

Good Practice Guide

How to comply with the EU Animal By-Products Regulations at Composting and Anaerobic Digestion Plants

European Compost Network ECN e.V.

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Glossary

ABP	Animal By-Products
ABP-IR	Regulation (EU) No 142/2011 - Animal By-Products Implementing Regulation
ABPR	Regulation (EC) No 1069/2009 – Animal By-Products Regulation
AD	Anaerobic Digestion
AT	Austria
BE	Belgium/Flanders
BSE	Bovine Spongiform Encephalopathy
cfu	Colony Forming Units
DE	Germany
<i>E. coli</i>	<i>Escherichia coli</i>
EC	European Community
EU	European Union
FL	Flanders
HACCP	Hazard Analysis and Critical Control Points
Hygienisation	Effective reduction or eradication of potential pathogenic organisms Also referred to as ‘sanitisation’
IE	Ireland
MS	Member States (of the European Union)
NO	Norway
Pasteurisation	Heating of material to a critical temperature for a minimum specified period of time to reduce the numbers of pathogenic micro-organisms
Prion	Proteinaceous Infectious Particle
Processing	Any action that substantially alters the initial product, including heating, smoking, curing, maturing, drying, marinating, extraction, extrusion or a combination of those processes
Reg	Regulation
Sanitisation	Effective reduction or eradication of potential pathogenic organisms Also referred to as ‘hygienisation’
TSE	Transmissible Spongiform Encephalopathy
Validation	Obtaining and evaluating evidence that the elements of a HACCP plan are effective
VFG	Vegetable, Fruit and Garden (compost)
Vlaco	Vlaco vzw, Vlaamse Compostorganisatie, Compost Organisation of Flanders

1 Introduction

1.1 Background

The Animal By-Product Regulation (ABPR) is a comprehensive piece of European legislation, covering all aspects relating to the collection, treatment, storage and use of animal by-products (ABPs). It was initially brought into force in 2002 (as EC 1774/2002), and has since been revised. The 2009 Regulation (EC No 1069/2009) lays down health rules as regards animal by-products and derived products not intended for human consumption, and is accompanied by the implementing Regulation (EU) 142/2011 (ABP-IR). Unfortunately there is no individual section covering all aspects of composting or treatment in anaerobic digestion plants within the Regulation, therefore the respective requirements are often hard to find and understand. Consequently, interpretation and implementation of the Regulation varies considerably between Member States (MS).

1.2 Aims of this Guide

This Guide is aimed at plant operators, consultants, providers of technology and authorities, providing information and guidance. It does not cover the ABPR in detail; however it sets out the key provisions required at composting and anaerobic digestion plants, describing how the Regulation can be proportionately and accurately implemented. The intention of this Guide is to make it easier to comprehend the structure and content of the specific obligations. It also sets out possible relaxations and exemptions for the processing of ABPs in composting and anaerobic digestion plants, without increasing risks to animal or public health or the environment. Details of some of the ways in which selected Member States have implemented the ABPR for composting and anaerobic digestion and to what extent they have made use of the possibility to apply national rules for certain animal by-products, are detailed in the appendices.

1.3 Terminology

The Animal By-Products Regulations contain a confusing array of terms, some of which are detailed in the glossary.

Within the Regulations, anaerobic digestion plants are termed 'biogas plants'. In line with current European terminology, we have referred to these facilities and processes as 'anaerobic digestion' plants within this Guide, and have only made reference to 'biogas plants' where directly quoting from the Regulation. The two terms can, of course, be used interchangeably.

2 Animal By-Products Regulation

The Animal By-Products Regulation (ABPR) consists of two Regulations, which are described below.

2.1 Regulation (EC) No 1069/2009 (ABPR)

This was adopted by the European Parliament and the Council on 21 October 2009, and came into force on the 4 March 2011. This Regulation consists of a total of 56 articles. Those of most importance for the collection and treatment/processing in composting and anaerobic digestion plants are summarised in Table 1.

Table 1 – Articles of relevance to composting and anaerobic digestion plants in Regulation (EC) No 1069/2009		
	Article	Article number
GENERAL PROVISIONS		
Common provisions	Subject matter, scope and definitions	1,2,3
	Obligations	4, 5
	Animal health restrictions	6
	Categorisation	9, 10
Disposal and use of animal by-products	Restriction on use	11
	Disposal and use	13,14
	Derogations	16-19
	Alternative methods	20
OBLIGATIONS OF OPERATORS		
General obligations	Collection, transport and traceability	21, 22
	Registration and approval	23, 24
	Own checks and hazard analysis and critical control points	29
Placing on the market	Animal by-products and derived products for feeding to farmed animals excluding fur animals	31
	Organic fertilisers and soil improvers	32
	Derived products regulated by certain other community legislation	33
	Other derived products	35-39
Import, transit and export		
OFFICIAL CONTROLS AND FINAL PROVISIONS		
	Official control	44-50
	Final provisions	

2.2 Regulation (EU) No 142/2011 (ABPR-IR)

This was adopted by the Commission on 25 February 2011, and is referred to within this Guide as ABP-IR. It implements Regulation (EC) No 1069/2009 and consists of a total of 37 articles divided into 10 chapters and 14 annexes. The articles of most importance for the collection and treatment/processing in composting and anaerobic digestion plants are summarised in Table 2.

In addition to the 25 February 2011 version of (EU) No 142/2011, a consolidated version was published on 19 August 2011, which incorporates an amendment Commission Regulation (EU) No 749/2011 of 29 July 2011. This amendment, however, does not affect composting or anaerobic digestion plants.

Table 2 – Articles and annexes of relevance to composting and anaerobic digestion plants in Regulation (EU) No 142/2011	
Article	Article number
General Provisions	5
Disposal and use of animal by-products and derived products	10
Derogation from certain provisions of Regulation (EC) No 1069/2009	
Authorisation of alternative methods	
Collection, transport identification and traceability	17
Registration and approval of establishments and plants	19
Placing on the market	22
Import, transit and export	
Official controls	32, 33
Final provisions	
Annex	Annex number
Restriction on the use of animal by-products	II
Transformation of animal by-products and derived products into biogas, composting	V
Standard format for applications for alternative methods	VII
Transport, identification and traceability	VIII
Organic fertilisers and soil improvers	XI

Copies of the Regulations can be downloaded from the European Commission's website:

http://ec.europa.eu/food/food/biosafety/animalbyproducts/index_en.htm

3 Categorisation of animal by-products

Animal by-products are classified into three categories which reflect the degree of risk they pose to human and animal health. The categories are *inter alia* defined according to their risk of entering the food chain, either directly or indirectly. Therefore, the possible options for further use or disposal of the material are associated with the particular Category to which they are assigned.

3.1 Categorisation of animal by-products

Category 1 materials are defined in Article 8 of the 2009 ABPR. They are animal by-products that present the highest risk of infection, such as those that may be contaminated with prion particles (which may cause diseases known as *transmissible spongiform encephalopathies*). They include Specified Risk Material (those parts of an animal considered most likely to harbour a disease such as the spinal cord), pet animals, zoo and circus animals and experimental animals.

Other material in this Category is catering waste that originates from international transport (i.e. outside of the EU).

Category 1 materials shall NOT be processed in composting or anaerobic digestion plants.

3.2 Category 2 material

Category 2 materials are defined in Article 9 of the ABPR. They are also high risk materials that are not fit for human consumption (e.g. manure) or remain of concern due to potential contamination with other potentially significant pathogens or substances e.g. pharmaceutical residues. It includes fallen stock, manure and digestive content. They may be derived from imported goods from outside the EU which do not meet all appropriate EU requirements or are residues collected from waste water at slaughterhouses. It is also the default status of any ABP not defined in the 2009 ABPR as either category 1 or category 3 material.

The most important Category 2 materials for the compost and anaerobic digestion sector are **manures** and **digestive tract content**. Secondly, in countries with prominent fishing and fish processing industries is **fish**.

A list of category 2 material is reproduced in Appendix 1.

3.3 Category 3 material

Category 3 material is defined in Article 10 of the 2009 ABPR, and constitutes an important feedstock for composting and anaerobic digestion. It includes:

1. products derived from healthy animal origin intended for, but not fit for human consumption;
2. products, that for commercial reasons, are not intended for human consumption, i.e. due to problems of manufacturing or packaging defects or other defects from which no risk to public or animal health arise, and

3. products that did not show any signs of disease communicable to humans or animals.

These characteristics have to be approved for all types of Category 3 materials, irrespective of their origin, be it a slaughter house, food or feeding stuff processing, retail, kitchen or any other origin (e.g. a farm). All types of hides, skins, hooves, wool, feathers, horns, hair, pig bristles, and raw milk are included. As long as it is not derived from international transport, catering waste is classed as a category 3 material.

A list of category 3 material is reproduced in Appendix 1.

Both Category 2 and 3 animal by-products may be processed in a composting or anaerobic digestion plant.

4 Traceability, identification and labelling

Operators shall ensure that Category 2 animal by-products are accompanied during transport by a commercial document. Category 3 **catering waste** can be collected and transported in accordance with national measures (see Section 5.1).

In the case of **manure**, the competent authority may authorise the transport between two points located on the same farm or between farms and users of manure within the same Member State without a commercial document or health certificate.

Operators consigning, transporting or receiving animal by-products or derived products shall keep records of consignments and related commercial documents or health certificates.

Colour-coded labelling during transport and storage shall be attached to the packaging, container or vehicle clearly indicating the category of ABP.

For:

- **Category 2 material other than manure and digestive tract content** – the label must be **yellow** colour-coded and be labelled as **“Not for animal consumption”**.
- **Category 3 material** – the label must be green colour-coded and be labelled as **“Not for human consumption”**

In the case of products intended for use as fertilisers and soil improvers it shall be labelled as: “Organic fertilisers or soil improvers/no grazing of farmed animals or use of crops as herbage during at least 21 days following application”.

5 Hygienisation options

5.1 Pathogen destruction

Human, plant and animal pathogens are micro-organisms that can cause illness or disease in their hosts. They can be either bound to solid materials, be suspended in water, or released into the air in form of bioaerosols. Pathogens are typically bacteria, fungi or viruses. Biological treatment facilities need to guarantee that the process results in an overall reduction in the level of pathogens; hence a flexible approach in process management is required in order to accommodate the wide variation of technological solutions, incorporating time-temperature regimes, quality management schemes, as well as recording and monitoring systems.

It is important to note that a biological treatment process cannot ever be 100% safe. Rather, the 'guarantee' refers to a level of residual risk that society deems acceptable. In the case of composting and anaerobic digestion, this is balanced against the environmental benefits gained through recycling and energy recovery. In this respect, the ABPR sets out a risk based categorisation of materials (see Section 3), which then determines how they must be treated and used.

The ABPR sets out four strategies for the composting and/or digestion of different types of materials, which vary depending upon the risk of infection (to animals and humans) they present. They are:

- **No mandatory treatment** – this is the case for raw materials that are regarded as presenting negligible risk and are commonly applied directly onto agricultural land without treatment within Member States. Examples include manure, digestive tract content and spilled milk.
- A requirement that raw material be raised to a **minimum temperature for a minimum period of time**, either during biological decomposition (composting or anaerobic digestion) or by means of pre or post heat treatment of the material. This is referred to as hygienisation, sanitisation or pasteurisation.
- A requirement that the pathogen reduction potential of a defined composting or anaerobic digestion system be **validated through the introduction of test indicator organisms**. In this case either an artificially introduced test organism or an endogenous indicator organism may be used. This is an obligatory element during the consenting and licensing process of plants in Member States such as Germany, Luxembourg, and The Netherlands. This method also enables the processes' critical control points to be identified (see Section 7.3).
- A requirement that **defined indicator micro-organisms in final products be tested** as part of a quality assurance scheme. Analysis shall always occur after treatment for hygienic purposes and to provide safe products. Unprocessed manure (with or without prior anaerobic digestion) is exempted from obligatory product testing.

In most Member States a combination of temperature/time/particle size conditions and end product tests are used to monitor and ensure that sanitisation has taken place. For product testing, typical indicator micro-organisms are *Salmonella* spp. and *Escherichia coli* or *Enterococcaceae* or

Enterococcus faecalis.

There is general agreement that temperatures between 55 °C and 70 °C have the desired pathogen reduction effect, although the duration for which this must be achieved shows some variation, and is dependent upon feedstock and processing conditions (e.g. whether it is a batch or continuous system, open windrow composting, in-vessel composting or thermophilic anaerobic digestion).

Temperature is not the only parameter that affects hygienisation. The biotic reactions that occur during degradation and transformation of ABP material also create competition for food between micro-organisms. Furthermore, the release of antibiotics, parasitism and presence of toxins are additional factors that effectively support pathogen eradication.

5.2 Treatment methods

Seven treatment options are possible for ABP material, depending upon the required level of hygienisation. For the purposes of this Guide, they have been classed as A, B, C, D, E, F, and G, and are detailed in Figure 1.

Category	Category description for treatment in composting and biogas plant	Different hygienisation methods fit for composting and biogas plant
Category 1	No material allowed in biogas or composting plants	
Category 2	<ul style="list-style-type: none"> Other Cat 2 material Eggs Fish Milk Manure 	<ul style="list-style-type: none"> Method 1 Sterilisation method 50 mm, 20 min, 133°C (A) Method 6 pH 4 in 24 h and 70° C, 60 min (B) No hygienisation process required before land application (C)
Category 3	<ul style="list-style-type: none"> Milk Fish Other Cat. 3 material Egg Catering waste Feedingstuff Processed foodstuff 	<ul style="list-style-type: none"> Method 1-5 and 7 Different heating/ cooking/sterilisation methods (D) Pasteurisation 12mm, 60 min, 70°C (E) Validated method (F) National methods (G)

Figure 1 - Permitted hygienisation methods for different categories of animal by-products

NB Category 2 'eggs' are those that are contaminated with Salmonella or under suspect to contain pharmaceuticals due to a known treatment of the flock

5.3 Hierarchy of treatment methods

If the main type of ABP is mixed with a material that requires a more stringent hygienisation method, then the most stringent method will take precedence. The hierarchy of the seven hygienisation methods are shown in Figure 2.

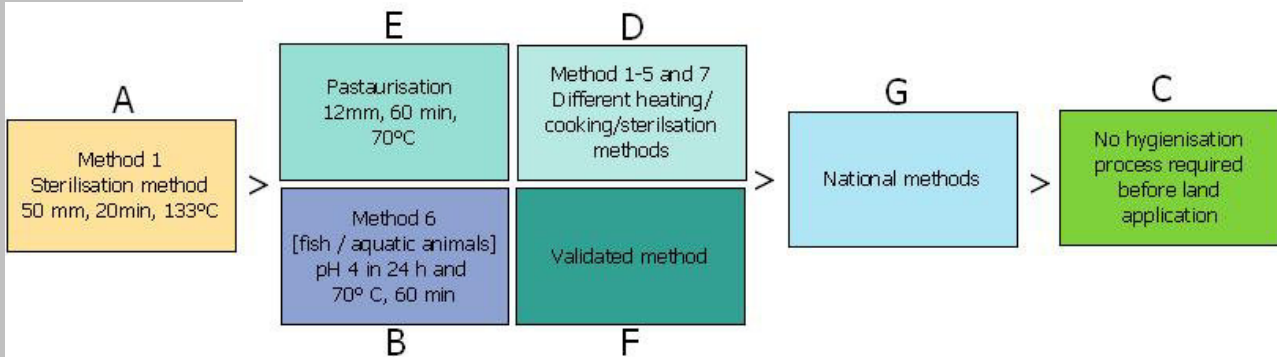


Figure 2 - Hierarchy of hygienisation methods

NB - Method B only applies to fish; however, fish can be treated with the other methods, except G and C.

A number of examples are given below illustrating this principle.

Example 1 – mixing catering waste with other ABPs

Catering waste has to be treated according to a national method as a minimum, but if it is mixed with untreated other Category 3 waste, i.e. feather residues from slaughterhouses, then the method D, E or F will apply for this mixed consignment of ABPs as a minimum.

Example 2 – separate sanitisation

Each feedstock can be sanitised separately. For example, pasteurised slaughterhouse waste (method E) can be subsequently digested with manure in a mesophilic fermentation process.

Example 3 – mixing manures

Manure as such does not require a specific treatment for hygienisation if the competent authority does not consider it presenting a risk for the spread of any serious transmissible disease. However, in an anaerobic digestion plant the (liquid) manure can be mixed with pre-treated fish that has undergone method B.

6 Category 3 catering waste

6.1 Collection, storage, transport and disposal

Article 21 (4) of the 2009 ABPR exempts catering waste from the general provisions on collection, transport and traceability. It reads:

‘Operators shall collect, transport and dispose of Category 3 catering waste, in accordance with national measures foreseen in Article 13 of Directive 2008/98/EC.’ (Waste Framework Directive)

Article 13 ‘Protection of human health and the environment’ of Directive 2008/98/EC (Waste Framework Directive) reads:

‘Member States shall take the necessary measures to ensure that waste management is carried out without endangering human health, without harming the environment and, in particular:

- (a) without risk to water, air, soil, plants or animals;*
- (b) without causing a nuisance through noise or odours; and*
- (c) without adversely affecting the countryside or places of special interest.’*

This means national implementation of the Waste Framework Directive is the relevant legislation to be complied with for collection, transport and disposal of Category 3 catering waste.

Therefore in the case of catering waste, the European ABPR does not require standard cleaning and disinfection procedures for collection vehicles and containers, but require Member States to observe the minimum requirements of good practice relative to environment and the protection of human health.

Member State Example - Austria

For the collection of household biowaste, including kitchen waste, no specific requirements are set in the framework for municipal collection schemes.

However, in case of the collection of catering waste from restaurants the following elements must be observed:

- Hot water or hot steam cleaning of containers after each emptying
- Disinfection of containers with suitable disinfection agent at least once per month
- Prevention of cross-contamination by aerosols by means of separation of clean and unclean containers during cleaning process
- Cleaning area must be in sufficient distance or physically separated from storage of feeding stuff, foodstuff, or areas where animals are kept
- Controlled drainage, storage and disposal of waste water
- Availability of appropriate cleaning equipment and agents
- Dry and clean storage of cleaned containers
- Cleaning and disinfection plan

6.2 Treatment through national rules

Article 15 (‘Implementing measures’) of the 2009 ABPR provides the basis to define parameters for the transformation of animal by-products, including catering waste, into biogas or compost. However, pending the adoption of rules for catering waste, **Member States may adopt or maintain national rules for the transformation of catering waste in anaerobic digestion and composting plants.** The competent authority in the Member State has to guarantee an equivalent effect regarding the reduction of pathogens.

New national rules for the processing of Category 3 catering waste can be implemented at any time.

At the same time, compost and digestate processed under those national rules may only be placed on the market in the territory of the same Member State.

Member State Example - Germany

Long before the ABPR was first adopted in 2002, Germany had established a validation scheme, investigating and approving the most common composting techniques and processes for its efficiency in reducing pathogenic indicator organisms. In this way the standardised processes, including minimum requirements for monitoring of critical control points and temperature, can be adopted by each composting plant without the need for additional site-specific validation.

Member State Example - Austria

Austria, in contrast, has probably the most practically oriented attitude towards catering waste based on years of experience in bio-waste collection and treatment. The national regulation implementing the EU ABPR exempted households from its scope. In this way it is expressed that the health risk of these sources is considered to be negligible and the traditional hygiene related process requirements are set under waste legislation (i.e. Compost Ordinance, national guide on good practice in composting) allowing, in principle, open windrow composting. A 10 day holding temperature above 55 °C in combination with final product testing for indicator pathogens is deemed sufficient to prevent microbiological risk.

Member States may authorise those specific requirements for composting and anaerobic digestion of Category 3 catering waste also when processed in a mixture with other ABPs. This is shown in Table 3.

Table 3 – Other ABPs that may be co-composted or digested with catering waste under national rules

<ul style="list-style-type: none">• Manure• Milk• Milk-based products• Milk-derived products• Colostrum• Colostrum products• Digestive tract content	<ul style="list-style-type: none">• Eggs• Egg products• Former foodstuff which has undergone 'processing'* as defined in article 2 in Regulation (EC) no 852/2004• Derived products from pet food and feeding stuff of animal origin
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

*** "processing" means any action that substantially alters the initial product, including heating, smoking, curing, maturing, drying, marinating, extraction, extrusion or a combination of those processes**

6.3 Use of product treated through national rules

If compost or digestate is manufactured at a composting or anaerobic digestion plant that complies with national rules, which can be the case for i.e. catering waste, processed foodstuff, manure, milk and eggs, these products may only be “placed on the market” within the Member State where it was manufactured¹.

Any product that is “placed on the market” in the EU has to undertake authorised hygienic parameters which are defined in the EU ABPR or a validated alternative method according to the described procedures in the Regulation.

In summary, if the compost or digestate complies only with a national method (G) which does not require a standard or a validated hygienisation treatment as defined by the ABP-IR (mainly method E or F), the product can only be placed on the market in that specific MS. This is shown in Figure 3.

This means that, even if two Member States have authorised identical national rules for processing catering waste and processed foodstuff in composting or anaerobic digestion plants, the cross border use of the compost or digestate is forbidden.

It is therefore important to decide if the compost or the digestate is intended to be produced for the European or national market, when considering the design of a compost or anaerobic digestion plant.

¹A high amount of unprocessed manure is traded between Member States without any preceding hygienisation. For this trade the specific authorisation of the competent authority of the Member State of destination is needed.

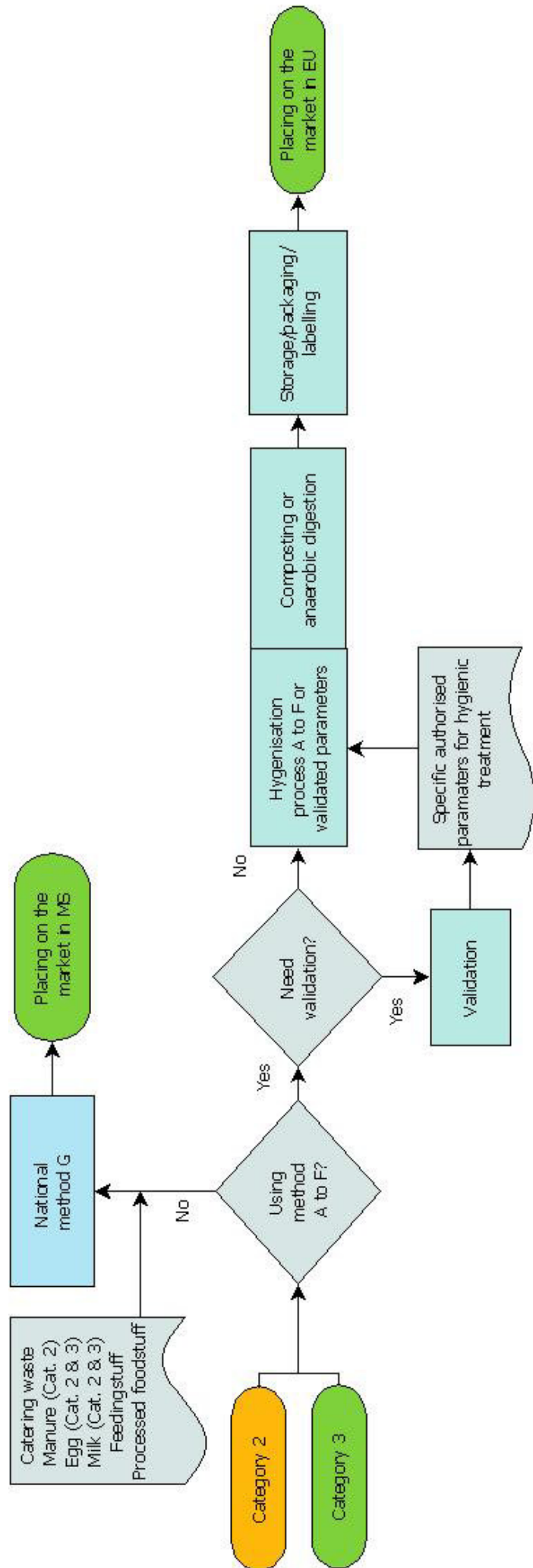


Figure 3 - Decision scheme for specific hygienic treatment as described in Figure 1 regarding the final use of compost or digestate

7 Composting and anaerobic digestion principles

7.1 General principles

The design of the composting or anaerobic digestion plant and its facilities has to take into account the general hygiene requirements of the ABPR (see below) and must not be located close to areas where farmed animals are kept and if necessary totally separated with fencing between plant and animals and their feed and bedding. This is not necessary if the only treated animal by-products are manure and milk or colostrums from that farm.

7.2 Hygiene requirements

These requirements as laid down in Annex V of ABPR-IR apply in principle to all composting and anaerobic digestion plants, treating permissible ABPs if no specific national rules have been set for catering waste. However, in addition to the latter, Member States would need to follow the '*general hygiene requirements*' as a guiding principle:

1. Animal by-products must be transformed as soon as possible after arrival at the anaerobic digestion or composting plant. They must be stored properly until treated.
2. Containers, receptacles and vehicles used for transporting untreated material must be cleaned and disinfected in a designated area. That area must be situated or designed so as to prevent risk of contamination of treated products.
3. Preventive measures against birds, rodents, insects or other vermin must be taken systematically². A documented pest-control programme must be used for that purpose.
4. Cleaning procedures must be documented and established for all parts of the premises. Suitable equipment and cleaning agents must be provided for cleaning.
5. Hygiene control must include regular inspections of the environment and equipment. Inspection schedules and results must be documented.
6. Installations and equipment must be kept in a good state of repair and measuring equipment must be calibrated at regular intervals.
7. Digestate and compost must be handled and stored at the anaerobic digestion or composting plant in such way that recontamination is prevented.

7.3 Composting

It is important that robust biological metabolism during composting be established, which is supported by the moisture content, the oxygen supply as well as the nutrition balance. Furthermore it is important to note that the achievement of higher temperatures (> 60 to 65 °C) may slow down the composting process and create intermediate products which also may cause additional odour emissions in open processes or during the storage. In the case of composting those peak temperatures when maintained over a longer period

² This does not mean that all process until completing hygienisation must be carried out in closed vessels or halls. Immediate mixing and coverage of fresh feedstock with bulking agents and/or fabric fleece as well as prompt processing after delivery in combination with the pest control programme are key elements to reduce the likelihood of massive access of birds or vermin.

of several days are specifically detrimental to humus formation and biological stabilisation.

7.3.1 Open windrow composting

Is open windrow composting allowed for ABP processing? In principle, the answer is yes. However, some Member States, such as the UK or Ireland, do not allow open windrow composting at least for the first stage of thermal hygienisation.

The wording of Annex V of the ABPR-IR does not specifically exclude open systems; this refers not only for catering waste and manure, for which general exemptions for national rules may apply. Open windrow composting can be applied for all allowed Category 2 and 3 Materials.

The conditions set out in Annex V, Chapter I, Section 2 of the ABPR-IR are as follows:

'2. By way of derogation from point 1, other types of composting systems³ may be allowed provided they:

- a) are managed in such a way that all the material in the system achieves the required time and temperature parameters, including, where appropriate, continuous monitoring of the parameters; or*
- b) transform only materials referred to in point 2 of Section 1; and*
- c) comply with all other relevant requirements of this Regulation.'*

It is important to note here the 'OR' between section 2 a) and 2 b). Otherwise open windrow composting would be only applicable for materials which have been pasteurised elsewhere or for former feeding stuff respectively former foodstuff which has undergone processing as defined in Article 2 in Regulation (EC) No. 852/2004

Clearly, point c) also addresses all exemptions granted for the implementation of diverting national rules and exemptions.

7.3.2 Composting digestate

If digestate is composted do both the anaerobic digestion and composting plant need to have a pasteurisation/ hygienisation unit or fully comply with transformation parameters? The answer is no. Chapter 1, Section 1, 2 f (iii) of the ABPR-IR reads:

"...a pasteurisation/hygenisation unit shall not be mandatory for biogas plants that transform only animal by-products which are transformed into biogas, where the digestion residues are subsequently composted or processed or disposed of in accordance with this Regulation."

In practice this means that thermophilic or mesophilic fermentation systems working at temperatures of 55 °C or 37 to 45°C, respectively, shall be permitted without providing pasteurisation or hygienisation if the entire digestate is further processed in a composting plant.

Depending on the treated feedstock, the hygienisation rules and standard or national transformation parameters must be then applied during composting.

³ ... other types of composting systems: i.e. "closed composting reactor or closed area"

Vice versa, if all applicable and appropriate hygienisation requirements have been complied with during the processing in an anaerobic digestion plant, no further hygienisation requirements of Annex V are required except the guiding principles of prevention of any cross contamination during composting of the digestate.

7.4 Anaerobic digestion

It is important that a stable anaerobic digestion process be established with good agitation, balanced feedstock mixture and a stable temperature level. This leads to a high population of non-pathogen micro-organisms, which increases sanitisation as well as increasing the biogas yield.

Mixing, retention and exposure time in the processes all have equal importance, especially at lower temperatures. All of these parameters must be simultaneously managed in order to provide optimised conditions over the entire period of process as well as during storage of the final product.

7.5 Approval of composting or anaerobic digestion plants

Irrespective of national processing and hygienisation requirements in place, composting and anaerobic digestion plants treating Category 3 material (including catering waste) need to be approved according to Article 24 of the 2009 ABPR. This means that all plants have to be approved (or registered) by the competent authority.

In the application the type of ABPs that are treated and the hygienisation process must be described, including maximum particle size, temperature / time regime and how the process is monitored and kept under control. In case of a validated process other parameters may have been identified as critical control points and these have to be monitored and supervised by the plant operator.

There is no particular guidance on the exact approval procedure under this Article but Article 44 advises the competent authority to approve only where an on-site visit has shown that all relevant requirements are fulfilled. Therefore some MS have implemented a simple registration during their environmental permit procedure for instance for composting or anaerobic digestion plants treating catering waste as the only ABP processed.

8 HACCP

8.1 Background

The ABPR adopts a system that identifies, evaluates and controls hazards which are significant for safety. It is called **Hazard Analysis and Critical Control Point (HACCP)** and was originally developed for food safety. It forms part of a site's quality assurance process and involves a number of discrete steps:

1. Conduct a hazard analysis
2. Determine the Critical Control Points (CCPs)
3. Establish Critical Limits (CLs)
4. Establish a system to monitor control of the CCP
5. Establish the corrective action to be taken when monitoring indicates that a particular CCP is not under control
6. Establish procedures for verification to confirm that the HACCP system is working effectively
7. Establish documentation concerning all procedures and records appropriate to these principles and their application.

This is shown schematically in Figure 4.

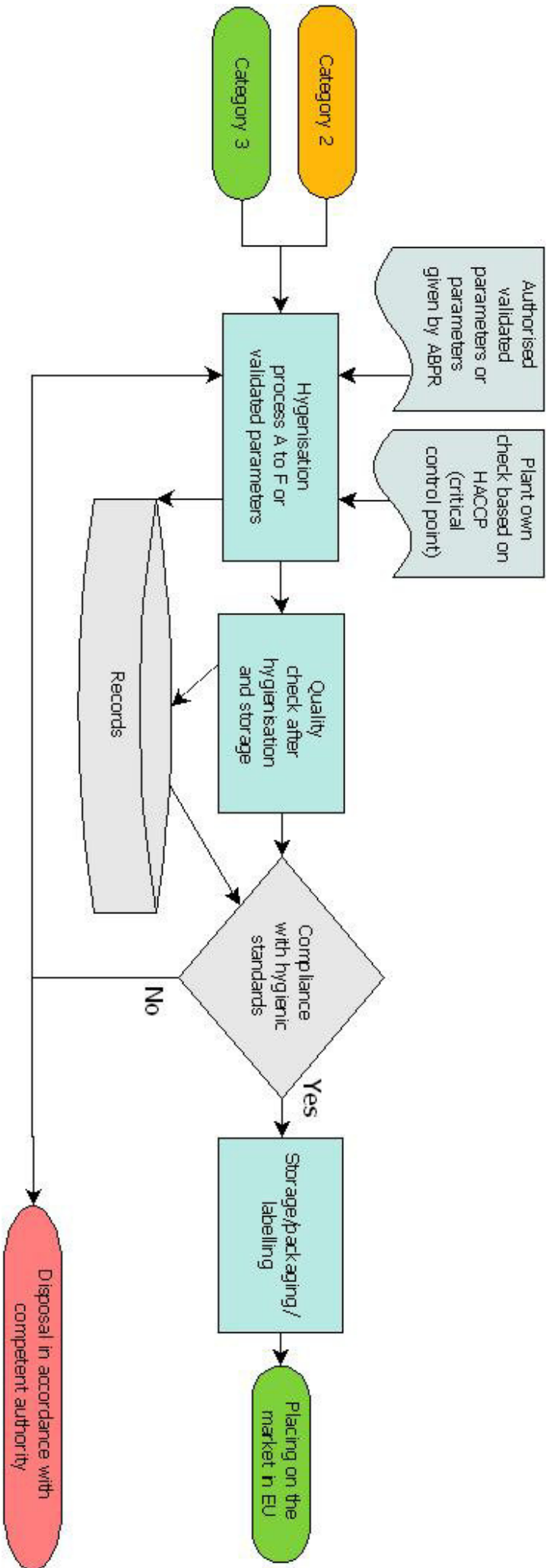


Figure 4 - Quality assurance system including HACCP

8.2 Plant's own checks and the HACCP principle

In Regulation (EC) No 1069/2009 Article 28 'Own checks' the operators shall put in place, implement and **maintain own check in order to monitor and document compliance with the ABP Regulation** so that no animal by-products leave the premises without proper treatment if not for designated disposal. This requirement is an obligation to implement a quality assurance system.

In Article 29 '**Hazard Analysis and Critical Control Points**' (HACCP) it is required that operators of anaerobic digestion and composting plants shall put in place, implement and maintain a permanent written procedure or procedures based on the HACCP principles for the transformation of animal by-products into compost and digestate. This is illustrated in Figure 4 for a validated method for compost or anaerobic digestion plants.

The phrase "procedures based on the HACCP principles" should be read together with **Article 30 because this allows a more relaxed and individual interpretation of HACCP** principles to be laid down in a voluntary guidance document on a national basis.

Article 30 'National guides to good practice' says:

- 1. Where necessary, competent authorities shall encourage the development, dissemination and voluntary use of national guides to good practice in particular for the application of HACCP principles as referred to in Article 29. Operators may use such guides on a voluntary basis.*
- 2. The competent authority shall assess national guides to ensure that:*
 - a) they have been developed in consultation with representatives of parties whose interests may be substantially affected, and have been disseminated by sectors of operators; and*
 - b) their contents are practicable for the sectors to which they refer.'*

8.3 Hazard analysis, identifying Critical Control Points

As a main rule, the hazards in ABPs are already identified and generally characterised by categorisation into the three categories, namely 1, 2 and 3. The identification and analysis of hazards of the input material is a necessity for the operators and plant owner so that they are aware of the type of categories that are allowed to enter the composting or anaerobic digestion plant. The plant should meet the hazard analysis requirements by documenting the following:

Making a list of the type of material that will enter the plant

- Classifying the material in accordance with the category and type of material specified in the APBR.
- Identifying the minimum hygienic process requirement for that type of material following the validation procedure (e.g. time/temp for a 5log₁₀ reduction of an indicator organism).
- Indicating if some of the ABP materials has already been pre-treated, including the method, name of the pre-treatment plant and official authorisation number.
- Preparing a brief list of concerns regarding relevant pathogenic organism and their probability which can be related directly to the incoming ABP, i.e. thermo-resistant parvovirus. Even though a validated method will

erase or reduce pathogenic hazards the plant operator should, in collaboration with institutes or experts with competence in handling and analysing pathogenic organisms, consider creating such a list.

- Describing the treatment process and what happens regarding the transformation of the material in the different stages through the composting plant or anaerobic digestion plant. This description shall also specify what the plant considers to be the critical parameters to obtain hygienisation and at which step these parameters have to be achieved (i.e. the Critical Control Points) and how they are monitored.
- Describing how the material should be treated when the hygienisation was unsuccessful (e.g. re-entering the treatment process).

8.4 Risk assessment and management

The risk assessment shall also cover the operation of the plant and the probability for atypical situations which may affect hygienisation and the critical parameters that are described in the HACCP plan. Atypical situations may include:

- Power failure
- Flooding
- Extreme weather conditions: i.e. storms, long lasting rainfall, long lasting freezing periods
- Breakdown or failure of equipment including monitoring equipment
- Lack of structure material / bulking agents
- Too little space for storage

The risk assessment shall identify the lethal aspect of the transformation process and how the critical control points should be monitored to ensure the proper control. However the risk assessment should also identify additional other control points ensuring good practice in composting or anaerobic digestion.

8.5 Validation techniques

It is important to ensure that evidence is collected that the elements of a HACCP plan are effective through a process called 'validation'. This is shown schematically in Figure 5.

There are two validation techniques which can be used:

- Using the endogenous (existing) indicator organism in the starting material, or
- Using test organisms and introducing them into the starting material using suitable test bodies.

When using endogenous organisms they must be present in high numbers, consistently present in the material, as well as being easy to quantify and identify. The lethal aspects of the test organisms should be in the same range as the pathogens of concern. Alternatively, there should be a clear correlation between both (e.g. a certain log reduction of virus correlated with a certain log reduction of *Enterococcus*).

The validated process shall demonstrate an overall risk reduction which is equally to a 5 log₁₀ reduction of *Enterococcus faecalis* or *Salmonella senftenberg* (775W, H₂S negative). This means that a maximum of 0.001% of the initial concentration of the indicator organism is left after processing in the composting or anaerobic digestion plant. If the hygienisation step is a chemical process, it also need to demonstrate a 3 log₁₀ reduction of *Acaris* spp.. If thermoresistant

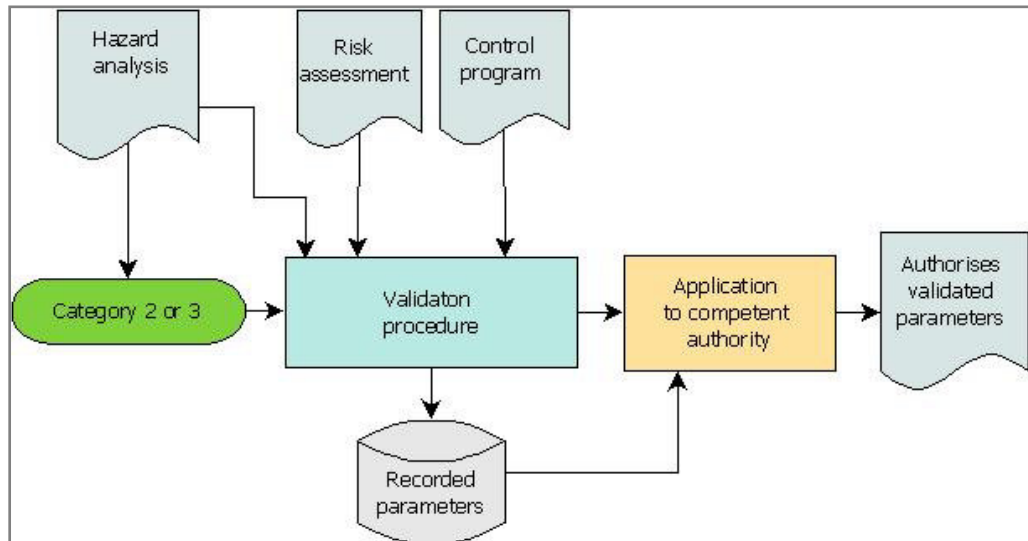


Figure 5 - Documentation and assessment for validation application and quality assurance system for operation of composting and anaerobic digestion plants

pathogenic organisms are a relevant hazard, the process should also prove a 3 log₁₀ reduction for these types of organisms.

To approve a validated treatment method the validation has to follow the procedures that are given in the ABPR-IR Annex V, Chapter III, Section 2. According to the first paragraph (1 a-f) the competent authority may authorise the use of other parameters provided that the applicant demonstrate the adequate reduction of biological risks. In the following sections the guide provides some basic elements to be included in an application for a validated process.

Useful information about the performance of a process validation as well as the test containers used to hold the test organisms can be found on the webpage indicated below.⁴

8.6 Monitoring control

The plant must document a complete control program, which includes procedures for monitoring the lethal aspect of the transformation process. This control program must include measures for continuous monitoring and supervision. The type of monitoring and supervision will depend on the conclusions of the risk assessment. Typical parameters to monitor in a control program will be, for example, the temperature, particle size, exposure time, dry matter content, volatile solids content, retention time, stirring or turning frequency, type and size and mixing ratio of structure material, oxygen, carbon dioxide, methane, alkalinity, and for chemical processes, the concentration of the chemicals and mixing ratio.

⁴ <http://animalhealth.defra.gov.uk/managing-disease/animalbyproducts/compost-biogas-manure/alternative-transformation-parameters.htm>

However, not all of the above mentioned parameters are related to the process which concerns the lethal aspect of the transformation process (hygienisation). The control program shall, nevertheless, cover critical parameters related to the validated lethal aspects of the transformation process as well as other critical aspects for the transformation in the composting or anaerobic digestion plant.

8.7 Documentation

The application should contain documentation of the measures that have been taken to ensure that the process is monitored and kept under surveillance by the plant operators.

This document should contain details on all the relevant process parameters and how they are recorded and maintained so that the owner, the operators or their representatives as well as the competent authority can assess the operation of the plant. The information related to the validated and authorised process shall be available for the Commission on request.

9 Standards

9.1 Compost and digestate after treatment and storage

The ABPR requires compost or digestate to be tested for indicator micro-organisms, as follows:

- a) Representative samples of digestate or compost during or immediately after transformation must comply with standards for *Escherichia coli* or *Enterococcaceae*. In 5 different samples the measured number in gram wet weight of the bacteria *Escherichia coli* or *Enterococcaceae* must be less than 1000 in 4 samples, and less than 5000 in all samples.
- b) Representative samples from digestate or compost taken during or on withdrawal from storage must comply with the absence of *Salmonella* in 25 g material in totally 5 samples.

Sampling under point a) describes a control measurement on the efficient reduction of the indicator organisms during the transformation / hygienisation process. It can be only applied where this takes place in a closed reactor (e.g. thermophilic digestion, pasteurisation unit, closed in vessel composting technique) during the first active decomposition stage.

In a continuous windrow composting system, the process is uniquely operated from setup of initial piles down to final maturation. The entire composting term may be described as a transformation process including all biological and thermal effects contributing to hygienisation. In this case, both measurements, a) and b), may be done after curing and samples could be taken from the compost prepared for marketing or use.

In the case of anaerobic digestion, Member States follow different approaches for testing for *E. coli* or *Enterococcaceae*. This is carried out either immediately after the digestate leaves the pasteurisation unit or after digestion in the mesophilic or thermophilic digestion reactor. As described above, the entire biological process contributes to an effective reduction of pathogenic micro-organisms. Therefore it is strongly recommended to apply test a) after digestion upon extracting the digestate prior to storage in a tank or lagoon.

The sampling for testing of *Salmonella* spp. during or upon withdrawal from storage shall be taken in principle from the digestate or compost as it is ready for use or being placed on the market. In case of digestate, test samples can be taken from the final digestion reactor if the extracted digestate is used directly without considerable intermediate storage.

If digestate or compost does not comply with the limit levels set for *Escherichia coli* or *Enterococcaceae* the material shall be resubmitted to the transformation process or composting. In the case of *Salmonella* spp., further handling or disposal shall be carried out in accordance with the instructions by the competent authority.

There are no standards set for **unprocessed manure**. Digestate and compost produced from manure as the sole ABP do not have to comply with the described standards but have to be considered as “unprocessed manure”.

10 Use of compost & digestate

Article 32 of the ABPR lays down the rules for the placing on the market of **organic fertilisers** and **soil improvers** containing ABPs. Here **digestate and compost** are explicitly mentioned.

The definition of ‘organic fertiliser’ and ‘soil improver’ is:

‘it means materials of animal origin used to maintain or improve plant nutrition and the physical and chemical properties and biological activities of soils, either separately or together; they may include manure, non-mineralised guano, digestive tract content, compost and digestion residues’

Article 11 of the ABPR lays down the **restrictions on use** of ABP derived materials. In this context a **21 day waiting period** after application of organic fertilisers and soil improvers – except manure – **before harvesting of herbage or direct grazing** of animals is included.

Paragraph 1 reads:

‘The following uses of animal by-products and derived products shall be prohibited:

...(c) ‘the feeding of farmed animals with herbage, either directly by grazing or by feeding with cut herbage, from land to which organic fertilisers or soil improvers, other than manure, have been applied unless the cutting or grazing takes place after the expiry of a waiting period which ensures adequate control of risks to public and animal health and is at least 21 days.’

Member States may adopt or maintain **national rules** which go beyond the requirements of the regulation but need to provide justification ‘on the grounds of the protection of public and animal health’.

These conditions for the feeding of farmed animals have been further specified in ABPR-IR in Annex II. However, an **exemption from the 21 days waiting period** is granted:

‘... provided only the following organic fertilisers or soil improvers have been applied to land:

- *manure and guano;*
- *digestive tract content;*
- *milk, milk-based products, milk-derived products;*
- *colostrum and colostrum products,*

which the competent authority does not consider to present a risk for the spread of any serious animal disease.’

This means that compost or digestate produced solely from these specified ABPs are exempted from the obligatory 21 day waiting period.

As regards ‘**identification and labelling**’, the label attached to the packaging, container or vehicle of organic fertilisers or soil improvers must bear the Category and the following words visibly and legibly displayed on the packaging, a container or vehicle, as applicable:

'organic fertilisers or soil improvers/no grazing of farmed animals or use of crops as herbage during at least 21 days following application'

However, the label shall not be required for the following organic fertilisers and soil improvers:

- (i) in ready-to-sell packages of not more than 50 kg in weight for use by the final consumer; or
- (ii) in big bags of not more than 1000 kg in weight, provided that:
 - they are authorised by the competent authority of the Member State where the organic fertiliser or soil improver is to be applied to land,
 - it is indicated on those bags that they are not destined for application to land to which farmed animals have access.

Finally, farmers are obliged to **document the application of compost or digestate** from ABPs to land to which farmed animals have access or from which herbage is cut for feeding to farmed animals:

1. the quantities of organic fertilisers and soil improvers applied;
2. the date on which the organic fertilisers and soil improvers were applied to land and the places of such application;
3. the dates, following the application of the organic fertiliser or soil improver, on which livestock has been allowed to graze on the land or on which the land has been cut for herbage to be used for feeding.

The records shall be kept for a period of at least two years.

In addition to the above minimum requirements e.g. in Ireland farmers have to register with the competent authority before using compost or digestate made from ABP; however, this is not mandated in the EU Regulation.

Again, **no records** are required if compost or digestate has been produced solely from ABPs which are also exempted from the 21 days waiting period as indicated above.

Compost and digestate shall be properly stored and transported, so that any contamination is prevented if stored in bulk in an adequate storage space to which no farmed animals have access.

In Article 22, laying down **rules for the placing on the market** and use of organic fertilisers and soil improvers, Member States are asked 'to encourage, where necessary, the development, dissemination and use of **national guides for good agricultural practice for the application of organic fertilisers and soil improvers to land**'.⁵

⁵For example, Ireland has included guidance on Good Agricultural Practice within the farmers' registration form when using ABP compost or digestate

11 Appendix 1 – ABP categories

Category 2 and Category 3 ABPs are specified in Regulation (EC) No 1069/2009 and are reproduced here.

11.1 Category 2 material

Category 2 material shall comprise the following animal by-products:

- a) **manure**, non-mineralised guano and digestive tract content;
- b) animal by-products collected during the **treatment of waste water** required by implementing rules adopted under point (c) of the first paragraph of Article 27:
 - i. from establishments or plants processing Category 2 material; or
 - ii. from slaughterhouses other than those covered by Article 8(e);
- c) animal by-products containing **residues of authorised substances or contaminants exceeding the permitted levels** as referred to in Article 15 (3) of Directive 96/23/EC;
- d) products of animal origin which have been declared **unfit for human consumption due to the presence of foreign bodies** in those products;
- e) **products of animal origin**, other than Category 1 material, that are:
 - i. imported or introduced from a third country and fail to comply with Community veterinary legislation for their import or introduction into the Community except where Community legislation allows their import or introduction subject to specific restrictions or their return to the third country; or
 - ii. dispatched to another Member State and fail to comply with requirements laid down or authorised by Community legislation except where they are returned with the authorisation of the competent authority of the Member State of origin;
- f) **animals and parts of animals**, other than those referred to in Article 8 or Article 10,
 - i. that died other than by being slaughtered or killed for human consumption, including animals killed for disease control purposes;
 - ii. foetuses;
 - iii. oocytes, embryos and semen which are not destined for breeding purposes; and
 - iv. dead-in-shell poultry;
- g) **mixtures** of Category 2 material with Category 3 material;
- h) animal by-products other than Category 1 material or Category 3 material.

11.2 Category 3 material

Category 3 material shall comprise the following animal by-products:

- a) **carcasses and parts of animals** slaughtered or, in the case of game, bodies or parts of animals killed, and which are fit for human consumption in accordance with Community legislation, but are not intended for human consumption for commercial reasons;
- b) **carcasses and the following parts** originating either from animals that have been slaughtered in a slaughterhouse and were considered fit for slaughter for human consumption following an ante-mortem inspection or bodies and the following parts of animals from game killed for human consumption in accordance with Community legislation:
 - i. carcasses or bodies and parts of animals which are rejected as unfit for human consumption in accordance with Community legislation, but which did not show any signs of disease communicable to humans or animals;
 - ii. heads of poultry;
 - iii. hides and skins, including trimmings and splitting thereof, horns and feet, including the phalanges and the carpus and metacarpus bones, tarsus and metatarsus bones, of:
 - animals, other than ruminants requiring TSE testing, and
 - ruminants which have been tested with a negative result in accordance with Article 6(1) of Regulation (EC) No 999/2001;
 - iv. pig bristles;
 - v. feathers;
- c) **animal by-products from poultry and lagomorphs** slaughtered on the farm as referred to in Article 1(3)(d) of Regulation (EC) No 853/2004, which did not show any signs of disease communicable to humans or animals;
- d) **blood of animals which did not show any signs of disease** communicable through blood to humans or animals obtained from the following animals that have been slaughtered in a slaughterhouse after having been considered fit for slaughter for human consumption following an ante-mortem inspection in accordance with Community legislation:
 - i. animals other than ruminants requiring TSE testing; and
 - ii. ruminants which have been tested with a negative result in accordance with Article 6(1) of Regulation (EC) No 999/2001;
- e) **animal by-products arising from the production of products intended for human consumption**, including degreased bones, greaves and centrifuge or separator sludge from milk processing;
- f) **products of animal origin, or foodstuffs containing products of animal origin**, which are no longer intended for human consumption for commercial reasons or due to problems of manufacturing or packaging defects or other defects from which no risk to public or animal health arise;
- g) **petfood and feedingstuffs of animal origin, or feedingstuffs containing animal by-products or derived products**, which are no longer intended for feeding for commercial reasons or due to problems of manufacturing or packaging defects or other defects from which no risk to public or animal health arises;
- h) **blood, placenta, wool, feathers, hair, horns, hoof cuts and raw milk** originating from live animals that did not show any signs of disease communicable through that product to humans or animals;

- i) **aquatic animals, and parts of such animals, except sea mammals**, which did not show any signs of disease communicable to humans or animals;
- j) **animal by-products from aquatic animals** originating from establishments or plants manufacturing products for human consumption;
- k) the following material originating from animals which did not show any signs of disease communicable through that material to humans or animals:
 - i. shells from shellfish with soft tissue or flesh;
 - ii. the following originating from terrestrial animals:
 - hatchery by-products,
 - eggs,
 - egg by-products, including egg shells,
 - iii. day-old chicks killed for commercial reasons;
- l) **aquatic and terrestrial invertebrates** other than species pathogenic to humans or animals;
- m) **animals and parts thereof of the zoological orders** of Rodentia and Lagomorpha, except Category 1 material as referred to in Article 8(a)(iii), (iv) and (v) and Category 2 material as referred to in Article 9(a) to (g);
- n) **hides and skins, hooves, feathers, wool, horns, hair and fur** originating from dead animals that did not show any signs of disease communicable through that product to humans or animals, other than those referred to in point (b) of this Article;
- o) **adipose tissue from animals** which did not show any signs of disease communicable through that material to humans or animals, which were slaughtered in a slaughterhouse and which were considered fit for slaughter for human consumption following an ante-mortem inspection in accordance with Community legislation;
- p) **catering waste** other than as referred to in Article 8(f).

12 Appendix 2 – Composting and anaerobic digestion rules

12.1 National rules and requirements in different Member States

The ABPR gives the Member States the possibility to establish national requirements and authorisation for some selected materials and treatment methods, including:

- derogation from a pasteurisation unit in anaerobic digestion plant for some selected types of Category 3 material;
- other treatment methods, i.e. more relaxed requirements for catering waste and for catering waste mixed with certain ABPs; and
- longer quarantine period after application of ABP derived products on pasture land.

This Appendix provides an overview of selected national provisions in different Member States for composting and anaerobic digestion plants with specific focus on the processing of catering waste and manure.

In this respect, Member States may authorise national rules (i.e. specific requirements) for composting and anaerobic digestion plant who transform only catering waste or mixtures of catering waste with:

- i. manure
- ii. milk
- iii. milk-based products
- iv. milk-derived products
- v. colostrum
- vi. colostrum products
- vii. digestive tract content
- viii. eggs
- ix. egg products
- x. former foodstuff which has undergone processing⁶ as defined in article 2 in Regulation (EC) No. 852/2004.
- xi. derived products from pet food and feeding stuffs of animal origin

However, it is important to note that digestate and compost which has been produced following those national rules may only be placed on the market within the Member State where those parameters have been authorised.

The following compilation compares the rules for different key criteria as implemented in *Austria, Flanders (Belgium), Germany, Ireland* and *Norway*. It shows the range interpretation of the ABPR resulting in deviating requirements for the above mentioned groups of materials.

⁶For example, Ireland has included guidance on Good Agricultural Practice within the farmers' registration form when using ABP compost or digestate

12.1.1 Types of material for which special national rules exist

AT - Catering waste from households is exempted from the national implementation ordinance for ABPs. Here the waste legislation ("Compost Ordinance", "Biowaste Ordinance") and national guidelines defining minimum requirements for composting and anaerobic digestion are in place. For catering waste from centralised kitchens and restaurants, specific national criteria have been established within the national ABP regulation. For manure no specific requirements were set.

BE/FL - Category II manure, digestive tract content and Category III milk, milk-derived products and colostrum can be treated through anaerobic digestion (mesophilic) without a pasteurisation unit. The end product (digestate) is considered as not processed under the ABPR; export is not possible. In addition, some validation tests are carried out to prove alternative hygienisation (thermophilic AD).

DE - As long as biowaste is treated together with ABP in composting or anaerobic digestion plants where the digestate is used in agriculture the input material must be listed in Annex 1 of the German Biowaste Ordinance. However, catering waste from private households treated in composting and anaerobic digestion plants is exempted from the national ABPR by law (TierNebV).
Manure may be anaerobically digested in a mesophilic process without a pasteurisation unit if the competent authority does not consider a risk of spreading any serious transmissible disease. The digestate is considered as unprocessed manure with regards to the ABPR.

IE - Special national rules exist for:

- Category 3 catering waste alone;

or

- Mixtures of Category 3. catering waste with the following materials:
 - Category 2: manure, digestive tract content separated from the digestive tract, milk, milk-based products, colostrum, eggs, egg products
 - Category 3: milk, milk-based products, milk derived products, colostrum, colostrums products, eggs, egg products.

If only manure generated on a farm is processed, there is no mandatory processing parameter as long as the output material (compost/digestate) is used for national land spreading.

For on-farm wet anaerobic digestion plants, manure from the same farm does not need to be pasteurised. ABP material imported to the same plant has to be pasteurised.

No transformation parameters are required for plants processing fishmeal, Category 3 ABPs pasteurised in another approved plant, processed Category 3 material (methods 1-5 or 7), processed Category 3 materials originating from aquatic animals (methods 1-7).

NO - There exist national rules for catering waste or catering waste mixed with: manure, digestive tract content, milk, milk-based products, milk-derived products, colostrum, colostrum products and defined as processed foodstuffs.

12.2 Composting plants - process requirements

12.2.1 Particle size

AT - No requirements for catering waste, 12 mm size only for non-processed Category 3 material.

BE/FL - For green waste and vegetable fruit and garden (VFG) waste no requirements; for manure composting: < 12 mm.

DE - No requirements.*¹

IE - 400 mm or less.

NO - No requirements on particle size.*²

*¹ Germany specifies very few technical requirements for treatment plants because process validation is commonly used and the technical requirements are stipulated individually for the different processes as an outcome of process validation.

*² Intermediate according to the Norwegian national fertiliser regulation.

12.2.2 Number of turnings during composting

AT - 1 to 5 turnings during a 10 – 14 days thermophilic process period depending on the temperature and time profile and the composting technology (open or closed / in vessel composting).

BE/FL - 4 turnings.

DE - No requirements.

IE - Has to be an in-vessel system; but at least 1 turning because the required time/temperature regime shall be performed twice.

NO - No requirements regarding the number of turnings* (See also 12.3.3 where there is one turning required by an older regulation for open windrow sites).

* Intermediate according to the Norwegian national fertiliser regulation

12.2.3 Temperature and exposure time

AT - Flexible regimes between 55 to 65 °C for open and closed composting systems over a monitoring period of 10 to 14 days; in closed systems: 55 °C over 4 days or 65 °C over a period of 3 days with continuous monitoring (for ABPs covered by national derogation).

BE/FL - Green waste: at least 10 weeks, at minimum of 45 °C, from which 4 days at 60 °C or 12 days at 55 °C
Vegetable, fruit & garden (VFG) waste: at least 6 weeks at a minimum of 45°C, from which 4 days at 60 °C or 12 days at 55 °C.

Treatment with ABP such as manure (indoor treatment in tunnels), process = biothermal drying: 1 h, 70 °C, max particle size 12 mm, total time of treatment no longer than a few days (but at least showing 1 h, 70 °C).

DE - 55, 60 or 65 °C over a period of 14, 6 or 3 days, respectively.

IE – 60 °C over a period of 48 hours must be achieved twice. This will require one turning in between the two monitoring periods.

NO - No explicit requirements on temperature and exposure time.
Temperature and exposure time must be selected according to a risk assessment regarding the input material and the process.

Older best practice guidelines from the food safety authorities describe three methods:

1. Closed composting: 55 °C for ten days including 48 hours above 65 °C
2. Open composting: 55 °C for three weeks – minimum one turning
3. Wet composting of semi-liquid manure (not anaerobic treatment): 55 °C for 10 hours or 60 °C for 4 hours.

12.2.4 Closed or open windrow composting systems

AT - Open windrow systems are permitted for all types of material. Immediate mixing and coverage with shredded material, compost or a fabric fleece is required in case of processing catering waste from centralised kitchens and processed former foodstuffs. For all other ABP Category 3 material, open windrow composting is allowed after applying standard transformation parameters (70 °C, 1 h, 12 mm) or using validated processes.

BE/FL - With ABP: always closed. For VFG (excluding ABP/meat) open windrow systems are allowed in the post-composting phase.

DE - All types of systems are permitted.

IE - Has to be closed in-vessel system.

NO - Not specified.* Older requirements permit closed and open windrow composting.

* Intermediate according to the Norwegian national fertiliser regulation

12.2.5 Process monitoring

AT - Continuous monitoring of temperature: over a time span of 4 hours, each after 5 mechanical turnings
Discontinuous monitoring of temperature: at least once per workday during a period of 10 days, documentation of turnings, mixing and watering.

BE/FL - Composting = Biothermal drying: each batch (tunnel) must be recorded. Input material (not treated) may not be contaminated by treated material, therefore in tunnels, the feedstock input side must be opposite to the output side, otherwise the input side of the tunnel must be cleaned and disinfected when emptying a tunnel. During the bio-thermal drying, the temperature must be measured and recorded (during 1 h 70 °C phase, the measuring and recording must be continuous). Particle size must be < 12 mm. All steps in the monitoring scheme must be described in a HACCP plan.

DE - Continuous recording of temperature and time.

IE - Time and temperature.

NO – None.

12.2.6 Other requirements

AT - No alternative processes have been validated and approved in Austria up to now.

BE/FL - Only for green and VFG waste composting: min 30-40% moisture, in first composting phase up to 45-55 % moisture required. It is stated that a certain moisture level is necessary for optimised degradation processes.

DE – None.

IE – None.

NO – None.

12.3 Anaerobic digestion plants - process requirements

12.3.1 Particle size

AT - No requirements for catering waste from households. For catering waste from other kitchens and former food stuff: < 12 mm.

BE/FL - 12 mm. (Not valid for VFG waste).

DE - Catering waste from households can be treated according to the German Biowaste Ordinance:
Thermophilic digestion: No particle size fixed. Mesophilic digestion with pasteurisation unit: 12 mm.

IE - 400 mm or less for catering waste.

NO - National methods for sewage sludge justified by validation (the parasite *Ascaris suum*). Specific particle size is not relevant for liquid processes, excluding sludges.

12.3.2 Retention time

AT Thermophilic digestion: > 55 °C; hydraulic retention time 20 days, minimum retention time 24 h
Mesophilic digestion: pasteurisation unit required; >70 °C for 1 h, or > 60 °C for 5 h; no specific retention time during fermentation specified.

BE/FL - In Flanders this is not a parameter for hygienisation. No minimum retention time. In case of validation tests in thermophilic anaerobic digestion, a minimum guaranteed retention time must be demonstrated.

DE - Thermophilic digestion: plants have to be validated according to the validation scheme of the German Biowaste Ordinance. For thermophilic anaerobic digestion the retention time must meet the requirements of process validation.
Mesophilic digestion: a pasteurisation unit is obligatory: >70 °C for 1 h; 12 mm.

IE - 48 hours twice.

NO - There is no required retention time; however the process shall result in a stabile (low odour) digestate. Common retention times between 12 and >20 days.

12.3.3 Temperature and exposure time

AT - No requirements for catering waste from households
Catering waste from centralised kitchens and restaurants and former foodstuffs:

- thermophilic processes: > 55°C over 20 days, minimum retention time 24 h
- mesophilic processes: 37-40 °C combined with one of the following hygienisation methods:
 - a) pasteurisation at 70 °C, 1 h
 - b) pasteurisation at 60 °C, 5 h
 - c) Post-composting of the digestate according to composting rules (see Section 7.3.2)
 - d) Process validation according Annex 5 of the ABPR.

BE/FL - Pasteurisation: minimum 1 h, 70 °C – no alternative is possible (apart from parameters temperature and time during validation tests); therefore, a minimum time under thermophilic conditions must be demonstrated (batch step in the process) – Process validation according ABPR.

DE - Thermophilic anaerobic digestion plants treating catering waste from households must demonstrate temperatures > 50 °C. The retention time must meet the period stipulated in the process validation of the German Biowaste Ordinance.
Mesophilic anaerobic digestion plants must have a pasteurisation unit complying with the ABPR (70 °C for 1 hour and 12 mm particle size) or prove the hygienisation in a post-composting process.

IE – 60 °C in 48 hours twice

NO - National validated methods for sewage sludge are used against special parasites. *Ascaris suum* requires 55 °C in closed reactors for 2 hours or 70 °C in closed reactors for 30 minutes.*

* Intermediate according to Norwegian national fertiliser regulation

12.3.4 Process monitoring

AT - Thermophilic processes (> 55 °C) with continuous temperature monitoring, in batch systems during a minimum retention time of 20 days; pasteurisation unit with continuous recording of temperature/time.

BE/FL - In the case of pasteurisation: the producer must show for each batch a successful temp-time regime (amount of digestate, time material pumped in, retention time in pasteurisation unit, achieved temperature, time material pumped out). Storage is needed in separate tanks to avoid cross contamination. The pasteurisation step may not be by-passed: there must be no direct link between digester and storage of treated digestate.

In case of thermophilic AD: operators need to show proof of temperature and time (minimum guaranteed retention time) by implementing a batch-like step in the AD process (e.g. 1 pump movement per day/per 20 hours) – this depends on technology and validation test parameters, such as the amount of digestate, temperature in digester, time of pumping the material in and out must be demonstrated.

All steps in the monitoring scheme must be described in a HACCP plan.

DE - Continuous recording of temperature and time.

IE - Time and temperature.

NO – None.

12.3.5 Other requirements

AT - In practise the competent authorities also requires that catering waste from households be treated to the same hygienisation standards as defined for catering waste from centralised kitchens.

All anaerobic digestion plants treating ABP (including manure) must be registered and approved under the national ABP regulation.

BE/FL - Any process (thermophilic anaerobic digestion) showing equal effect of hygienisation (validation procedure) or treatment through composting.

DE - Meeting the hygienisation requirement for anaerobic digestion plants can be demonstrated as well by means of post-composting of the digestate.

IE – None.

NO – None.

12.4 Validation schemes for standard processes

AT - Not applied at present.

BE/FL - For VFG-compost and green compost, there are standard parameters which are described in the general regulations of the quality assurance certification scheme of Vlaco. In BE/FL VGF is not considered to be ABP.

For thermophilic AD, validation tests can be carried out to show at least an equal effect than a pasteurisation unit. This is done by inserting pots with reference concentrations of pathogens in the fermenter and measuring the reduction value. When a sufficient log reduction of indicator organism is shown and the operator has an approved HACCP plan, the alternative temp/time conditions during thermophilic AD can be applied and the resulting digestate can be used.

DE - Process validation according to Annex 2 of the German Biowaste Ordinance, no process validation but technical approval in case of pasteurisation (>70°C, minimum 1 h, 12 mm)

For composting and anaerobic digestion plants the results of the validation for *Plasmodiophorae brassica* needs to be an infection index ≤ 0.5 ; for tomato seeds the germination rate per sample should be $\leq 2\%$. For composting plants the limit value for *Nicotiana virus* in bio-test is $\leq 4\%$ infection rate.

IE - An independent proposal for validation has to be prepared by an expert (not the plant owner or technology supplier). This includes a proposal on the number of probes (1 per 30 m³) and locations in the tunnel or anaerobic digestion tank (A minimum of 1 temperature probe per 5 cubic metres of material or 2 probes per pasteurisation unit).

When the department approves this proposal, a compost plant must have 6 batches of compost processed within 3 months, but this may be extended to a 6 month period depending on progress.

The independent expert then prepares a detailed report on the temperature profiling and makes a recommendation based on the data collected during the 6 batches on how many probes there should be.

The Department of Agriculture then reviews the report and will then approve it.

For wet anaerobic digestion the technology validation period will comprise of a 4 week period from the date conditional approval is granted. At least 10 batches must be processed in the plant during this time.

NO – None.

12.5 End product standards

This includes indicator organisms / pathogens and limit values.

AT – For compost (according to the Compost Ordinance): *Salmonella* absent in 50 g for all applications of compost.
For use in agriculture: if pathogenic *E. coli* is positive, recommendations for further treatment and safe use by the authorised expert or laboratory is required.

Use as bagged compost or for sports and play grounds: *Salmonella* spp, *E. coli*, *Listeria* sp, *Campylobacter* absent in 50 g.

For anaerobic digestion:

- manure: no requirements;
- other ABPs: *Salmonella* absent in 25 g, in 5 samples.

Number of measurements:

- Bagged compost – 1 test for each 500 m³ compost produced;
- Bulk compost – from 1 test every 3 years below 300 m³ yearly compost production up to 12 tests per year depending on the amount of compost production.
- Digestate – 1 test every 2 years up to 300 t feedstock per year; 1 test per year between 300 - 4000 t feedstock per year and 1 further test per year for each 4000 t additional feedstock treated.

BE/FL - *E. coli* or *Enterococcaceae*: n = 5, c = 1, m = 1000 cfu, M = 5000 cfu in 1 g*

Absence of *Salmonella* in 25 g: n = 5, c = 0, m = 0 cfu, M = 0 cfu

For each sample compost / digestate, a measurement of viable weed seeds is required. No viable weed seeds in the end product are allowed.

DE - Regular tests of the products ready for use for *Salmonella* in a 50 g sample and for weeds/propagules (< 2 per litre) according to the German Biowaste Ordinance. These are mandatory on product (compost or digestate) ready for sale.

The number of tests depends on the plant capacity and is between 4 and 12 times a year.

Digestate only produced from manure and energy crops do not have to be analysed for hygienic parameters.

IE - *Escherichia coli*: n = 5, c = 1, m = 1000 cfu, M = 5000 cfu in 1 g;*

or

Enterococcaceae: n = 5, c = 1, m = 1000 cfu, M = 5000 cfu in 1 g;

and

Representative samples of compost or digestate taken during or on withdrawal from storage at the plant must comply with the following standards: *Salmonella*, absence in 25 g: n = 5; c = 0; m = 0 cfu; M = 0 cfu;

NO – Thermotolerant coliform bacteria (TKB): max. 2500 cfu/g dry matter and absence of *Salmonella* and parasitic eggs.

* 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.

12.6 Land application

AT - No waiting period for composted catering waste from households, for composts and digestate produced from all other Category 3 materials the 21 day waiting period before grazing or harvesting of herbage applies.

BE/FL - Use of end product is destined for professional use in agriculture.
Use is not allowed:

- On grassland and for production of feeding stuff unless a waiting period of 6 weeks between application and grazing or harvesting herbage is taken into account.
- On soils where vegetables, fruits and potatoes are grown (meaning application when the crop is already present), except for fruit trees after harvesting and before the next flowering.
- On soils that are destined for the production of vegetables or fruits that are in direct contact with the soil and are consumed as a raw product, during a period of 10 months before harvest.

DE - Waiting period is 21 days after application for grazing of animal and for harvesting herbage.

IE - After use organic fertilisers and soil improvers containing ABR material no grazing of farmed animals or use of crops as herbage during at least 21 days following application.

NO - Waiting period is 21 days following the ABPR rules.

12.7 Miscellaneous national conditions

This includes transport, storage and cleaning.

AT - For catering waste from households: no specific regulations on cleaning and transport
For catering waste from centralised kitchens and restaurants and former foodstuffs:

- Cleaning of the containers with hot waste or hot steam after each collection. Disinfection at least once per month. Location for the site for cleaning and disinfection must be separated from areas where foodstuff or where already processed ABPR are stored.
- Sufficient distance and separation from keeping of animals or storage of feeding stuff and bedding materials.

BE/FL - None.

DE - None.

IE - Compost plant vehicles transporting compost must be on the transport register. Non ABP feedstock supplied to a plant must complete a feedstock acceptance form.

In the event that compost and digestate is being supplied

- to a storage, handling or mixing premises (non-retail), the premises must be approved by Department of Agriculture in advance of supply;
- in bulk or in bags >50 kg to a retail (e.g. garden centre) premises, the retail premises must be registered by Department of Agriculture in advance of supply.

NO - None.

