/year)
Total amount for biological treatment (t/year)	**Qualification year**	**Minimum frequency at continuous control**	**Minimum frequency**
<5,000	2	1	1
>5,000	4	2	1
>10,000	8	4	2

A treatment plant which applies for certification must report on technical data, which must include the following information:

- a declaration of the properties and contents of the compost/digestate and recommendations for use;
- an analysis report, in which the plant demonstrates that the technical requirements are fulfilled, based on analyses and control during the qualification year. The report must be carried out by an independent institution together with proof that no changes regarding the process have been made since the issuing date of the application form; and
- a process description, in which the plant operator describes their processes, e.g. which material is accepted and how the treatment works.

Those plants with products which go through the qualification year successfully have the right to use the label **'Certified Recycling**'.

Products, dispatch notes or similar which are equipped with the quality label should include the number of certification, the name of the owner of the certificate, the name of the product and number and date of production series or similar. The shape of the label must be acknowledged by the certification institution. The certified portion in e.g. soil mixtures has to be clearly declared.

Continuous operation phase

Continuous monitoring is used to ensure that certified products continuous fulfil the requirements of the certification regulations. Monitoring must be carried out through an internal control procedure which the plant operator carries out himself, and a continuous independent external monitoring procedure. The continuous control shall be made as agreed by the operator and the certification institution.

After the qualification year (when the certificate was issued) one or two inspections of the plant are to be made. At one of the visits the self-monitoring of the producer must be analysed and a sample taken from the plant for testing. If necessary, an extra visit may be made during the year for sample taking, depending on the plant capacity.

The period of validity of the label is 5 years. If the label owner applies for an extension of its validity this can be acknowledged on account of the reports of the monitoring organisation. The owner of the certificate must inform the certification institution of every change in raw material or process.

SEPARATE COLLECTION

Proper source-separation is required. The plant operator must control the input in such a way that undesirable materials are minimised. Such material, which basically includes harmful matter and impurities reducing the product quality, are not considered suitable as raw materials.

INPUTS

Contrary to most other European countries, Sweden allows the use of animal manure for composting and anaerobic digestion if it meets the animal by products regulation. This is part of a country-wide strategy to connect the material and energy flow between urban and rural areas.

PROCESS REQUIREMENTS

Treatment must be carried out with a high level of expertise and with fully functioning biological treatment technology. The risk of contaminating hygienised material or the mixing with uncertified material must be minimised following the requirements of the Animal-By products Regulation.

The following paragraphs give the operational parameters which, as part of the internal control, have to be observed and documented continuously:

COMPOSTING

- type and amount of raw material and additional materials;
- length and cross section of windrows or channels;
- start and finishing date, and composting period;
- combined time and temperature;
- moisture content;
- re-stacking and watering intervals;
- measures against re-contamination; and
- optical evaluation (e.g. coverage of weeds, pool formation).

DIGESTION

- type and amount of raw materials and additional materials;
- temperature and pH value in the reactor;
- period between filling;
- hydraulic retention time;
- combined time and temperature in the hygienisation tank;
- organic load;
- volume load;
- measures against re-contamination;
- possible interruption of operations.

End product quality requirements
Control of end product quality must be carried out in such a way that it is assured that the product or products correspond to the specified regulations. Table A– 7 shows the requirements for the quality of the end product which have to be fulfilled.

Table A– 7: Quality requirements and product specifications for certified end products

Quality criteria	Value
Guide values for heavy metal content	**mg/kg dm** [1]
Lead	100
Cadmium	1
Copper	100 [2]
Chromium	100
Mercury	1
Nickel	50
Zinc	300 [2]
Further criteria	
Visible impurities (plastics, glass, metals etc.) with particle size of >2 mm,	0.5 weight percent in dm
Organic matter	20% weight of dm
Germinating seeds and plant parts (weed)	≤2 germinating seeds and plant parts per litre
Water content in the end product	< 50%
Declaration parameters	
Stability degree (Self-heating or Solvita-test)	Pre-mature, fresh, stable, very stable
Nutrients (N_{tot}, NO_3-N, NH_4-N, P soluble, P_{tot}, K_{tot}, Mg, S, CaO – range depends on application)	–
Conductivity	–
Particle size, volume weight, stone content	–
pH value	

[1] Eco-label criteria for soil improvers.
[2] Values become valid in 2004. A transitional period for the guide values of copper and zinc contents exist where digestion residues from biogas plants which process a high amount of cattle manure can be applied. Until the year 2003 the same values as for sewage sludges are applicable (§ 11 of the Ordinance 1985:840 for products which are dangerous for the health and environment) that means copper with a maximum of 600 mg/kg in dm and zinc with a maximum of 800 mg/kg in dm are accepted.

Declaration of content
Minimum requirements corresponding to those in the table above are valid for all products with respect to the declaration of the compost's quality and properties. The measured values recorded in the declaration must be updated at least once a year and must be in agreement with the average values of the analyses over the previous 12 months. The parameters that must be declared for different products are listed below.

DECLARATION FOR COMPOST USE IN AGRICULTURE

- details of the production plant;
- details of the production management process;
- raw materials used in volume or percentage of volume;
- nutrients present (N-tot, NO_3-N, NH_4-N, P-tot, K-tot, Mg, S);
- soil improving and physical properties of the product (CaO, OM, pH, dm, particle size, volume weight, stability (measured in 4 ways);

- additives in volume, or percentage of volume ;
- application recommendations;
- statement of heavy metals influencing the environment, protection from infections, weed and similar impurities;
- date, together with the latest 'revision date' of the compost plant by the certification organisation.

MINIMUM REQUIREMENTS FOR THE DECLARATION OF COMPOST WHEN APPLIED DIRECTLY OR INDIRECTLY IN SOIL MIXTURES IN AREAS SUCH AS PARKS ETC., HOBBY GARDENING AND NURSERIES

- details of the production plant;
- details of the production management process;
- raw materials used in volume or percentage of volume;
- nutrients present ($N\text{-}_{tot}$, NO_3-N, NH_4-N, P soluble, $P\text{-}_{tot}$, $K\text{-}_{tot}$, Mg, S, conductivity);
- soil improving and physical properties of the product (CaO, OM, pH, dm, particle size, volume weight, stones, stability (measured in 4 degrees));
- additives in volume or percentage of volume;
- application recommendations;
- statement of heavy metals influencing the environment, protection from infections, weed and similar impurities;
- date together with the latest revision date of the compost plant

MINIMUM REQUIREMENTS FOR THE DECLARATION OF DIGESTION RESIDUES WHEN APPLIED IN AGRICULTURE

- details of the production plant;
- details of the production management process;
- raw materials used in volume or percentage of volume;
- nutrients present (N, P, K, Mg, S);
- soil improving and physical properties of the product (CaO, OM, pH, dm, particle size);
- additives in volume or percentage of volume;
- application recommendations;
- statement of heavy metals influencing the environment, protection from infections, weed and similar impurities;
- date together with the latest revision date of the digestion plant.

RECOMMENDATIONS FOR USE

For all products, valid instructions and recommendations for use must be issued, with the exception of compost or digestion residues which are raw materials for the soil improving or fertiliser mixing industry.

Hygiene and sanitation requirements

REQUIREMENTS FOR DIFFERENT PLANT CATEGORIES

Waste of animal origin (e.g. from the food industry, animal manure), which is accepted by the Swedish Certification System in its list of inputs, is the main potential source of infections. In order to minimise risks, a lengthy catalogue of requirements and criteria for hygienisation related to raw material, treatment process and use of the end product is included in the certification system.

In the criteria for hygienisation a reference is made to the definitions and regulations of animal waste of the Swedish Board of Agriculture (Jordbruksverk), which is the government authority in the field of agricultural and food policy.

To define different risk classes, plants are classified as 'A', 'B' or 'C' plants, depending on the raw material used (see Table A– 8). The classification of composting and digestion plants makes a

translation of the regulations of the Swedish Board of Agriculture (Jordbruksverket) necessary. A definition of low-risk waste of animal origin[*1] and examples of suitable raw material are given in a list of acceptable raw materials.

Table A– 8: Requirements for different categories of plants

Plant categories:	Qualification year control	Continuous control of operation	Control of the end product
A: A plant which processes organic waste including low risk waste from animals. Product application according to Level 1	X [2]	X	X [1]
B: A plant which processes organic waste without low risk waste from animals Product application according to level 1 (= possible food production areas)	X [2]	X	– [1]
C: A plant which processes the same types of waste listed in category B, but will have product application according to level 2 (= on non food production areas).	–	X	– [1]

[1] Weed control is valid for compost.
[2] As long as the hygienisation examination is carried out no requirements for a qualification control is valid for composting plants. During this time product application is limited to level 2.

As a general recommendation for the time being, it should be stated that compost and residues from digestion are not allowed to be applied before harvest and before cattle turnout (on grass land or pastures). This is a safety measure which will remain in place until more experience concerning plant operation is available. The levels of application referred to above are described in Table A– 9 below.

Table A– 9: Requirements for product application

Application	Application on agricultural areas
Level 1	Application on possible food production areas: When application on arable land is considered the regulations of the Swedish Board of Agriculture (Jordbruksverk) referring to animal manure [1] must be respected. Apart from these no hygienic restrictions exist. Further areas for application of compost: Nursery of vegetables in fields, fruit and small fruit nursery, plant nurseries, greenhouses and those areas which are listed in Level 2.
Level 2	Application on non food production areas: When application on arable land is considered the regulations and recommendations of the Swedish Board of Agriculture (Jordbruksverk) referring to animal manure[1] must be respected, with the following restrictions: products from residues must be applied on areas covered with straw from crops or technical seeds. In other cases only with the agreement of the interested parties. Other application areas for compost: in gardens, parks and public green areas, forestry. If there are well-founded reasons for a safe application on areas according to Level 1 it can be accepted after agreement with interested parties.

[1] Official regulations for animal manure and green areas, Jordbruksinformation 4-1996, Swedish Board of Agriculture With reference to animal manure!, Jordbruksinformation 15-1995, Swedish Board of Agriculture

[1] The group of low risk waste of animal origin includes: meat or fish waste which has not been treated with heat and which comes from fractionating in the catering industry or a restaurant, or from slaughter or fractionating by retailers or wholesalers, and from processing and packaging industry.

Control in the qualification year

DIGESTION

monitoring is carried out during the qualification year. Two different indicating organisms, E-coli or Enterkocker are used.

COMPOSTING

Assessment of hygienic effects for different composting methods must be carried out. Those results form the basis for adjusting process requirements to defined methods.
The suitability of defined and acceptable methods and adjusted process requirements is to be guaranteed through a classification of the plant as Category A, B or C.

Control during the continuous operation of the plant

The following paragraphs outline the controls required at different compost plants during operation.

DIGESTION AND COMPOSTING IN PLANT CATEGORY A

Low-risk waste from animals should be subject to: 'an enclosed heat treatment of at least 70 °C during at least one hour. Temperature and time is valid for total waste. After treatment the waste has to undergo a process such as digestion or composting which guarantees that the processed waste cannot be used as food for animals' (SJVFS 1998:34).
Open composting in plant Categories B and C
The process must operate under the following conditions:
It must reach this temperature at least 3 times with 2 turnings between.

Temperatur minimum, °C	No. of days (minimum)
55	7
60	5
65	3
70	1

- waste material that is accepted must be shred to reduce particle size;
- temperature should be at least 55 °C over at least two 2-week periods, with at least one re-stacking between the two 2-week periods;
- alternatively, at least 65°C over two one-week periods, with at least one re-stacking between the two 1-week periods;
- subsequent decomposition for at least 2 weeks;
- humidity in the compost should be 40–60%; and
- there should be effective aeration or re-stacking.

REACTOR COMPOSTING IN CATEGORIES B AND C

The process must be carried out under the following conditions:

- the incoming waste material must be logged;
- temperature of all materal should be at least 55°C during 10 successive days, and at least 65°C during at least 2 of these days;
- subsequent decomposition at least 2 weeks;
- humidity in the compost should be 40–60%; and
- there should be effective aeration or re-stacking.

WET COMPOSTING IN CATEGORIES B AND C

The process must be carried out under the following conditions:

- the incoming waste material must be shredded to reduce particle size;
- temperature should be at least 55 °C over at least 10 hours;
- hydraulic dwelling-time should be at least 7 days;

- a total re-stacking must be guaranteed in the reactor, together with a sufficient temperature distribution. In cases where this is not realised, higher temperatures and more time is required; and
- there should be effective aeration or re-stacking.

WET DIGESTION IN CATEGORIES B AND C

The process must be carried out under the following conditions;

- the incoming waste material must be shredded to reduce particle size;
- temperature should be at least 55 °C over at least 10 hours;
- hydraulic dwelling-time should be at least 7 days; and
- a total re-stacking must be guaranteed in the reactor, together with a sufficient temperature distribution. In cases where this is not realised higher temperatures and more time is required.

Control of the end product

PLANT CATEGORY A

The control of the end product must be carried out according to the microbiological requirements which are stated in SJVFS 1998:34. Samples of the end product from both low- and high-risk waste must fulfil a special statistical evaluation.

PLANT CATEGORIES B AND C

An indication of a hygienic effect is given by monitoring the presence of germinating seeds and sprouting plant parts.

MEASURES TO AVOID RE-INFECTION WHILE TRANSPORTING

For plants within Categories A and B, it is not permissible to use the same vehicle for the transportation of raw materials to the plant and for the transport of treated products from the plants, if the vehicle has not been cleaned and disinfected between both procedures.

INTERNAL CONTROL OF THE PLANT

The requirement for internal control of compost and digestion residuals in the Swedish Certification System strictly follows the principles of quality management system according to ISO 9000ff.
The plant operator must initiate a continuous internal control in order to assure that products with the quality label fulfil the requirements of those certification regulations. The internal control must be described in a control programme document, quality manual or similar, and must adhere to the following requirements:

Quality policy

The plant operator must have a quality policy which describes the steps of product quality control, including:
Responsibility and competence: There must be clear organisation of internal control and the names of those persons who have the responsibility for control, and who are charged with taking action if the quality seems to deteriorate.
Plant operators representative: A person who represents the plant operator must be found concerning internal control. This person should have the necessary competence and responsibility to assure and maintain the quality of the certified products.
The plant manager or his representative should document internal control procedures at least once per year in order to assure effectiveness. The staff in charge should have certified training which is recognised by the management.
Staff in charge must have access to the latest documents and information available concenring the company. There must be a schedule and a distribution list for the documents, together with guidelines for the preparation of new documents, alterations in current documents and the replacement of invalid documents.

The plant operator must set up guidelines for the control of raw material, suppliers, collection and transport, and must provide the necessary equipment for the responsible persons to use. Incoming raw material which may influence the product quality must be monitored according to the documented guidelines. Process control and testing of the end product must be carried out in such a way that it is

assured that the specified regulations for the certification are fulfilled. This includes the minimum frequency of sample taking according to Table A– 6.
Products which do not fulfil the specified regulations must be separated from those that do. If non-compliant products are labelled as though they were compliant, any labelling that indicates this must be removed. Non-compliant products are not allowed to enter the market under the same name or sign as certified products. If a product is already delivered before the faults are detected, it is necessary to inform the client. Furthermore, the causes must be examined and the necessary changes made to rectify any problems identified.
The handling of final products must be carried out in such a way that homogenisation is guaranteed. Persons handling goods must be made aware how of damage and contamination can be avoided during handling, taking in stock, packaging and delivering.
Sufficient records must be kept to make it possible to trace back end products to an intermediate stock, time of production or similar.
The producer must establish measures in the form of a plan for the assurance and improvement of the product quality.
Measures which have been taken to avoid deterioration of the product quality must be noted. Complaints from clients etc. about certified products, labelling or marketing introduction must be documented together with the measures undertaken for improvement.
The producer must retain proof by collecting and storing all the relevant documents regarding product specification and quality. Documents of controlling and sample taking must be traceable.

Independent external monitoring
Independent monitoring control must be carried out one to two times per calendar year, depending on the plant capacity. The examining organisation will visit the plant without prior notice.
The examining organisation will monitor the functioning of internal controls and will take samples of the certified products and organise the analysis of these samples.
If the control analysis and/or examinations of the plant's internal control are not sufficient the reasons must be looked at by the examining organisation. Unacceptable results may lead to another visit, a sample taking or examination of the continuous controls.
The independent external monitoring body must inform the producer or the plant owner about the results of the inspection in written report.
If the plant operator finds unacceptable values during sample taking and analysing they must inform the examining organisation or certifying organisation.

Other conditions for certifying
The owner of the certificate is responsible for the products which bear the quality label of the certifying organisation. This person is responsible for ensuring that these products meet all the requirements of the certification and that they are suitable for use and are not harmful. The owner of the certificate has the right of labelling those products which are certified with the quality label and the right to use this label for public relations and advertising.

The certifying organisation can cancel the label with immediate effect, definitely or temporarily if the owner of the certificate uses the quality label of the certifying organisation in relation to products which do not apply to the conditions of the certificate; or if the continuous monitoring was stopped because of deterioration; or the owner of the certificate did not pay fees; or failures in the certificate are detected.

Where a certificate has been cancelled for some reason, the full application process must be under gone by the plant concerned in order to re-obtain a certificate.

The control group of the certifying system is responsible for ensuring that the technical requirements are built on latest trends and experiences, e.g. conventional standards or given specifications, and fulfil legal requirements, together with the general opinion of a relevant quality standard that is valid among the interested parties. The examining organisation is responsible for the careful and accurate performance of the examination of certified products according to the regulations.

7 Concept of a European Quality Assurance System for Compost ECN QAS

Quality assurance schemes for compost and digestion residuals established themselves in the last 15 years successfully in various European Member States and contributed well for the sustainable recycling of organic waste. Nevertheless the running revisions of various environmental and agricultural directives at the Commission and the EU's free trade principle advice to develop consistent quality standards for compost and digestion residuals.

The example of the advanced countries clearly shows that effective biowaste treatment has to include quality standards and their control in order to guarantee environmentally safe application and successful marketing and markets. On the basis of existing experiences in countries with running quality assurance schemes the European Compost Network ECN develops at present a European Quality Assurance Scheme (ECN-QAS) for compost.

Targets for a European Quality Assurance
The establishment of a European quality assurance schemes QAS includes the target to define an accepted basic product standard, to harmonise essential requirements for the production process and to monitor all by an independent and regular control.

Existing European quality assurance schemes should get a common basis by the ECN-QAS and countries in a starting/build up situation of quality assurance should get support through it.

The Revision of the EU Waste Framework Directive intends to stipulate criteria for the end-of-waste respectively product standard for secondary raw materials first of all for compost. The monitoring need of these standards recommends establishing a consistent and independent voluntary quality assurance scheme for compost and digestion residuals. The linkage of the product property of compost and digestion residuals to an independent product certification - intended by the ECN-QAS - would essentially contribute to legal certainty and to a deregulation from the control tasks of the authorities.

The European Quality Assurance Scheme ECN-QAS
The ECN-QAS presents an independent quality assurance scheme and includes basic requirements for a European product standard for compost and digestion residuals. Besides a positive list for source materials also product criteria are laid down in the scheme.

National quality assurance organisations, which intend to participate in the European quality assurance scheme, must guarantee its requirements. It is expected that the national quality assurance organisation is acknowledged by national authorities. The national quality assurance organisations are responsible for the monitoring and the awarding of the quality label. It is optional for the national organisations to exceed the demands of the ECN-QAS.

European quality assurance includes:

- Regular assessment of the production plant by a certification body (National quality assurance organisation NQAO) including some process requirements
- Regular sample taking and analysis of the final product from independent labs and additionally the evaluation of the results by a certification body.

- Preparation of the test documents by the certification body with information about the quality properties of the product, the fulfilment of legal requirements, the necessary product declaration and information about application and rates according to good practice.
- Awarding of the quality label by the certification body.

Fig. A– 5 summarises the 4 sector concept for a European Quality Assurance:

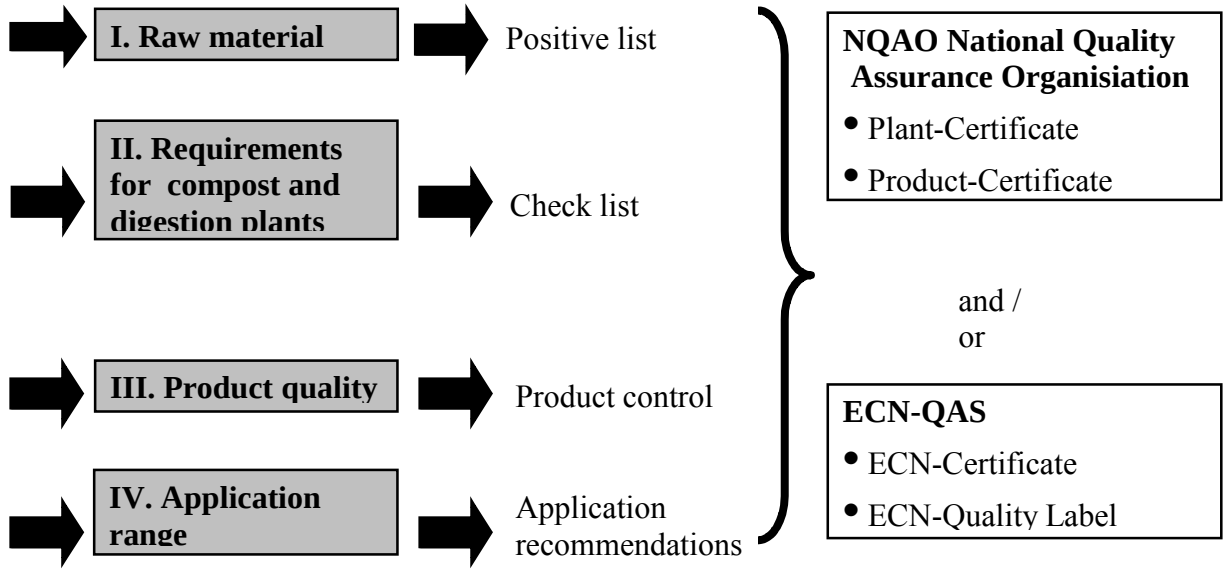

Fig. A– 5: Survey of the concept for the European Quality Assurance (ECN-QAS) for compost and digestion residuals

Outlook

Quality assurance and product specifications are preconditions to show and do demonstrate that the quality of recycled goods fulfil consumer requirements and product standardisation needs of the market. It gives the European legislation a chance to grant product status for the end products of composting and anaerobic digestion processes of separately collected organic waste. This eliminates the waste images and establishes compost and digestion residuals sustainable as a valuable organic fertiliser, soil improver and mixture component for growing media.

The European Compost Network is developing a quality management handbook, where the requirements for the process and product control and although the requirements for national quality assurance organisations are laid down.

ANNEX 2: European Sampling and Test Methods

The European Commission has given a standardisation mandate to CEN for the development of horizontal standards in the field of sludge, biowaste and soil under consideration of the characterisation of waste (Mandate M/330). (The standards in these crosscutting environmental areas are needed in regard to existing and upcoming EU Directives.)
The mandate considers standards on sampling and analytical methods for hygienic and biological parameters as well as inorganic and organic parameters. Consequently the CEN Technical Board (BT) created a BT Task Force (BT/TF 151) "Horizontal Standards in the fields of sludge, biowaste and soil" (CEN/BT TF 151). On most sampling and analytical topics, the final consultation and validadtion of the draft standards has taken place in autumn 2007[2]. The final decision on the appropriateness of the standards for treated biowaste will be taken on the next meeting of BT Task Force (BT/F 151) in spring 2008.
During the period in which Commission Decision (2006/799/EC) will be in force, test methods should be in line with the outcomes of BT/TF 151 as much as possible.
Until horizontal standards elaborated under the guidance of CEN Task Force 151 become available, testing and sampling shall be carried out in accordance with test methods developed by Technical committee CEN 223 'Soil improvers and growing media'[3].
Other test methods may be used if their equivalence is accepted by National Member states. For instance, if other consolidated and approved test methods for soil improvers and fertilisers are used in Member States or third countries, they may substitute some of those set by CEN. Where required testing is not covered by CEN standards or CEN standards in progress of approval, other test methods are pointed out in the annex. These methods are indicative by nature and, as stated above, may be substituted by other methods in use.
Analysis should be carried out by reliable laboratories that are preferably accredited for the performance of the required tests in an acknowledged quality assurance system

TERMS AND DEFINITIONS

The glossary is regarded to be useful for a uniform comprehension and in order to keep univocal interpretation on test methods.

Alkaline effective matter: calcium and magnesium in basifying form (e.g. as oxide, hydroxide and carbonate)
Bulk density: ratio of the dry mass and volume of the sample in grams per litre measured under standard suction conditions (suction pressure: 10 cm); it is sometimes referred to as "apparent density".
Dry matter: the portion of substance that is not comprised of water. The dry matter content (%) is equal to 100 % minus the *moisture content %.*
Electrical Conductivity: measure of a solution's capacity to carry an electrical current; it varies both with the number and type of ions contained in the solution; it is an indirect measure of salinity.
Heavy Metals: elements whose specific gravity is approximately 5 or higher. They include lead, copper, cadmium, zinc, mercury, nickel, chromium.
Impurities: physical impurities are defined as all non-biodegradable materials (glass, metals, plastics) with a size > 2 mm.
Maturity: Maturity (see also 'stability') can be defined as the point at which the end product is stable and the process of rapid degradation is finished, or, a biodegraded product that can be used in horticultural situations without any adverse effects. The term maturity can also be interpreted in a wide sense, and also includes the term stability. An attempt to define maturity could be that it is a

2 see also: www.ecn.nl/horizontal
3 contact: http://www.cenorm.be/cenorm/index.htm

measure of the compost's readiness for use that is related to the composting process. This readiness depends upon several factors, e.g. high degree of decomposition, low levels of phytotoxic compounds like ammonia and volatile organic acids.
Moisture content: the liquid fraction (%) that evaporates at 103 ± 2°C (EN 13040).
Organic matter (OM): The carbon fraction of a sample of compost which is free from water and inorganic substances, clarified in EN 12829 (HORIZONTAL WI CSS99023) as 'loss on ignition' at 550 ± 10 °C.
Plant response: (Prenormative Work item of CEN/TC 223 for soil improvers and growing media)
Stability/Stabilisation: refers to a stage in the decomposition of organic matter during composting. The stability is measured as residual biological activity like the Oxygen uptake rate (Prenormative Work item of CEN/TC 223 for soil improvers and growing media), Self-heating test (DIN V 11539; Prenormative work item of CEN/TC 223 for compost). Material that is not stable, but still putrescent, gives rise to nuisance odours and may contain organic phytotoxins.
Test methods: Analytical methods approved by Member States, institutions, standardising bodies (CEN, UNI, DIN, BSI, AFNOR, OENORM etc.) or by reliable manufacturers' associations (BGK in Germany, TCA in UK, etc.).
Weed seeds: all viable seeds (and propagules) of undesired plant species found in end products.

Testing parameters	Methods (e.g. EN, etc.)	Short description	EU-Project HORIZONTAL Draft Standards BT/TF 151
General material properties			
pH value	EN 13037	A sample is extracted with water at 22°C ± 3.0°C in an extraction ratio of 1+5 (V/V). The pH of the suspension is measured using a pH meter.	WI CSS99017 Extraction with $CaCl_2$
Electrical conductivity	EN 13038	A sample is extracted with water at 22°C ± 3.0°C in an extraction ratio of 1+5 (V/V). The specific electrical conductivity of the extract is measured and the result is adjusted to a measurement temperature of 25°C.	WI CSS99037
Water content	EN 13040	Dry the sample (50g) at 103 ± 2°C in an oven and cool in the desiccator.	WI CSS99022
Dry matter content	EN 13040-	Dry the sample (50g) at 103 ± 2°C in an oven and cool in the desiccator.	WI CSS99022
Organic matter content (Loss on ignition)	EN 13039/ EN 12829	The test portion is dried at 103°C, than ashed at 450°C/550°C. The residue on ignition (loss on ignition) is a functional dimension for the organic matter content in composts.	WI CSS99023 Determination at 550 °C
Alkaline effective matter (CaO content)	BGK 2006[4] BGBl 1992[5] Teil 1 S. 912 VDLUFA , 1995[6]	The method is based on the detemination of basifying substances in fertilisers and sludges. The method is applicable on treated biowaste like compost containing calcium and magnesium in basifying form (e.g. as oxide, hydroxide and carbonate). The substance shall be rendered soluble with acid and the excess of acid back-titrated. The basifying substances shall be specified as % CaO.	no
Particel size distribution	EN 15428	The standard describes a method to determine the particle size distribution in growing media and soil improver by sieving (Sieve size: 31.5 mm, 16 mm, 8 mm, 4 mm, 2 mm, 1 mm).	no
Nutrients			
N (total) (Kjeldahl N)	EN 13654-1	The moisture sample is extracted with a sulphuric acid, is distilled in boric acid. To titrate the ammonia with sulphuric acid 0.1 N.	WI CSS99021
P (total)	EN 13650	The sample is finely ground and extracted with a hydrochloric/nitric acid mixture by standing for 12 hours at room temperature, followed by boiling under reflux for two hours, the extract is clarified and extracted element determined by ICP.	WI CSS99025B

[4] BGK, 2006:Methodenbuch zur Analyse organischer Düngmittel, Bodenverbesserungsmittel und Kultursubstrate, ISBN 3-939790-00-1

[5] Federal Law Gazette BGBl, I p. 912, 1992: Sewage Sludge Ordinance (AbfklärV).

[6] VDLUFA, 1995: Methodenbuch Band II. Die Untersuchung von Düngemitteln, Kap. 6.3 Bestimmung der Basisch wirksamen Bestandteile in Kalkdüngemitteln, 4. Auflage, VDLUFA-Verlag.Darmstadt

Testing parameters	Methods (e.g. EN, etc.)	Short description	EU-Project HORIZONTAL Draft Standards BT/TF 151
K (total)	EN 13650	Idem	WI CSS99025B
Mg (total)	EN 13650	Idem	WI CSS99025B
$N0_3$-N (dissolved)	EN 13651	The moisture sample is extracted with 0.0125 $CaCl_2$, ration 1:10. The extract is clarified and analysed by spectrophotometric method.	WI CSS99019 Extraction with 1mol/l potassium chloride, ratio 1:20
NH_4-N (dissolved)	EN 13651 DIN 38405 E5	The moisture sample is extracted with 0.0125 $CaCl_2$, ration 1:10. The extract is clarified and analysed by spectrophotometric method.	WI CSS99019 Extraction with 1mol/l potassium chloride, ratio 1:20
Biological parameters			
Stability	CEN/TC 223 prWI Aerobic Biological Activity	This parameter refers to a stage in the decompo-sition of organic matter during composting. The stability is measured as residual biological activity like the Oxygen uptake rate (Prenormative Work item of CEN/TC 223 for soil improvers and growing media), Self-heating test (DIN V 11539; Prenormative work item of CEN/TC 223 for compost). Material that is not stable, but still putrescent, gives rise to nuisance odours and may contain organic phytotoxins.	no
	Part I Oxygen uptake rate	This pre-standard describes a method for determination of the determination of Aerobic biological activity by measuring the oxygen uptake rate (OUR). The method may be applied to growing media and growing media constituents. The oxygen uptake rate is an indicator of the extent to which biodegradable organic substance has been broken down.	no
	Part II Self-heating	This pre-standard describes a method for determination of the degree of decompositon in a self-heating test. The method is applicable to biodegradable materials and composts. The degree of decomposition of the test materials is an indicator of the extent to which highly biodegrable organic substances has been broken down. It is used to distinguish between compost types (fresh, mature and substrate compost).	no
Viable seeds and reproductive parts of plants		This standard specifies a test procedures for the assessment of contamination by viable plant seeds and propagules on soil, treated biowaste and sludge. Test sample material is filled into seed trays. The trays are kept at temperature suitable for plant germination for 21 days. The germinated plants have to be counted.	WI CSS99048

Testing parameters	Methods (e.g. EN, etc.)	Short description	EU-Project HORIZONTAL Draft Standards BT/TF 151
Plant response	CEN/TC 223 prWI plant response	This pre-standard specifies procedure to test the plant response on the following materials used as growing media, growing media constituents or soil improvers: Compost, peat, wood fibres, rice hulls, coir, cocoa hulls, clay, clay minerals, expanded clay, perlite, vermiculite, rock wool, sand, pumice, lava, bark and readily mixed growing media. To test the plant response directly using the test material, the test sample is filled into plant containers. Seeds of the respective species are evenly distributed on the surface of the test material. For Chinese cabbage, 15 seeds, for barley, 20 seeds per container have to be used.Then, the pots are kept at a temperature suitable for plant germination. The plant response of the material can be evaluated by the germination rate and growth of the plants.	no
Physical contaminants			
Impurities	BGK 2006[6]	Determination of impurities and stones. This standard describes a method to determine the physical impurities > 2 mm and stones > 5 mm in soils, sludges and treated biowastes. The test material is dry sieved and the fractions of stones > 5 mm and differentiated impurities > 2 mm are determined by weight or, for plastics, by weight and area.	WI CSS99049
Chemical contaminants – Heavy metals			
Pb	EN 13650	The dried sample is finely ground and extracted with a hydrochloric/nitric acid mixture by standing for 12 hours at room temperature, followed by boiling under reflux for two hours, the extract is clarified and extracted element determined by ICP.	WI CSS99025B
Cd	EN 13650	Idem	WI CSS99025B
Cr	EN 13650	Idem	WI CSS99025B
Cu	EN 13650	Idem	WI CSS99025B
Ni	EN 13650	Idem	WI CSS99025B
Hg	EN 13650	Idem	WI CSS99025B
Zn	EN 13650	Idem	WI CSS99025B
Hygienic aspects			

[6] BGK, 2006:Methodenbuch zur Analyse organischer Düngmittel, Bodenverbesserungsmittel und Kultursubstrate, ISBN 3-939790-00-1

Testing parameters	Methods (e.g. EN, etc.)	Short description	EU-Project HORIZONTAL Draft Standards BT/TF 151
Salmonellae	CEN/TC 308 WI (prEN 15215-1, prEN 15215-2, prEN 15215-3)	The Salmonella procedure in sludges, soils and treated biowastes comprises three methods (prEN 15215-1, prEN 15215-2, prEN 15215-3). The absense of Salmonellae in treated biowaste is an indicator that the process requirements in respect to hygienic aspects are fulfilled and that the material is sanitized.	still under validation, deadline of validation phase 30.11.2007
Sampling			
Sampling	EN 12079	Soil Improver and growing media – Sampling	This has been elaborated by CEN TC 223
Framework on sampling		Framework for the preparation and application of a sampling plan: This standard specifies the procedural steps to be taken in the preparation and application of the sampling plan. The sampling plan describes the method of collection of the laboratory sample necessary for meeting the objective of the testing programme.	CSS99031
Selection and application of criteria for sampling		Sampling Part 1: Guidance on selection and application of criteria for sampling under various conditions	CSS99058
Sampling techniques		Sampling Part 2: Guidance on sampling techniques	CSS99057
Sub-sampling in the field		Sampling Part 3 Guidance on sub-sampling in the field	CSS99032
Sample pachaging, storage etc.		Sampling Part 4: Guidance on procedures for sample packaging, storage, preservation, transport and delivery	CSS99059
Sampling plan		Sampling Part 5: Guidance on the process of defining the sampling plan	CSS99060
Sample pretreatment		Guidance for sample pretreatment	CSS99034

The reports include the following documents:
PART 1. Sampling of sewage sludge, treated biowastes and soils in the landscape - Framework for the preperation and application of a Sampling plan
PART 2. Report on sampling draft standards
Sampling of sludges and treated bio-wastes.
A. Technical Report on Sampling – Guidance on selection and application of criteria for sampling under various conditions.
B. Technical Report on Sampling – Guidance on sub-sampling in the field.
C. Technical Report on sampling – Guidance on procedures for sample packaging, storage, preservation, transport and delivery.
Sampling of sewage sludge and treated biowastes - Guidance on sampling techniques 30-3-2006
Sampling of sewage sludge and treated biowastes - Definition of the sampling plan 27-4-2006

ANNEX 3: National Implementation of the Animal By-Products regulation (EC) nr. 1447/2002 in some Member States

AT	Diverting national regulation or full implementation of Annex VI ABPR	Time/temp. regime	Max. Particle size	Closed reactor or open windrows	Final product testing		Waiting period for grazing/harvesting of feedingstuff
					indicator pathogens tested	Requirement /limit	
Catering waste from households	Compost ordinance; BGBl. II 291/2001 Guideline state if the art of composting; Waste Management Plan 2006	Felixble regimes between 55 to 65 °C over a monitoring period of 10 to 14 days	---	Open windrows possible	*Salmonella ssp* *E. coli* *Listeria sp* *Campylobacter*	absent in 50 g agric.: if positive recommendations for further treatment absent in bagged compost	---
Catering waste from central kitchens							
Former foodstuff	Annex VI ABPR	70 °C 60 min or validated process	12 mm or validated process	Open systems if validated	Annex VI ABPR		3 weeks
All other Cat. 3 material							
Manure	No requirements						

BE/Fl	Diverting National regulation or full implementation of Annex VI ABPR	Time/temp. regime	Max. Particle size	Closed reactor or open windrows	Final product testing		Waiting period for grazing/harvesting of feedingstuff
					Indicator pathogens tested	Requirement/limit	
Catering waste from households	VFG-waste (Vegetable, fruit and garden waste) from households per definition is **not** containing meat products. However some treatment plants do allow ABP Cat 3 catering waste and have recognition. Either 1 h 70°C 12 mm is reached during the biothermic heating process or is reached in the composting phase which follows anaerobic digestion, although transitional measures are still allowed for 2 existing plants.	1h/70°C	12 mm (?not sure about particle size)	closed, possibly open windrows in maturing phase after hygienisation	E.coli or Entero-coccaceae Salmonella	n=5, c=1, m=1000, M=5000 in 1 g n = 5, c = 0, m = 0, M = 0 in 25 g	3 weeks
Catering waste from central kitchens	There is no difference between Catering waste from households or central kitchens.	1h/70°C	12 mm (?not sure about particle size)	closed, possibly open windrows in maturing phase after hygienisation	E.coli or Entero-coccaceae Salmonella	n=5, c=1, m=1000, M=5000 in 1 g n = 5, c = 0, m = 0, M = 0 in 25 g	3 weeks
Former foodstuff	Differentiation between sort of former foodstuff. (a) Bakery products eg bread, cake, chocolate, cookies, … containing ABP for instance fat, milk, dairy products, eggs, honey, … but these ingredients are not the main ingredient: 1774 is not applicable when not containing raw meat, fish or products derived from raw products, and have	1h/70°C	12 mm (?not sure about particle size)	closed, possibly open windrows in maturing phase after hygienisation	E.coli or Entero-coccaceae Salmonella	n=5, c=1, m=1000, M=5000 in 1 g n = 5, c = 0, m = 0, M = 0 in 25 g	3 weeks

BE/Fl	Diverting National regulation or full implementation of Annex VI ABPR	Time/temp. regime	Max. Particle size	Closed reactor or open windrows	Final product testing		Waiting period for grazing/harvesting of feedingstuff
					Indicator pathogens tested	Requirement/limit	
	not been in contact with these. (b) for small amounts produced of products containing ABP that have been packed before becoming ABP and with max of 10 kg/week can go to incineration together with residual waste (exception for small shops). (c) all other former foodstuff: recognised biogas or composting plant according to treatment measures in Annex VI of ABPR.						
All other Cat. 3 material							
Manure	Full implementation of Annex VI ABPR	1h/70°C	12 mm	closed	E.coli or Entero-coccaceae Salmonella	n=5, c=1, m=1000, M=5000 in 1 g n = 5, c = 0, m = 0, M = 0 in 25 g	3 weeks

CZ	Diverting national regulation or full implementation of Annex VI ABPR	Time/temp. regime	Max. Particle size	Closed reactor or open windrows	Final product testing		Waiting period for grazing/harvesting of feedingstuff
					indicator pathogens tested	Requirement /limit	
Catering waste from households	Veterinary Act No 166/1999 Coll. Full implementation of Annex IV ABPR	at least 70 C / 60 minutes	12 mm	only closed systems	*Salmonella* *Enterobacteriaceae*	absent in 25 g ≤ 3.0 x 10^2 CFU/g	-
Catering waste from central kitchens	Veterinary Act No 166/1999 Coll. Full implementation of Annex IV ABPR	at least 70 C / 60 minutes	12 mm	only closed systems	*Salmonella* *Enterobacteriaceae*	absent in 25 g ≤ 3.0 x 10^2 CFU/g	-
Former foodstuff	Veterinary Act No 166/1999 Coll. Full implementation of Annex IV ABPR	at least 70 C / 60 minutes	12 mm	only closed systems	*Salmonella* *Enterobacteriaceae*	absent in 25 g ≤3.0 x 10^2 CFU/g	-
All other Cat. 3 material	Veterinary Act No 166/1999 Coll. Full implementation of Annex IV ABPR	at least 70 C / 60 minutes	12 mm	only closed systems	*Salmonella* *Enterobacteriaceae*	absent in 25 g ≤ 3.0 x 10^2 CFU/g	-
Manure	Veterinary Act No 166/1999 Coll. Full implementation of Annex IV ABPR	at least 70 C / 60 minutes	12 mm	closed reactors os open widrows	*Salmonella* *Enterobacteriaceae*	absent in 25 g ≤ 1000 CFU/g	-

DE	Diverting national regulation or full implementation of Annex VI ABPR	Time/temp. regime	Max. Particle size	Closed reactor or open windrows	Final product testing		Waiting period for grazing/harvesting of feedingstuff
					indicator pathogens tested	Requirement /limit	
Catering waste from households	National regulation (TierNebV)	Compost: 55°C/2 Weeks 65/60°C /1 week Fermentation: 55°C/24h 20 Days 70°/1h	-	Closed reactor or Open windrow	Salmonella	Absent in 50g	
Catering waste from central kitchens	National regulation (TierNebV)	Compost: 55°C/2 Weeks 65/60°C /1 week Fermentation: 55°C/24h and Fermentation > 20 Days 70°/1h	-	Only closed reactor	Salmonella	Absent in 50g	
Former foodstuff	ABPR	70°/1h	12 mm	Closed reactor or Open windrow	Salmonella E.coli	Absent in 25g < 1000 MPN / 4 of 5 samples	21 Days
All other Cat. 3 material	ABPR	70°/1h	12mm	Closed reactor or Open windrow		1000-5000 MPN / 1 of 5 samples	21 Days
Manure	ABPR	-	-	-	-	-	-

HU	Diverting national regulation or full implementation of Annex VI ABPR	Time/temp. regime	Max. Particle size	Closed reactor or open windrows	Final product testing		Waiting period for grazing/harvesting of feedingstuff
					indicator pathogens tested	Requirement /limit	
Catering waste from households	-	at least 70 C / 60 minutes	-	only closed systems	*Salmonella* *Enterobacteriaceae*	absent in 25 g ≤ 3.0 x 10^2 CFU/g	-
Catering waste from central kitchens	Nr. 71/2003. Category 3.	at least 70 C / 60 minutes	12 mm	only closed systems	*Salmonella* *Enterobacteriaceae*	absent in 25 g ≤ 3.0 x 10^2 CFU/g	-
Former foodstuff	Nr. 71/2003. Category 3.	at least 70 C / 60 minutes	12 mm	only closed systems	*Salmonella* *Enterobacteriaceae*	absent in 25 g ≤3.0 x 10^2 CFU/g	-
All other Cat. 3 material	Nr. 71/2003. Category 3.	at least 70 C / 60 minutes	12 mm	only closed systems	*Salmonella* *Enterobacteriaceae*	absent in 25 g ≤ 3.0 x 10^2 CFU/g	-
Manure	Nr. 71/2003. Category 2.	at least 70 C / 60 minutes	12 mm	closed reactors os open widrows	*Salmonella* *Enterobacteriaceae*	absent in 25 g ≤ 1000 CFU/g	-

IE	Diverting national regulation or full implementation of Annex VI ABPR	Time/temp. regime	Max. Particle size	Closed reactor or open windrows	Final product testing		Waiting period for grazing/harvesting of feedingstuff
					indicator pathogens tested	Requirement /limit	
Catering waste from households		70°C, 1 hr, 60°C for 48 hrs, twice	12mm 400mm	Closed reactor	*E. coli* or *Enterococaceae* and *Salmonella*.	≤ 1000cfu/g ≤ 1000cfu/g) absent	21 days for ruminant animals and 60 days for pigs
Catering waste from central kitchens		70°C, 1 hr, 60°C for 48 hrs, twice	12mm 400mm	Closed reactor	*E. coli* or *Enterococaceae* and *Salmonella*.	≤ 1000cfu/g ≤ 1000cfu/g absent	21 days for ruminant animals and 60 days for pigs
Former foodstuff		70°C, 1 hr	12mm	Closed reactor	*E. coli* or *Enterococaceae* and *Salmonella*.	≤ 1000cfu/g ≤ 1000cfu/g absent	3 years
All other Cat. 3 material		70°C, 1 hr	12mm	Closed reactor	*E. coli* or *Enterococaceae* and *Salmonella*.	≤ 1000cfu/g ≤ 1000cfu/g absent	3 years
Manure							

NL	Diverting National regulation or full implemtation of Annex VI ABPR	Time/temp. regime	Particle size	Closed reactor or open windrows
Catering waste from households	no	no Instead of that process validation for all biowaste plants which include HACCP - < 1000 Enterob., E-coli - no salmonella - 5 log reduction No time-temp and no particle size requirements Additional requirements: Final storage after screening is part of the process validation 1) Valid for all materials	no	Closed plants (one open channel plant with 240.000 t/y capacity covers top of channels with chipped wood layer - then considered as enclosed
Catering waste from central kitchens				
Former foodstuff				
All other Cat. 3 material				
Manure		same requirements dto for co-digestion		
Is there process validation or are there validated processes according to Paragraph 13 Annex VI Reg. (EC) 208/2006		All biowaste composting plants have to it once.		
What are the requirements for an end-product control		Sampling and analysis 4 times a year on Enterob., E-coli (<1000) and salmonella (no salmonella) Costs 2000 Euro/y		

SE	Diverting national regulation or full implementation of Annex VI ABPR	Time/temp. regime	Max. Particle size	Closed reactor or open windrows	Final product testing		Waiting period for grazing/harvesting of feedingstuff
					indicator pathogens tested	Requirement /limit	
Catering waste from households	National regulation	55° 7 days, 60° 5 days, 65° 3 days, 70°1 day	-	Repeat three times for open windrows			
Catering waste from central kitchens	National regulation	55° 7 days, 60° 5 days, 65° 3 days, 70°1 day	-	Repeat three times for open windrows			
Former foodstuff	ABP						
All other Cat. 3 material	ABP						
Manure	ABP						

UK	Diverting national regulation or full implementation of Annex VI ABPR	Time/temp. regime	Max. Particle size	Closed reactor or open windrows	Final product testing		Waiting period for grazing/harvesting of feedingstuff
					indicator pathogens tested	Requirement /limit	
Catering waste from households	EU reg Annex VI or National reg alternative	Nat reg: 60 °C 2 d OR 70 °C 1 h OR if 'housed windrows': 60 °C for 8 days (3 turnings at < 2 day intervals). **N.B.:Treatment must be done twice if 'catering waste, meat included).**	40 cm OR 6 cm OR 40 cm	Closed reactor OR 'Housed windrows'	Salmonella in 25 g	n=5, c=0, m=0, M=0	
Catering waste from central kitchens		Same as for catering waste from households					
Former foodstuff	EU reg Annex VI	EU: 70 °C for 60 minutes	12 mm	Closed reactor	Salmonella AND Eschericia coli in 1 g OR Enterococacae in 1 g	n=5, c=0, m=0, M=0 n=5, c=1, m=1000, M=5000 n=5, c=1, m=1000, M=5000	
All other Cat. 3 material	Same as for former foodstuffs						
Manure* * only if exported !	EU reg Annex VIII, Chapter III, Point II.A (5) (from EU Reg 208/2006, which amends EU Reg 1774/2002)	70 °C 60 min and 'subjected to reduction in spore-forming bacteria and toxic formation'. Other standardised process parameters may be authorised by the Competent Authority.	Not specified	Closed reactor	Validation: according to Annex VI Enterococcus faecalis Parvovirus Processed manure: Salmonella AND Eschericia coli in 1 g OR Enterococacae in 1 g	At least 5 log 10 reduction At least 3 log 10 reduction n=5, c=0, m=0, M=0 n=5, c=1, m=1000, M=1000 n=5, c=1, m=1000, M=1000	

n = number of samples to be tested; m = threshold value for the number of bacteria; the result is considered satisfactory if the number of bacteria in all samples does not exceed m; M = maximum value for the number of bacteria; the result is considered unsatisfactory if the number of bacteria in one or more samples is M or more; c = number of samples the bacterial count of which may be between m and M, the sample still being considered acceptable if the bacterial count of the other samples is m or less

ANNEX 4: Assumptions for the assessment of the organic waste and residue streams volumes[7]

Residual material includes residues, by-products and other waste that results from agriculture, wood and food processing and at the end of the production chain. The biomass that is not intended for use as material and/or cannot be used as a material is available. The following section describes the procedure for determining each potential from residues for 2000 and extrapolating it for 2010 and 2020. The section also describes the available statistics. The potential of waste wood, pruning from agriculture, commercial and industrial waste, sewage sludge and organic municipal waste including landfill gas are assumed unchanged for 2010 and 2020.

According to the energy potential of this study the biomass potentials were calculated by the following equation:

- thermo-chem. conversion: biomass potential f.m: = $\frac{\text{energy potential}}{\text{Heating value}}$

- bio-chemi. conversion: biomass potential f.m. = $\frac{\text{energy potential x 100}}{\text{Biogas revenue x oTS-cont. x heating value}}$

Herbaceous residues

Straw that results consists of wheat, barley, rye, oats, grain maize, rapeseed, sunflowers and legumes (peas and beans). We assume 20% of all straw can be used to produce energy to take into account different recovery rates, weather and material use (horticultures, litter, etc.).

The amount of straw for 2000 is calculated using harvest quantities and a specific grain/straw ratio for each type of cereal. Data on harvest yields are taken from FAO harvest statistics. The arithmetic mean of the crop years 1999 – 2002 is used to account for annual deviations (due to crop rotation, weather etc.) /26/.

The extrapolation of straw potential for 2010 and 2020 is based on the estimate of country-specific food consumptions for this time span (see section 3.3.2). Population growth is also taken into account. We also assume that an increase in yields will change the grain/straw ratio in favour of grain by 8% on average in 10 years (trend according to /63/). Each rate of change is applied as a percent to cereal, rapeseed, sunflower and legume yields.

Calculation of the biomass potential by thermo-chemical conversion with the following calorific values:

maize, beans and peans:	7,0 MJ/kg
cereal straw:	14,4 MJ/kg
rapeseed and sunflowers:	14,0 MJ/kg

Other residues

Excrements and litter

To determine the energy potential of biogas from excrements and litter, we take cattle, pigs, chicken and turkeys into account. The calculations assume a total of 68% housing for cattle, chickens and

[7] Source: Institute for Energy and Environment (publisher) "Sustainable Strategies for Biomass Use in the European Context" Page 132 – 143 Download of the full report, references and the annex with the data tables: http://www.bmu.de/english/renewable_energy/downloads/doc/37442.php

turkeys (85% housing during the 4 winter months and 60% during the rest of the year) and 100% for pigs. The calculations also assume that litter is provided for 15% of animals but do not take into account that some of the straw used for litter is eaten by the animals. Other farm animals such as sheep, goats, horses, geese and ducks are not included because they are normally kept outdoors or produce little manure.
Quantities of excrements and litter for 2000 were calculated from animal stocks. Animal stock statistics were taken from 2000 FAO statistics /27/.
The estimates of the energy potential for biogas for 2010 and 2020 assume that the amount of excrements and litter for pigs, chickens and turkeys remains unchanged. The change in demand for beef and milk (see section 3.3.2) is taken into account in the amount of excrements and litter for cattle. The rates of change are applied to the entire cattle stock as percentages (reference year 2000).

Calculation of the biomass potential by bio-chemical conversion with the following data:

Mean biogas revenue: 30,5 m³/t f.m.

Heating value: 21,4 MJ/m³

Other agricultural harvest residues

In addition to straw, beet and potato leaves are the primary harvest residues from agriculture that can be used to produce biogas. Calculations assume that 25 to 50% of beet leaves and 17 to 33% of potato leaves are available for producing energy /28/.
The amounts of beet and potato leaves for 2000 are calculated using harvest quantities (FAOSTAT; arithmetic mean of crop years 1998 to 2002 /26/) and a specific root- (or tuber-) to-leaf ratio.
The extrapolated biogas potential of beet and potato leaves for 2010 and 2020 is based on the estimate of country-specific food consumption (see section 3.3.2). The specific root- (or tuber-) to-leaf ratio is assumed to remain constant.

Calculation of the biomass potential by bio-chemical conversion with the following data:

	Beet leaves	Potato leaves
Biogas revenue:	0,48 m³/kg oTS	0,72 m³/kg oTS
oTS-content :	10 %	20 %
Heating value:	21,4 MJ/m³	21,4 MJ/m³

Brewing residues

Brewing residues that can be used to produce biogas include spent grain, yeast and hot wort and cool wort. We assume that 25 to 40% of these residues can be used to produce energy to account for the portion that is used as a material, such as livestock feed /29/. The volume of beer brewed is calculated from hops processing, as there are no brewing data available for the individual European countries. The quantity of hops processed is calculated from hops cultivation, if available (FAOSTAT, mean value of 1998 to 2002 /261), and the balance of hops imports and exports (EUROSTAT 2000 /30/). Although the amount of land under hops cultivation in the EU-15 countries declined by over 20% in the past 10 years, beer production increased due to better technology and fewer bitter beers. Calculations assume 100 g hops/hl beer.
The potential of brewing residues is assumed to remain constant for 2010 and 2020.

Calculation of the biomass potential by bio-chemical conversion with the following data:

Biogas revenue: 0,70 m³/kg oTS

oTS-content : 18 %

Heating value: 21,4 MJ/m³

Residues from grape pressing

Pomace (skins, seeds, stems, etc.) left over from grape pressing can be used to produce biogas. It is also used to produce pomace brandies and wine due to its relatively high sugar content and acidity. Pomace can also be used as fertiliser and feed in agriculture. We therefore assume that only 10 to 20% of pomace is actually available for biogas production /29/.
The amount of pomace is calculated from wine production statistics (EUROSTAT 2000 /31/). Around 25 kg of pomace are produced per hectolitre of wine.
The potential from grape pressing residues is assumed to remain constant for 2010 and 2020.

Calculation of the biomass potential by bio-chemical conversion with the following data:	
Biogas revenue:	0,67 m³/kg oTS
oTS-content :	42 %
Heating value:	21,4 MJ/m³

Residues from sugar production

Sugar production creates by-products in the form of treacle and beet pulp. Some of the beet pulp is mixed with treacle, dried and pressed into pellets, which are used as high-energy feed. Treacle is used as a syrup for livestock feed and in yeast plants and distilleries. These uses of the by-products reduce the volume available for biogas production considerably (approximately 1% of beet pulp and approximately 10% of treacle) /29/.
The potential for energy production in 2000 is calculated based on harvest quantities of sugar beets (FAOSTAT 2000 /26/) and 17% sugar content of beets, which is assumed to remain constant. Around 450 kg of beet pulp and 215 kg of treacle are produced for each ton of sugar produced.
The residues from sugar production available for biogas production are assumed to remain constant for 2010 and 2020.

Calculation of the biomass potential by bio-chemical conversion with the following data:	
Biogas revenue:	0,42 m³/kg oTS
oTS-content :	76 %
Heating value:	21,4 MJ/m³

Slaughterhouse by-products and meat processing residues

Certain slaughterhouse by-products resulting from slaughtering and processing can be used as substrate or co-substrate in biogas plants when legal regulations[22] are followed. Ninety percent of slaughterhouse by-products consist of stomachs and rumens, pluck and mucus and up to 10% fat. One-third to two-thirds of these by-products are assumed to be able to be used to produce energy.
Figures on slaughterhouse by-products are based on the number of slaughtered animals (FAOSTAT 2000 /27/) and specific waste quantities for each species. Potential losses (animals that expire without being slaughtered) are not taken into account.
The potential from slaughterhouse by-products is assumed to remain constant for 2010 and 2020.

Calculation of the biomass potential by bio-chemical conversion with the following data:	
Biogas revenue:	0,53 m³/kg oTS
oTS-content :	14,9 %
Heating value:	21,4 MJ/m³

Waste water from the milk processing industry

Waste water from the food and luxury food industry can be used to produce energy in a biogas plant. Only waste water from the milk processing industry is included in this study due to its relevance. Calculations assume that around 50% of waste water can be used to produce energy.

As there are no specific statistics on waste water from the milk processing industry, the ratio of cow's milk collected by dairies to waste water produced for Germany is applied to the other European countries (0.1 m^3 waste water/t cow's milk /281). Goat's and sheep's milk (around 2% of all milk collected) are not taken into account.
The waste water volume from the milk processing industry is assumed not to undergo any significant changes for 2010 and 2020.

Calculation of the biomass potential by bio-chemical conversion with the following data:	
Biogas revenue:	0,31 m³/kg oTS
oTS-content :	6 %
Heating value:	21,4 MJ/m³

Sewage sludge
Waste water treatment produces sewage sludge, which can be used thermo-chemically or bio-chemically. This study assumes that at least the volume that is already used for combustion can be used to produce energy. The maximum that can be used to produce energy is the amount that is produced less the amount currently used (agricultural use and composting).
EUROSTAT provides data on the amount of sewage sludge and its current use and disposal /32/.
The amount of sewage sludge is assumed to remain constant for 2010 and 2020.

Calculation of the biomass potential by thermo-chemical conversion with the heating value: 11 MJ/kg

Municipal waste and landfill gas
Organic municipal waste can be used in different ways: in thermo-chemical conversion (combustion), bio-chemical conversion of the separately recorded biogenic category in special fermentation plants and bio-chemically through the use of the gas from storing waste in landfills. In the following the volume and quality of waste stored in landfills is assumed to remain constant over time. In other words, no significant changes are expected in landfill production over the years. The entire landfill gas potential of all possible stored waste of the reference year is allocated to the reference year. The potential of landfill gas from waste from earlier years is not taken into account. Combustion is considered the upper limit for energy potential and landfill gas use the lower limit for determining the fuel potential from municipal waste.

The fuel potential of municipal waste including landfill gas use is assumed to remain constant from 2000 to 2010 and 2020.

Calculation of the biomass potential by thermo-chemical conversion with the heating value: 7,9 MJ/kg

Combustion
The energy potential for the thermo-chemical conversion of the biogenic portion of municipal waste is based on the total amount of waste for 2000, which is aggregated in the statistics /33/. Separate categories (such as paper), if data are available, are not taken into account. Forty percent of all waste for all countries is assumed to be organic /111/. An average heating value of 7.9 MJ/kg is assumed. Marginal double counts (wood waste also has potential as waste wood) are not taken into account in the potential calculation.

Landfill gas production
Landfill gas is produced in landfills for domestic waste (shortly after waste is added to the landfill) by microbiological decomposition. The amount of landfill gas is determined by several factors. The landfill volume and composition have a considerable influence on the amount of landfill gas. Other

factors affecting landfill gas production include the temperature, water content, structure of the landfill, conversion state of the landfill, start of degasification, gas collection rate, and type and time of surface sealing /75/. This list demonstrates that estimating the potential involves many uncertainties. The specific amount of landfill gas varies greatly and ranges between 120 to 300 m3 of landfill gas per 1 t of domestic waste /75/.

The potential is derived in this project based on the amount of mixed municipal waste occurring in 2000 /33/. All waste is assumed to be stored in landfills and thus available 100% as landfill gas potential. An average gas formation rate of 180 m3 landfill gas/t of municipal waste and an average gas collection rate of 50% are assumed /75/. The result is the total amount of landfill gas that can technically be used based on the volume stored in 2000. Note that the total gas volume does not occur in one single year. Instead it is distributed over a long period. The heating value of the landfill gas depends greatly on the methane content and thus varies greatly. The energy potential was calculated using an average heating value of 15 MJ/m3 /62/.

Residues that are not taken into account

In addition to the categories already mentioned, park maintenance and landscaping create large amounts of residues. These cannot be shown satisfactorily, however, due to the variety of reserves and maintenance activities and numerous gaps in the data and the present knowledge base. Preparing these biomasses is comparatively expensive, with the result that they can only be used for targeted measures. Consequently, they are generally insignificant under present conditions. Other residues not considered include production residues from food processing (seeds/stones, glumes, peels, etc.). These residues include inedible cereals, which are expected to increase due to increased

consumer protection (mycotoxin limits). The data have thus far made it difficult to formulate quantitative conclusions for the European level.

ANNEX 5: List of German legal and technical regulations, quality requirements and application information affecting the use and application of compost

A. Legislation

Loop Management and Waste Law (KrW- / AbfG) - for the promotion of environmentally friendly disposal of wastes from 09/27/07, Federal Law Gazette I page 2705, last amended through article 2 G as of 07/19/07, Federal Law Gazette I page 1462.

Federal Law on Soil Protection (BBodSchG), Law for the protection against harmful structural changes of the soil and for the remediation of contaminated land as of 03/17/98, Federal Law Gazette I page 502, last amended through article 3 G as of 12/09/04, Federal Law Gazette I page 3214.

Biowaste Ordinance (BioAbfV), Ordinance about the utilisation of biowastes on soils used in agriculture, forestry and gardening as of September 21, 1998, Federal Law Gazette I page 2955, last amended through article 5 V as of 10/20/06, Federal Law Gazette I page 2298.

Federal Law on Soil Protection (BBodSchG), Federal Law on Soil Protection and Contaminated Land Ordinance as of 07/12/19999. Federal Law Gazette I page 1554, last amended through article 2 V as of 12/23/2004, Federal Law Gazette I page 3758.

The Federal Mining Law (BBergG) as of 08/13/1980 Federal Law Gazette I page 1310, last amended through article 11 of the law as of 12/09/2006, Federal Law Gazette I page 2833.

Landfill Ordinance (DepV), ordinance about landfills and long-term storage as of 07/24/2002 Federal Law Gazette I page 2807, last amended through article 2 V as of 12/13/2006 Federal Law Gazette I page 2860.

Landfill Utilisation Ordinance (DepVerwV), ordinance about the utilisation of wastes on landfills aboveground as of 07/25/2005, Federal Law Gazette I page 2252, last amended through article 3 V as of 12/13/2006, Federal Law Gazette I page 2860.

Fertiliser Ordinance (DüMV), ordinance about the placing of fertilisers on the market, soil additives,growing media and plant additives as of 11/26/2003, Federal Law Gazette I No. 57, pages 2373 – 2437.

Fertiliser Ordinance (DüMV), ordinance about the application of fertilisers, soil additives, growing media and plant additives following the principle of good expert practice at fertilising as amended and promulgated on February 27, 2007, Federal Law Gazette I No. 7, pages 221 – 243.

Guidelines for the permission of mining dumps in the area of mining supervision, minister sheet North-Rhine-Westphalia (MBl. NW), as of July 13, 1984, page 931 ff.

State of Thuringia guidelines for potassium salt dumps, guideline for the covering and vegetation of potassium salt dumps in the State of Thuringia - Potassium Salt Dump Guideline - as of 18 April 2002, Government Gazette No. 19/2002, page1539 ff.

Administrative assistance to §12 Federal Law on Soil Protection and Contaminated Land Ordinance of the Federal State Joint Venture Soil (LABO) and the involvement of the State Joint Venture Waste ((LAGA) and Water (LAWA) and the State Commission Mining (LAB) as of 09/11/2002.

Data Sheet 20 of the State Joint Venture Waste, requirements for the material utilisation of mineral wastes - Technical Rules - part I General Part as of 11/06/2003, part II Technical Rules for Utilisation, TR Soil as of 11/05/2004.

B) German Branch Technical Guidelines DIN

DIN 18 915 Vegetation Technology in Landscaping, Land Cultivation, 2002. DIN German Institute of Standards e.V., Berlin.

DIN 18 916 Vegetation Technology in Landscaping, Plant and Plant Cultivation, 2002, DIN German Institute of Standards e.V., Berlin.

DIN 18 917 Vegetation Technology in Landscaping, Lawn and Seed Cultivation, 2002, DIN German Institute of Standards e.V., Berlin.

DIN 18 918 Vegetation Technology in Landscaping, Biological Safety Construction, 2002. DIN German Institute of Standards e.V., Berlin.

DIN 18 919 Vegetation Technology in Landscaping, Development and Maintenance of Green Land, 2002. DIN German Institute of Standards e.V., Berlin.

DIN 18 731 Soil Structure - Utilisation of Soil Material, Land Cultivation, 2002. DIN German Institute of Standards e.V., Berlin.

DIN 11 540 Peat and Peat Products. Technic Terms of Delivery, Nature of Test Procedures, 2005. DIN German Institute of Standards e.V., Berlin.

CEN (German DIN EN) 12 580 Soil Improving Means and Growing Media, 1999. German Institute of Standards e.V., Berlin.

c) Additional Specifications of the FLL - Research Society for Development of Landscapes Landscaping e.V., Bonn.

FLL Recommendations for Tree Nurseries, part 1. Planning, Planting, Maintenance Issue 2005. FLL - Research Society for Development of Landscapes Landscaping e.V., Bonn.

FLL Recommendations for Tree Nurseries, part 2. Preparing Sites for the Cultivation of New Plants Issue 2004. FLL - Research Society for Development of Landscapes Landscaping e.V., Bonn.

FLL Guidelines for the Planning, Realisation, and Maintenance of Roof Cultivation, Issue 2002. FLL - Research Society for Development of Landscapes Landscaping e.V., Bonn.

FLL Guidelines for the Planning, Realisation, and Maintenance of Façade Cultivation with Green, Issue 2002. FLL - Research Society for Development of Landscapes Landscaping e.V., Bonn.

FLL Guidelines for the Planning, Realisation, and Maintenance of Indoor Green, Issue 2002. FLL - Research Society for Development of Landscapes Landscaping e.V., Bonn.

FLL, Description of Fertiliser Directory, Issue 1999.. FLL - Research Society for Development of Landscapes Landscaping e.V., Bonn.

FLL-Recommendations for the Greening of Problematic Areas Issue 1998.. FLL - Research Society for Development of Landscapes Landscaping e.V., Bonn.

FLL-Recommendations for the Construction and Maintenance of Gravel Lawn, Issue 2000. FLL - Research Society for Development of Landscapes Landscaping e.V., Bonn.

FLL-Recommendations for the Planning, Performance, Maintenance of Paved Areas to be covered with Green, Issue 2003.. FLL - Research Society for Development of Landscapes Landscaping e.V., Bonn.

FLL-Recommendations for the Maintenance and Use of Outdoor Sports Facilities, Issue 2006. FLL - Research Society for Development of Landscapes Landscaping e.V., Bonn.

FLL-Recommendations for the Planning, Construction and Maintenance of Outdoor Riding Rings Issue 2007. FLL - Research Society for Development of Landscapes Landscaping e.V., Bonn.

FLL-Recommendations for the Construction of Golf Courses, Issue 2000. FLL - Research Society for Development of Landscapes Landscaping e.V., Bonn.

FLL-Guidelines for the Planning, Performance and Maintenance of Adequate Woods to be planted in Settlement Areas, Issue 1999.. FLL - Research Society for Development of Landscapes Landscaping e.V., Bonn.

FLL-Quality Requirements and Recommendations for the Application of Organic Mulch Material and Composts in Landscaping, Issue 1994.. FLL - Research Society for Development of Landscapes Landscaping e.V., Bonn.

ZTV = Technical Regulation in Germany for the Replanting of Big Trees - Additional Technical Contract Conditions and Guidelines for the Replanting of big Trees and big Woods, Issue 2005. FLL - Research Society for Development of Landscapes Landscaping e.V., Bonn.

ZTV-Vegetation Substratum, Additional Technical Contract Conditions for the Production and Application of improved Vegetation Substratum, Issue 2002. FLL - Research Society for Development of Landscapes Landscaping e.V., Bonn.

D) Quality Standards

Quality Standards for Bark in Plant Cultivation, Quality Assurance RAL-Quality Label 250, Issue 2001. RAL German Institute for Quality Assurance and Labelling e.V., Sankt Augustin.

Quality Standards for Compost, Quality Criteria and Guidelines for Fresh Compost, Mature Compost, Mulch Compost, Substrate Compost. Quality Assurance RAL-Quality Label 251, Issue 2007. RAL German Institute for Quality Assurance and Labelling e.V., Sankt Augustin.

Quality Standards for Growing Media. Quality Assurance RAL-Quality Label 252, Issue 2006. RAL German Institute for Quality Assurance and Labelling e.V., Sankt Augustin.

Quality Standards for Roof Substrates. Quality Assurance RAL-Quality Label 253, Issue 2004. RAL German Institute for Quality Assurance and Labelling e.V., Sankt Augustin.

Quality Standards for Original Material of Substrates. Quality Assurance RAL-Quality Label 254, Issue 2004. RAL German Institute for Quality Assurance and Labelling e.V., Sankt Augustin.

Quality Standards for Flower Mould. Quality Assurance RAL-Quality Label 255, Issue 2000. RAL German Institute for Quality Assurance and Labelling e.V., Sankt Augustin.

Quality Standards for Tree Substrates. Quality Assurance RAL-Quality Label 259, Issue 2006. RAL German Institute for Quality Assurance and Labelling e.V., Sankt Augustin.

Special Quality Standards of Quality Assurance for Agricultural Waste Utilisation (QLA) for Aerobically Treated Solid Wastes (Composts), Issue 2005, Association of German Agricultural Research Institute (VDLUFA), German Association for Water Management, Waste Water And Waste e.V. (ATV-DVWK).

ZVG and BGK - Recommendations for Compost Application. Soil Improvement for Lawn Planting, 2002, BGK Federal Compost Quality Assurance Organisation e.V., Cologne, ZVG German Horticulture Association e.V., Bonn.

ZVG and BGK - Recommendations for Compost Application. Soil Improvement for the Cultivation of Planting Areas, 2002, BGK Federal Compost Quality Assurance Organisation e.V., Cologne, ZVG German Horticulture Association e.V., Bonn.

ZVG and BGK - Recommendations for Compost Application. Cultivation of Lawn and Planting Areas, 2002, BGK Federal Compost Quality Assurance Organisation e.V., Cologne, ZVG German Horticulture Association e.V., Bonn.

ZVG and BGK - Recommendations for Compost Application. Filling of Plant Holes at Planting of Woods, 2002. BGK Federal Compost Quality Assurance Organisation e.V., Cologne, ZVG German Horticulture Association e.V., Bonn.

ZVG and BGK - Recommendations for Compost Application. Filling of Lawn Grating Bricks, 2002, BGK Federal Compost Quality Assurance Organisation e.V., Cologne, ZVG German Horticulture Association e.V., Bonn.

ZVG and BGK - Recommendations for Compost Application. Mulching, 2002, BGK Federal Compost Quality Assurance Organisation e.V., Cologne, ZVG German Horticulture Association e.V., Bonn.

ZVG and BGK - Recommendations for Compost Application.in Ornamental Horticulture, 2002. BGK Federal Compost Quality Assurance Organisation e.V., Cologne, ZVG German Horticulture Association e.V., Bonn.

ZVG and BGK - Recommendations for Compost Application in Vegetable Growing, 2002, BGK Federal Compost Quality Assurance Organisation e.V., Cologne, ZVG German Horticulture Association e.V., Bonn.

ZVG and BGK - Recommendations for Compost Application. Soil Improvement in the Tree Nursery, 2002, BGK Federal Compost Quality Assurance Organisation e.V., Cologne, ZVG German Horticulture Association e.V., Bonn.

ZVG and BGK - Recommendations for Compost Application. in the House and Family Garden, 2002, BGK Federal Compost Quality Assurance Organisation e.V., Cologne, ZVG German Horticulture Association e.V., Bonn.

ANNEX 6: National experts and contacts who provided information in the context of this study

AT	KEB Compost - Consulting & Development Technical Office Agriculture Dipl.Ing. Florian Amlinger Hochbergstr. 3 A-2380 Perchtoldsdorf	
BE	Vlaco Ms Elke Vandaele Kan. De Deckerstraat 37 2800 MECHELEN BELGIUM	
BG	Liliya Evtimova Ministry of Environment and Waters Water Protection Department Maria Luisa, blvd. 22 1000 Sofia Bulgaria	
CY	Michalis Partis Chief Inspector of Solid Waste Management Sector Ministry of Interior CY- 1453 Nikosia	
CZ	Ing. Lucie Valentová, Ph.D. ZERA Zemědělská a ekologická regionální agentura V. Nezvala 977 Náměšť n. O.	Pokorna, Alzbeta Ministry of the Environement Vrsovicka 65 CZ-110 00 Praha 10
DE	Bundesgütegemeinschaft Kompost e.V. (BGK) Dr. Stefanie Siebert Von-der-Wettern Str. 25 51149 KÖLN-GREMBERGHOVEN GERMANY	
DK	Danish Waste Management Association (**DAKOFA**) Mr. Henrik Wejidling Vesterbrogade 74, 3. DK 1620 V **Copenhagen**	
EE	Robert Kiviselg Keskkonnaministeerium Jäätmeosakonna peaspetsialist	
ES	Francesc Giró i Fontanals Departament de Gestió de Matèria Orgànica Agència de Residus de Catalunya Dr. Roux, 80 08017 Barcelona	
FI	YTV Jätehuolto SAD Avfallshantering YTV Waste Management Region Helsinki PL 521, 00521 HELSINKI FINLAND	
FR	ADEME - Direct. Agriculture and Bioenergy Ms Fabienne David/Ms Isabelle Feix Siége Social 2square La Fayette B.P. 406 49004 ANGERS CEDEX 01 FRANCE	

GR	Katia Lasaridi	
HU	Hungarian Compost Quality Assurance Association Dr. Alexa Laszlo, 2100 GÖDÖLLÖ HUNGARY Pater K.u. 1	
IE	Percy Foster Executive Administrator Cré - Composting Association of Ireland Teo Business Innovation Centre Institute of Technology Campus Ballinode, Sligo Ireland	
IT	Gruppo di Studio sul Compostaggio e la gestione Integrata dei Rifiuti Scuola Agraria del Parco di Monza Enzo Favoino Viale Cavriga 3, I-20052 Monza (MI) Italy	
LT	United Partners Mr. Vidas Andriks Laisves pr. 3 LT-04215 VILNIUS LITHUANIA	
LU	Liette MATHIEU Administration de l'Environnement Division des Déchets 16, rue Eugène Ruppert L - 2453 Luxembourg	GLux s.a r.l. Klaus Gröll B.P. 44 3701 RUMELANGE LUXEMBOURG
LV	LASA Waste Management Association of Lativia Dr Ruta Bendere Kursu Str. 9 - 2 1006 RIGA LATVIA	
MA	Malta Environment & Planning Authority Mr. Kevin Mercieca St. Francis Ravelin Floriana Malta	
NL	Dutch Waste Management Organisation DWMA Mr. Evert-Jan Verbunt Hugo de Grootlaan 39 NL-5223 LB 's-Hertogenbosch NETHERLANDS	BVOR Dr.. Paul J.M. Sessink Agro Business Park 38 6708 PW WAGENINGEN NETHERLANDS
PL	Institute of Soil Science and Plant Cultivation Grzegorz Siebielec Czartoryskich 8 PL 24-100 PULAWY Poland	
PT	New University of Lisbon Environmental Engineering Department Professor Ana Silveira Quinta da Torre 2829-516 CAPARICA PORTUGAL	

RO	Brînduşa PETROAICA Director – Directorate for Waste and Chemicals National Environmental Protection Agency
SE	Avfall Sverige Hanna Hellström Prostgatan 2 211 25 MALMÖ SWEDEN
SI	Cabrijan, Marijana Cabrijan, Marijana CISTO MESTO PTUJ D.O.O. DORNAVSKA CESTA 26 2250 PTUJ Slovenija
SK	Maroš Záhorský Ministry of the Environment of the Slovak Republic Waste Management Department Námestie L. Štúra 1, 812 35 Bratislava
UK	TCA The Composting Association Dr. Jane Gilbert, Ms Emily Nichols 3 Burystead Place Wellingborough Northamptonshire NN8 1AH UNITED KINGDOM

ANNEX 7: Questionnaire sent to national experts in biowaste management and composting

European Compost Network ECN

An Initiative of the ORBIT ASSOCIATION

15.10.2007

QUESTIONNAIRE FOR EU END OF WASTE STANDARDS PROJECT

Dear Colleagues and Compost Friends,

You might know that Revision of the Waste Framework Directive - in order to create markets for recycled materials - demands End-of-Waste EoW standards for some material streams e.g for compost. The Institute of Prospective Technology Studies IPTS of JRC is contracted by the Commission to develop the concept and methodology for this End-of-Waste Standards.

In this respect ECN is contracted with a study for the fundamental input to the end of waste compost case study including data about the material flows of the most important types of organic residues and wastes including their properties which are suitable for the production of compost.

The outcome of the study should give JRC a survey of a reasonable set of criteria for EoW, an idea of the quality parameter and requirements, their levels and the implication of the different levels on the compost production, the products, compost use and markets.

In order to provide the data for the study we developed the questionnaire below. We are quite sorry but the timeline is very short and we would like to ask you to fill in this questionnaire until the DEADLINE 6th of November. Don't hesitate to contact us in case of problems with the questionnaire and we can arrange a telephone meeting. As assistance you will find various European studies including country specific information in the web at www.composting.net/eow

Thank you very much for your support.

With kind regards

Josef Barth
Managing Director

Florian Amlinger
Head of WG European Affairs

End of Waste Project – Questionnaire Country ……

The "Tasks" refer to the report which we have to deliver. The year 2005 will be used as far as possible as reference year in order to be able to compare data.

Task 1.1 & 1.2: Denomination of *Compost classes* & related legislation, standard, protocols?

Class designation/name		Short description of the statutory legislation or voluntary monitoring scheme/protocol* [Title in English & n°]:			Description of the class; [which quality criteria and level is defined with this specific compost class; what is the implication for the compost declaration, and the use?]
Original language	English				
			statutory		
			voluntary		
			statutory		
			voluntary		
			statutory		
			voluntary		
			statutory		
			voluntary		
			statutory		
			voluntary		
			statutory		
			voluntary		
			statutory		
			voluntary		
			statutory		
			voluntary		

Task 1.3: Compost *approval* and *certification* scheme

The question here is:

What is the regulatory scheme under which composts are approved and certified to be marketed or used ?

Legislation/statutory or voluntary scheme/protocol or product licensing* [title in English & number n°]:										Statutory ?	
										Voluntary ?	
Is there an obligatory external inspection & approval system ?	YES		If Yes **who is in charge of carrying out the scheme:**								
	NO		**Competent Authority**		**Acknowledged laboratory**		**Private QAS-Organisation**		**Other:**		
What are the key elements and criteria of the system?*											
Who may do the sampling for product certification?	**Compost producer**		**Competent Authority**		**independent laboratory**		**Private QAS-Organisation**		**Other:**		

*** e.g.: final product quality analyses; compliance with quality criteria; inspection with checklist on process management and operation; written records, monitoring systems and frequency, documentation system etc.**
QAS = Quality assurance scheme

Are there any data/surveys available about compost quality the following the regulatory schemes?

Please specify and send the files.

Task 1.5: Input materials dedicated for the production of compost

Statutory legislation or volun-tary scheme/protocol* [title in English & n°]:	_____.	Statutory ?	
		Voluntary ?	

*** also indicate type and framework of the provision where the input materials for composting are defined [waste legislation, fertiliser legislation, national standard or voluntary protocol within a Quality Assurance Scheme]**

Please tick with a ✓ if this waste-material is allowed for producing compost in your country; add an explanation if necessary

	Type and indication of suitable waste material	EU Waste Catalog No.	Corresponding waste designation of the European Waste Catalogue [EWC]	✓?
1.1 High quality waste for biological treatment from exclusively vegetable origin (NO *Animal By Products or meat*)				
1.1.01	Mixtures from organic wastes according to 1.1 =[this corresponds to VFG = vegetable, fruit & garden waste sperately collected from households]	n.s.		
1.1.02	Green cuttings, leaves	20 02 01	Compostable waste	
1.1.03	Vegetable, fruit and flower waste	20 02 01 02 01 03	Compostable waste Waste from vegetable tissue	
1.1.04	Bark	03 01 01[8] 03 03 01	Bark and cork waste Waste from wood preparation and the production of cellulose, paper and cardboard	
1.1.05	Wood	03 01 05	Saw dust, wood shavings, cuttings, wood, chipboard, veneer with the exception of those which belongs to 03 01 04	
1.1.06	Wood, cuttings of tree and bushes	20 01 38 20 02 01	Wood with the wood with the exception of those which belongs to 20 01 37 Biodegradable waste	
1.1.07	Wood, from the processing of untreated wood	03 01 05	Saw dust, wood shavings, cuttings, wood, chipboard, veneer with the exception of those which belongs to 03 01 04	
1.1.08	Wooden oversize fraction from screening compost for reuse in composting	---	--- missing	
1.1.09	Harvest and processing residues	02 01 02[9]	Waste from vegetable tissue	
1.1.10	Food residues	02 01 02 02 03 04[10]	Waste from vegetable tissue Materials not suitable for consumption or processing	
1.1.11	Press and filter residues of the food and fooder production like			
1.1.11.01	- marc, seeds, skins,	02 03 01	Sludges from washing, cleaning, peeling, centrifuging and segregation processes	
1.1.11.02	- crushed grain or process residues	02 03 01	Sludges from washing, cleaning, peeling, centrifuging and segregation processes	
1.1.11.03	- fruit, grain and potato drafts	02 03 01	Sludges from washing, cleaning, peeling, centrifuging and segregation processes	
1.1.12	Spoilt seeds	02 01 02	Waste from vegetable tissue	
1.1.13	Sub-aqua plants; sea weed	02 01 02	Waste from vegetable tissue	
1.1.14	Cemetery waste	20 02 01	Biodegradable waste	
1.1.15	Micelles from antibiotics production	16 03 06	Organic waste with the exception of those listed under 16 03 05	
1.1.16	Biodegradable packaging	02 03 04[11]	Materials not suitable for consumption or processing	

[8] **Waste from wood processing and the production of plats and furniture**
[9] **Waste form agriculture, horiculture, fish farming, forestry, hunting and fishing**
[10] **Waste from the preparation and processing of fruit, vegetables, grain, cooking oil, cacao, coffee, tea and tabaco, from canned food production, yeast production and preparation of melasse**
[11] **Waste from preparation and processing of fruit, vegetables, grain, cooking oil, cacao, coffee, tea and tabaco, from canned food production, yeast production and preparation of melasse**

	Type and indication of suitable waste material	EU Waste Catalog No.	Corresponding waste designation of the European Waste Catalogue [EWC]	✓?
1.1.17	Cooking oil and fats, grease trap residues of vegetable origin	02 03 04 20 01 25	Materials not suitable for consumption or processing Cooking oil und fat	
1.1.18	Silage leachate water	02 01 99	Waste not further specified	
1.1……	…….			
1.1……	…….			
1.2 Further waste for biological treatment exclusively from vegetable origin *[these wastes might need additional approval of origin and involved processes]*				
1.2.1	Eventually slightly polluted sludges from the food and fodder industry exclusively of vegetable origin	02 03 01 02 03 05	Sludges from washing, cleaning, peeling, centrifuging and segregation processes Sludges from company owned waste waste treatment	
1.2.2	Eventually slightly polluted pressfilter, extraction and oil seed residues from the food and fodder industry exclusively of vegetable origin	02 03 04[12]	Materials not suitable for consumption or processing	
1.2.3	Digestion residues from the anaerobic treatment of the waste classes 1.1 and 1.2	19 06 06	Digestion residues/-sludge from the anaerobic treatment of animal and vegetable waste	
1.2……	…….			
1.3 Additives for composting *[added in minor quantities (up to 10 – 15 % at maximum) in order to improve the composting process, humification and maturation]*				
1.3.1	Rock dust	01 03 08 01 04 09	Dusty and powdery waste except those belonging to 01 03 07 Waste from Sand and clay	
1.3.2	Lime	02 04 02	Calcium carbonate sludge not according to specification	
1.3.3	Bentonite			
1.3.4	Ash from combustion of plant tissue			
1.3.5	Excavated soil			
1.3…..				
1.3…..				
1.4 High Quality Waste for biological treatment with parts of animal origin				
1.4.1	Kitchen and food waste from private households with animal residues	20 01 08	Biologically degradable catering waste (To be utilised only if compatible with the provisions of the Animal By-products regulation)	
1.4.2	Kitchen and food waste from central kitchens and catering services with animal residues	20 01 08	Biologically degradable catering waste (To be utilised only if compatible with the provisions of the Animal By-products regulation)	
1.4.3	Former foodstuffs of animal origin			
1.4.4	Eggshells			
1.4.5	Sludges from the food and fodder industry with parts of animal origin			
1.4.6	Pressfilter, extraction and oil seed residues from the food and fodder industry with parts of animal origin			
1.4.7	Spoilt feeding stuff of animal origin from fodder producing industry			
1.4.8	Residues from horn, hoof, hair, wool, feathers			
1.4.9	Sludge and press-filter residues from slaughter houses and fattening industries			
1.4.10	Pounch waste			
1.4.11	Solid and liquid manure			
1.4.12	Gelatine waste			
1.4.13	Digestion residue of anaerobic digestion of			

[12] **Waste from preparation and processing of fruit, vegetables, grain, cooking oil, cacao, coffee, tea and tabaco, from canned food production, yeast production and preparation of melasse**

	Type and indication of suitable waste material	EU Waste Catalog No.	Corresponding waste designation of the European Waste Catalogue [EWC]	✓?
	materials of waste group 1.4 rendered fat and cooking oil of animal origin			
1.4.14	Digestion residue of anaerobic digestion of milk and dairy residues			
1.4.15	Digestion residue of anaerobic digestion of slaughter house waste and by-products			
1.4.16	Digestion residue of anaerobic digestion of skins, hides and furs			
1.4.....	…….			
1.4.....	…….			
1.5 Further waste for biological treatment for biological treatment with parts of animal origin *[these wastes might need additional approval of origin and involved processes]*				
1.5.1	Municipal sewage sludge			
1.5....	…..			
1.5....	…..			
1.6 Mixed municipal solid waste treated in a mechanical biological treatment plant or a mixed waste composting plant				
1.6.1	Municipal solid waste – not source separated			

Is there any waste-material which is specifically EXCLUDED for composting

	Type and indication of excluded waste material	Background for exclusion (e.g. plant diseases, ABPR ..)

Task 1.8: Compost - *WASTE* or *PRODUCT*

In the description please explain:

- **General framework of the legislation ruling the waste or the product status of compost for recycling or marketing**
- **Key arguments why in your country compost is handled under the waste or the product regime respectively.**
- **Key criteria for the product status (if applicable)**
  e.g.:
  - **Input-List**
  - **Documentation**
  - **External quality approval by acknowledged *laboratory* or *quality assurance organisation***
  - **Quality parameter for final compost**
  - **Process parameter (sanitisation)**
  - **Criteria for product licensing, declaration and labelling**
  - **…….**

Legislation [title & n°]:	_____					
Compost is	WASTE?			PRODUCT?		*please tick*
Description of key criteria and arguments for being marketed as waste or product						

Task 1.9: Accompanying *national* legislation for compost production and use

Please give a short description of accompanying national legislations, standards and protocols which affect biowaste recycling, management, compost production and use.
These might include e.g.:

- **Licensing and permits with environmental requirements for composting plants (BAT)**
- **National implementation of hygiene requirements of the Regulation (EC) 1774/2002 Animal By Products Regulation.**
- **Application rules** ➔ if not already covered in 1.10
  - **Fertiliser/Fertilising Law**
  - **Water protection**
  - **Nitrates Directive and limitation for Nitrogen/Phosphorous**
  - **Soil protection regulations**
  - **Cross compliance**
  - **Subsidies Programmes in Agriculture / Environmental Programmes**
- **……..**

Legislation [title in English & n°]:	
Main scope an area	
Description of key criteria affecting biowaste/compost	

Task 1.10: Legislation and standards for *compost use*

Please specify especially if legislation valid for the agriculture/food and other applications/non food area.

A) General rules

Type of regulation & validity [national / provincial / standard]	Legislation title & n° [in English !]	Requirements or restriction for the use of compost
1)		
2)		
3)		
EXAMPLE		
Federal Ordinance under the Waste Act; national	**Austrian Compost Ordinance; (BGBl. II 291/2001)**	**Compost= Product as long as it applied according to the following limitations which have to be indicated in the labelling:** **Agriculture/regular application: 8 t d.m./ha*y in average during 5 years** **Agriculture/one-time soil reclamation: 160 t d.m./ha*y ; once in 20 years** **Landscaping/regular application: 20 t –40 t in 3 years ; depending on heavy metal quality class.** **Landscaping/one-time soil reclamation: 200-400 t in 20 years depending on heavy metal quality class.** **Plantations: 40% (v/v) in soil mixtures for tree transplants** **Ho**

B) Specific application rules / restrictions depending of the *used input materials (COMPOST TYPE)*

Main sector	Type of used input materials	Descriptions of rules for application **[limitation of quantities; exclusion of specific application areas such as agriculture and food production etc.)**
Biowaste compost (BWC)	**From source separated household waste including organic wastes from food industries etc.**	
Green waste compost (GWC)	**From garden and park waste only**	
Mixed BWC and GWC	**If based on available data it cannot be distinguished you may give the amount for the entire BWC/GWC**	
Sewage sludge compost (SSC	**Sludge from municipal waste water treatment plants**	
Manure compost (MC)	**Processed predominantly from stable manure**	
Municipal Solid Waste compost (MSWC	**Processed from residual mixed household waste without source separation**	
Others……		

C) Specific application rules / restrictions depending of the *COMPOST CLASS* **[task 1.4]**

Class designation	Description of the class; [which quality criteria and level is defined with this specific compost class]	Descriptions of rules for application **[limitation of quantities; exclusion of specific application areas such as agriculture and food production etc.)**
Class:		
Class:		
Class:		
Class:		
Class:		
Class:		

Task 2.1: Amount of compost produced – classified for the different *compost types from different raw materials* (The treated annual amount of input materials is subject to Task 3)

Main sector	Type of used input materials	Quantity [tons]		Remark and forecast (Amount wiil increase, stable, decrease)
		Reference year: 2005	Latest estimation: YEAR: _ _ _ _	
Biowaste compost (BWC)	**from source separated household waste including organic wastes from food industries etc.**			
Green waste compost (GWC)	**from garden and park waste only**			
Mixed BWC and GWC	**If based on available data it cannot be distinguished you may give the amount for the entire BWC/GWC produced**			
Sewage sludge compost (SSC	**sludge from municipal waste water treatment plants**			
Manure compost (MC	**processed predominantly from stable manure**			
Municipal Solid Waste compost (MSWC	**processed from residual mixed household waste without source separation**			
Others……				
TOTAL				

Task 2.3: Amounts of compost used in the different *use types* and *sectors*

If concrete data are not available also a rough estimation is welcome

Total quantity of compost produced

1) Amount in EoW reference year 2005:_____tons

2) Latest estimation /investigation : year:_____; amount:_____tons

Main sector	Specific applications included in this sector	Estimated Range [% of production]		Remark
		Reference year: 2005	Latest estimation/ **statistics:** year: _____	
Agriculture [food]	Conventional agriculture **- Arable and grass land, vinyards, orchards, all field and field vegetable crops** **- bulky / large quantities**	**e.g 43 %**		
	Organic farming			
Horticulture and green house production	**vegetable production, ornamental plants, nurseries and similar**			
Landscaping	**Park and public gardens, residential garden construction**			
Blends	**Substrates,** **Growing media** **Potting soil** **For all purposes**			
Soil mixing companies	**Manufactured soils, Large quantities** **Organic fertiliser manufacturers**			
Land restoration	**Large quantities (Incl. brown fields, landfill reclamation etc.)**			
Wholesalers	**Bagged composts; retailers/supermarket etc.**			
Private /Hobby gardening	**Private customers for hobby gardening; direct sale at the compost plant**			
Mulch	**For soil cover**			
Export 1)	**Please specify/estimate as far as possible:** • **Country** • **Compost/product type** • **Quantities** • **Legal requirements/framework**			
Others				

1) EoW should open the European market for compost. Therefore we are especially interested in the import and export situation with compost

Task 2.5: Percentage of compost that has been produced in the nationally specified *compost quality classes* (e.g. heavy metal classes 1 and 2 or fresh and mature compost, if applicable).

If possible distinguish between the following main *compost types*:

- **Biowaste compost (BWC; from source separated household waste including organic wastes from food industries etc.)**
- **Green waste compost (GWC; from garden and park waste only)**
  - **If BWC and GWC cannot be specified you may give the data for the entire BWC/GWC samples or quantity respectively!**
- **Sewage sludge compost (SSC; sludge from municipal waste water treatment plants)**
- **Manure compost (MC; processed predominantly from stable manure)**
- **Municipal Solid Waste compost (MSWC; processed from residual mixed household waste without source separation)**
- **Others: .....**

***Compost Class*: please give the designation of the compost class (e.g. heavy metals - class 1) ans describe in the *explanation box* the type of classification.**

Please copy the template table for further compost types.

Compost Type:		Number of samples // OR / AND Total quantity [tons]	Compost Class:	Compost Class:	Compost Class: .....
Ref. Year: *2005*	**% of compost samples:**				
	% of total compost produced				
Most recent investigation	**% of compost samples:**				
Year:	**% of total compost produced**				
Source of information / reference:					
Explanation:					

Task 2.6: Range of *COMPOST PRICES* in the different *sectors*

Indicate the range of price in EURO per unit. Indicate the unit [t] or [m³] and the reference year you used.

Main sector	Specific applications included in this sector	from (low)	to (high)	… or mean	Unit: per [t] or [m³]
Agriculture [food production]	Conventional agriculture **- Arable and grass land, all field and vegetable crops** **- bulky / large quantities**				
	vineyards, orchards				
	Organic farming				
Horticulture and green house production	**vegetable production, ornamental plants, nurseries and similar**				
Landscaping	**Park and public gardens, residential garden construction**				
Blends	**Substrates** **Growing media** **Potting soil** **For all purposes**				
Soil mixing companies	**Manufactured soils Large quantities** **Topsoil mixes** **Organic fertiliser manufacturers**				
Land restoration	**(Incl. brownfields, landfill reclamation etc.), large quantities**				
Wholesalers	**Bagged composts;** **Retailers/supermarket etc.**				
Private /Hobby gardening	**Private customers for home gardening; direct sale at the compost plant**				
Mulch compost					
Others …..					

Task 3: Materials flows of the most important streams of organic residues

Organic material stream	**Amounts [tons] and year**
Mixed municipal solid waste MSW **National MSW waste statistics combined with waste composition analysis allow estimating material flows and potentials. Please specify the organic portion (e.g. 33 %) if a national waste composition analysis is available.**	
Organic kitchen waste **(separately collected fraction; if possible distinguishing household and non-household origin) Please specify if the kitchen waste is collected together with garden waste in bins.**	
Organic wastes from food preparation and processing	
Garden and park wastes	
Industrial/commercial organic waste	
Waste bark **from various sources (from wood processing, from pulp, paper and cardboard production)**	
Sewage sludge **from the treatment of urban waste water and anaerobic treatment sludges of municipal and similar waste If possible specify the** portion which is composted	
Sewage sludge **from the treatment of industrial waste water (distinguishing if possible betweevfood and non-food industries)**	
Agricultural organic residues **(If possible distinguish between animal faeces, urine, manure and plant-based agricultural wastes).**	
Others: ……..	

References for the information above (please quote):

Your contact details