Appendix M

PAS 110:2010

Specification for whole digestate, separated liquor and separated fibre derived from the anaerobic digestion of source-segregated biodegradable materials

wrap

Material change for
a better environment

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Contents

Foreword

This Publicly Available Specification (PAS) has been sponsored by WRAP (Waste & Resources Action Programme)[1)] and Renewables East[2)]. It has been developed in conjunction with the Renewable Energy Association (REA)[3)] and the Association for Organics Recycling[4)], in collaboration with the British Standards Institution (BSI). This PAS was developed from earlier work that was carried out by a team from REA which was triggered by the development of an AD facility in Orkney and sponsored by Highlands and Islands Enterprise, the Scottish Enterprise Highland Energy Team and the Scottish Environment Protection Agency.

The purpose of this PAS is twofold: to ensure that digested materials are made using suitable inputs and effectively processed by anaerobic digestion (AD) for sufficient time; and to ensure that the process has been well managed and monitored so as to produce digested material that meets market needs and protects the environment. Any producer who claims digested material conforms to this PAS shall ensure that it is fit for purpose at all times.

Acknowledgement is given to the following organizations who were instrumental in the development of this PAS:

- BiogenGreenfinch;
- Bundesgütemeinschaft Kompost e.V. (German certification body for composted and digested materials);
- Department for Environment, Food and Rural Affairs;
- Environment Agency;
- European Compost Network;
- Kuttner (UK) Ltd;
- Open University;
- Summerleaze Group / AnDigestion Ltd;
- Scottish Environment Protection Agency;
- University of Glamorgan;
- University of Reading;
- University of Southampton;
- Waste & Resources Action Programme; and
- Welsh Assembly Government.

Wider comments from other interested parties were invited by BSI. The additional expert contributions made by organizations and individuals consulted in the development of this PAS are also gratefully acknowledged.

This PAS is not intended to restrict new developments in design and materials. Accordingly, all feedback about it and proposals for future work will be considered. It will be reviewed as and when the technical need arises or after two years, whichever is the sooner.

This PAS is not to be regarded as a British Standard and will be withdrawn upon publication of its content in, or as, a British Standard.

Marking PAS 110:2010 on or in relation to whole digestate, separated liquor or separated fibre, represents a producer's declaration of conformity, i.e. a claim by or on behalf of the producer that the requirements of this PAS have been met. The accuracy of the claim is therefore solely the responsibility of the person or organization making the claim. Such a declaration is different from third party certification of conformity.

Producers who use this PAS are advised to apply for and obtain third party certification of product conformity with this PAS.

Producers and users seeking the relevant certification body, or bodies, may ask BSI to forward their enquiries to the relevant organizations.

1) See www.wrap.org.uk
2) See www.renewableseast.org.uk
3) See www.r-e-a.net
4) See www.organics-recycling.org.uk

Presentational conventions

This PAS is structured according to **BS 0-2:2005**, *A standard for standards – Part 2: Structure and drafting – Requirements and guidance*, and its structure is reflected in the contents page.

The provisions of this PAS are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation (guidance) and general informative material is presented in smaller italic type, and does not constitute normative elements (requirements). Much of this appears as notes in this PAS, each beginning with 'NOTE'.

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a Publicly Available Specification cannot confer immunity from legal obligations.

In addition to the requirements of this PAS, users' attention is drawn to the following statutory requirements, the Codes of Good Agricultural Practice, the Code of Practice for Agricultural Use of Sewage Sludge, and the Anaerobic Digestate Quality Protocol (ADQP), some of which are also referred to in the foreword or introduction:

[1] Environmental Protection, The Packaging (Essential Requirements) Regulations 2003 (as amended);

[2] Consumer Protection, The General Product Safety Regulations 2005;

[3] Environmental Protection, The Environmental Protection Act 1990 (as amended);

[4] Environmental Protection, The Waste Management Licensing Regulations (1994) (as amended);

[5a] EU Regulation 1774/2002 'Laying down health rules concerning animal by-products not intended for human consumption' (as amended) [5b], and implementing these in:

- [6] England, The Animal By-Products Regulations 2005 (as amended);
- [7] Wales, The Animal By-Products Regulations 2006 (as amended);
- [8] Scotland, The Animal By-Products Regulations 2003 (as amended); and
- [9] Northern Ireland, The Animal By-Products Regulations 2003 (as amended).

[10] The Nitrate Vulnerable Zones Action Programmes Packages of Measures;

[11] Protecting our Water, Soil and Air – A Code of Good Agricultural Practice for farmers, growers and land managers, Department for Environment, Food and Rural Affairs [only applicable in England];

[12] Code of Good Agricultural Practice for the Protection of Air, Ministry of Agriculture, Fisheries and Food, and the Welsh Office Agriculture Department (as amended) [now only applicable in Wales];

[13] Code of Good Agricultural Practice for the Protection of Soil, Ministry of Agriculture, Fisheries and

Food, and the Welsh Office Agriculture Department [now only applicable in Wales];

[14] Code of Good Agricultural Practice for the Protection of Water, Ministry of Agriculture, Fisheries and Food, and the Welsh Office Agriculture Department [now only applicable in Wales];

[15] Scottish Executive, Prevention of Environmental Pollution from Agricultural Activity Code of Good Practice (PEPFAA code) [only applicable in Scotland];

[16] Code of Practice for Agricultural Use of Sewage Sludge, Department for the Environment, Food and Rural Affairs;

[17] England and Wales, The Environmental Permitting (England and Wales) Regulations 2007[5)];

[18] Scotland, The Pollution Prevention and Control Act 1999;

[19] Scotland, The Waste Management Licensing Regulations 1994 (as amended);

[20] Northern Ireland, the Waste Management Licensing (Northern Ireland) Regulations 2003;

[21] Northern Ireland, the Pollution Prevention and Control Regulations (Northern Ireland) 2003;

[22] Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on waste, which is the codified version of this Framework Directive on Waste 75/442/EEC (as amended) [23];

[24] Quality Protocol. Anaerobic digestate. End of waste criteria for the production and use of quality outputs from the anaerobic digestion of source-segregated biodegradable waste. Waste Protocols Project (Environment Agency and WRAP), September 2009. (Abbreviated title Anaerobic Digestate Quality Protocol (ADQP)).

5) The Environmental Permitting (England and Wales) Regulations is a single set of regulations that replace over 40 statutory instrument regulations, thus streamlining the waste management licensing and pollution control regimes. The regulations were published on 13 December 2007 and came into force on 6 April 2008. Their implementation comprises the first phase (EPP1) of the Environment Agency, Defra and Welsh Assembly Government's Environmental Permitting Programme. Read more about the Environmental Permitting Programme at www.defra.gov.uk/environment/epp/ and www.environment-agency.gov.uk/business/1745440/1745496/1906135/

0 Introduction

0.1 What is anaerobic digestion?

Well managed, anaerobic digestion (AD) systems are capable of conferring multiple environmental and socio-economic benefits. This type of biological treatment technology has become well established in some countries of the European Union but is currently under-utilized in the UK. AD is an important technology for the local recovery of source segregated biowastes, especially those that arise as liquids and the more putrescible fractions of solid biowastes. The biogas they produce can be converted into energy to meet the needs of the AD system itself, for local use, for supply as electricity to the national grid or for processing into biofuel for vehicles.

The whole digestate, separated liquor and separated fibre outputs that AD systems can produce have significant fertilizer value and can return useful amounts of organic matter to soils. Such digested materials are particularly suitable for maintaining and improving soil fertility and function. Benefits of these kinds can effect particular value in agriculture, soil-grown horticulture (field and some covered crops grown in soil), forestry, land restoration, land reclamation and land remediation applications.

***NOTE** See Clause **3** for definitions of the terms whole digestate, separated liquor and separated fibre.*

The whole process of anaerobic digestion and the controlled application of digested materials reduce the environmental impact of manures and biowaste streams by lowering methane emissions and controlling odours. Such applications have the potential to reduce nitrogen losses to groundwater, surface water and to the atmosphere.

The volume of digested materials is set to increase significantly as industry responds to the latest strategies in the nations of the UK for diverting biowastes from landfill [4], and to other policy initiatives and measures geared to develop the supply of renewable energy, tackling climate change and protecting soils.

0.2 What is PAS 110?

The purpose of this PAS is to remove a major barrier to the development of AD namely by encouraging markets for these digested materials. It creates an industry specification against which producers can check that the digested materials are of consistent quality and fit for purpose. This PAS, together with other supply and demand market development measures, should encourage more sustainable practices in the management of biowastes and biodegradable materials.

This PAS is a fast-track precursor to a potential future British Standard. This voluntary, industry led specification sets out the minimum quality required for whole digestate, separated liquor and separated fibre which may be used as a fertilizer or soil improver. Meeting its quality and other criteria enables the producer to demonstrate conformance to this PAS.

0.3 Obligations under relevant regulations

This PAS is a non-statutory document and does not set regulatory limit values for the quality and use of digested materials (whole digestate, separated liquor and separated fibre). All producers are required to comply with all applicable existing legislation irrespective of whether the whole digestate, and any separated liquor and fibre, complies with this PAS or not.

Whilst compliance with this PAS helps producers to demonstrate due diligence in the recovery of controlled, source segregated biowastes it does not exempt the digestion facility or its digested materials from environmental or health protection regulations (see references in the Foreword). The production and use of digested materials derived from controlled wastes is subject to Environmental Permitting or Waste Management Licensing Regulations, according to the country in which the anaerobic digestion process is located and the digested material is used.

In England and Wales, processes that digest controlled source segregated biowastes must have an authorization to operate or an exemption. An example of an authorization is an environmental permit [17] (permits include waste management licences and exemptions issued prior to 6 April 2008 when the environmental permitting regulations came into effect). In Scotland, processes that treat biowastes must have a Waste Management Licence (WML) or an exemption from licensing.

In some circumstances, Pollution Prevention and Control Regulations [18] and [21] also apply; facilities treating more than a threshold amount of Category 3 Animal By-Products, must have a Pollution, Prevention and Control Permit (PPC).

The use of digested materials made from controlled, source segregated biowastes is subject to environmental permitting (in England and Wales) [17] or waste management licensing regulations (in Scotland) [19]. However, in countries which have adopted the Anaerobic Digestate Quality Protocol (ADQP) [24] there may be a case for digested materials to be exempted from environmental permitting / waste management regulations that control their use, if the ADQP requirements are met. Those requirements include independent certification of conformance to this PAS. In such circumstances, restrictions on digestate end-use markets apply.

Enquiries about ADQP applicability in a specific country should be addressed to its agency responsible for protecting the environment. Whatever the circumstance, land managers should follow the relevant parts of the Codes of Good Agricultural Practice for the Protection of Air, Water and Soils [11 if in England, 12, 13, 14 if in Wales, or 15 if in Scotland], or any superseding publications.

0.4 How does PAS 110 work?

PAS 110's Clause **1** states which digested materials are within or outside its scope. This PAS's requirements begin at Clause **4** on the topic of Quality Management Systems and are followed in Clause **5** by Hazard Analysis and Critical Control Point planning. The subsequent clauses follow a digestate production sequence, beginning with requirements for the input materials, progressing to process management controls and monitoring, then to digestate sampling, testing, validation checks and information for end users. Such information enables appropriate use of digestates, minimizing the risks of environment pollution or adverse effects on humans, animals or plants.

Annex A provides information to assist producers to meet pasteurization requirements. Many requirements of this PAS are likely to have been met already in the existing documents used and procedures followed by producers.

1 Scope

This Publicly Available Specification (PAS) covers whole digestate from an anaerobic digestion (AD) system that accepts only source segregated biowastes (see **3.75** and **3.8**) and/or biodegradable non-waste materials (see **3.7**). It also covers liquor and fibre fractions that may be produced by separating whole digestate, after the anaerobic digestion process.

NOTE 1 *Digested materials that conform to this PAS should be suitable for use as soil improvers, without causing harm or nuisance. They should confer beneficial effects when used, as a result of their combined physical, chemical and microbial properties (see Clause **14**). Clause **14** requires that the digested material placed on the market is fit for purpose.*

NOTE 2 *The addition of further biowaste / biodegradable material to separated fibre at the start of or during maturation is outside the scope of this PAS. In this scenario, the PAS 100 Specification for composted materials derived from source segregated biodegradable materials may be applicable. If digested material, composted material or a blended mixture of treated source segregated biowastes, soil or soil-like material is placed on the market for use as a 'product', it will have to meet all requirements of the relevant Quality Protocol in any country in which it applies.*

This PAS specifies:

a) controls on input materials and the management system for the process of anaerobic digestion and associated technologies;

b) that the AD system is allowed to accept packaged biowastes / biodegradable non-waste materials that are depackaged prior to anaerobic digestion, subject to **6.1**;

c) minimum quality of whole digestate (see **3.88**), separated liquor (see **3.71**) and separated fibre (see **3.70**);

d) information that is required to be supplied to digested material (see **3.21**) customers (see Clause **14**); and

e) requirements applicable to, and associated with, the use of any whole digestate or separated liquor that does not conform to PAS 110's limits for Potentially Toxic Elements (see **14.1.6** and **14.1.7**, and **3.60** for definition of PTEs).

This PAS includes a reduced range of test parameters for digested materials made from specific input materials that arise within the producer's premises or holding and that are used entirely within the producer's premises or holding (see **11.2.5** and **12.2.4**). Those producers are exempt from carrying out a pasteurization step during anaerobic digestion (see **7.2** and **3.58**). Similar provisions are made for farming / horticultural / forestry co-operatives, but without exemption from a pasteurization step.

Exemption from the pasteurization step has also been allowed for specific input materials that arise within the producer's premises or holding, which are co-digested with pasteurized biodegradable materials / wastes from outside the producer's premises or holding, provided that the digested material is used entirely within the producer's premises or holding (see **7.2.4**).

NOTE 3 *See clauses **11.2.5** and **12.2.4** regarding whether the digested material can be tested according to a reduced range of parameters.*

NOTE 4 *Check the regulator's relevant position statement or briefing note regarding the circumstances in which waste regulatory controls do not apply to agricultural manures and slurries, and crops grown specifically for anaerobic digestion.*

This PAS requires the producer to undertake Hazard Analysis and Critical Control Point (HACCP) planning (see **3.36** and Clause **5**) and to implement and maintain a Quality Management System (QMS) (see **3.64** and Clause **4**) that ensures digested materials meet the minimum quality requirements set in this PAS, and are fit for purpose.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS EN 13037, *Soil improvers and growing media – Determination of pH*

BS EN 13650, *Soil improvers and growing media – Extraction of aqua regia soluble elements*

BS EN 13652, *Soil improvers and growing media – Extraction of water soluble nutrients and elements*

BS EN 13654-1, *Soil improvers and growing media – Determination of nitrogen – Part 1: Modified Kjeldahl method*

BS EN 13654-2, *Soil improvers and growing media – Determination of nitrogen – Part 2: Dumas method*

BS EN 14346, *Characterization of waste – Calculation of dry matter by determination of dry residue or water content*

BS EN 15169, *Characterization of waste – Determination of loss on ignition in waste, sludge and sediments*

BS ISO 16649-2, *Microbiology of food and animal feeding stuffs – Horizontal method for the enumeration of ß-glucuronidase-positive Escherichia coli – Part 2: Colony count technique at 44 °C using membranes and 5-bromo-4-chloro-3-indolyl-ß-D-glucuronide*

***NOTE** The following normative documents contain provisions which constitute provisions of **BS ISO 16649-2**:*

***BS ISO 6887-1**, Microbiology of food and animal feeding stuffs – Preparation of test samples, initial suspension and decimal dilutions for microbiological examination – Part 1 – General rules for the preparation of the initial suspension and decimal dilutions*

***BS ISO 7218**, Microbiology of food and animal feeding stuffs – General rules for biological examinations*

BS ISO 16772, *Soil quality – Determination of mercury in aqua regia soil extracts with cold-vapour atomic absorption spectrometry or cold-vapour atomic fluorescence spectrometry*

Animals, England, Animal Health. The Animal By-Products Regulations 2005. Statutory Instruments 2005, No. 2347.

- Schedule 3, Part I, Method for the isolation of *Clostridium perfringens*.
- Schedule 3, Part II, Methods for the isolation of *Salmonella*.
- Schedule 3, Part III, Method for the isolation of *Enterobacteriaceae*.

www.opsi.gov.uk/si/si2005/uksi_20052347_en.pdf

Animal Health, The Animal By-Products Regulations (Northern Ireland) 2003. Statutory Rules of Northern Ireland 2003, No. 495.

- Schedule 2, Part I, Method for the isolation of *Clostridium perfringens*.
- Schedule 2, Part II, Methods for the isolation of *Salmonella*.
- Schedule 2, Part III, Method for the isolation of *Enterobacteriaceae*.

www.opsi.gov.uk/sr/sr2003/20030495.htm

Animal Health, The Animal By-Products (Scotland) Regulations 2003. Scottish Statutory Instruments 2003, No. 411.

- Schedule 2, Part I, Method for the isolation of *Clostridium perfringens*.
- Schedule 2, Part II, Methods for the isolation of *Salmonella*.
- Schedule 2, Part III, Method for the isolation of *Enterobacteriaceae*.

www.opsi.gov.uk/legislation/scotland/ssi2003/ssi_20030411_en.pdf

Animal Health, The Animal By-Products (Wales) Regulations 2006. Welsh Statutory Instrument 2006, No. 1293 (W.127).

- Schedule 3, Part I, Method for the isolation of *Clostridium perfringens*.
- Schedule 3, Part II, Methods for the isolation of *Salmonella*.
- Schedule 3, Part III, Method for the isolation of *Enterobacteriaceae*.

www.opsi.gov.uk/legislation/wales/wsi2006/wsi_20061293_mi.pdf

***NOTE** Regarding Salmonella spp, the national ABP regulations for each nation in the UK allow laboratories to use method **BS EN ISO 6579**, titled Microbiology of food and animal feeding stuffs – Horizontal method for the detection of Salmonella spp, or an equivalent method published by BSI.*

EU Animal By-products Regulation 1774/2002 [5a] as amended by EU ABP amendment regulation 208/2006 [5b]

NOTE *The user of this PAS should check with the competent authority for animal by-products (see **3.3**) which method(s) of test are acceptable as indicators of human and animal pathogens. See also national ABP regulations for each nation in the UK.*

OFW004-005. Development and evaluation of a method for testing the residual biogas potential of digestates, Section 4, Full description of the RBP test. Waste & Resources Action Programme, January 2010.

NOTE *Total solids (abbreviated as TS, also referred to as dry matter) and volatile solids (abbreviated as VS, also referred to as loss on ignition, which is a measure of organic matter) should be determined as instructed in the report (see section **4.2**). Volatile fatty acids should be determined by gas chromatography; an example specific to the equipment used during development of the RBP test is provided in OFW004-005 report's Appendix 9.2.*

Downloadable from *www.wrap.org.uk/AD*

REA-DM-PC&S. Methodology for determination of physical contaminants and stones in digestates, Renewable Energy Association, London.

SCA MSS Part 2. Standing Committee of Analysts, April 2003. The Microbiology of Sewage Sludge (2003) – Part 2 – Practices and procedures for sampling and sample preparation. *Methods for the Examination of Waters and Associated Materials*, in this series, Environment Agency.

Blue Book No. 189, downloadable from *www.environment-agency.gov.uk/research/commercial/32874.aspx*

SCA MSS Part 3A. Standing Committee of Analysts, March 2003. The Microbiology of Sewage Sludge (2003) – Part 3 – Methods for the isolation and enumeration of Escherichia coli, including verocytotoxigenic Escherichia coli. Methods for the Examination of Waters and Associated Materials. A – The isolation and enumeration of Escherichia coli by a chromogenic membrane filtration technique.

Part 3A is within Blue Book No. 190, downloadable from *www.environment-agency.gov.uk/research/commercial/32874.aspx*

SCA MSS Part 4A. Standing Committee of Analysts, May 2004. The Microbiology of Sewage Sludge (2004) – Part 4 – Methods for the detection, isolation and enumeration of Salmonella. *Methods for the Examination of Waters and Associated Materials*. A – The detection of Salmonella species using a presence / absence technique.

Part 4A is within Blue Book No. 195, downloadable from *www.environment-agency.gov.uk/research/commercial/32874.aspx*

SOP Z/004. The determination of ammonium in organic wastes (liquid or solid), Standard Operating Procedure Z/004, Edition 05, 31.01.2006, Eurofins Laboratories Ltd, Wolverhampton.

NOTE *This method of test is based on Method 53 in RB427, The Analysis of Agricultural Materials, Ministry of Agriculture, Fisheries and Foods, 1985.*

3 Terms and definitions

3.1 agriculture

horticulture, fruit growing, seed growing, livestock farming, the use of land as grazing land, meadowland, osier land, land used for growing arable crops (such as cereals, oil seed rape and some types of vegetables) and biomass grown for non-food purposes, market gardens and nursery grounds, and woodlands where the land used is ancillary to the farming of land for other agricultural purposes

***NOTE** In this context, horticulture means only 'soil- / field-grown horticulture', a separately defined term (see **3.40**).*

3.2 anaerobic digestion (AD)

process of controlled decomposition of biodegradable materials under managed conditions where free oxygen is absent, at temperatures suitable for naturally occurring mesophilic or thermophilic anaerobic and facultative bacteria species, that convert the inputs to biogas and whole digestate

***NOTE** Digested materials can confer benefits to soils to which they are applied and the plants those soils support.*

3.3 animal by-product (ABP)

entire bodies or parts of animals or products of animal origin referred to in Articles 4, 5 and 6 of EU Regulation 1774/2002 [5a] as amended [5b] that are not intended for human consumption, including ova, embryos and semen

***NOTE** Articles 4, 5 and 6 of EU Regulation 1774/2002 [5a] as amended [5b] respectively state Category 1, Category 2 and Category 3 animal by-products. 'Not intended for human consumption' also means material that at some point was intended for human consumption but which has become unfit for that purpose. Most arisings of catering waste (see **3.9** and **3.10**) and 'former foodstuffs' are Category 3 ABPs, which can be recovered using a digestion process.*

3.4 Animal Health

the Government's executive agency primarily responsible for ensuring that farmed animals in Great Britain are healthy, disease-free and well looked after

3.5 authorization

in the context of an anaerobic digestion activity, one of the following:

in England and Wales, an Environmental Permit issued under the Environmental Permitting (England and Wales) Regulations 2007 [17];

***NOTE** A Waste Management Licence issued under the Environmental Protection Act 1990 [3] as amended by the Waste Management Licensing Regulations 1994 [4] (as amended) is now an Environmental Permit [17].*

in Scotland, a Licence issued under the Environmental Protection Act 1990 [3] (as amended) and the Waste Management Licensing Amendment (Scotland) Regulations 1994 [19] (as amended), or a PPC permit issued under the Pollution Prevention and Control (Scotland) Regulations 2000 [18]; or

in Northern Ireland, a Licence issued under the Waste Management Licensing (Northern Ireland) Regulations 2003 [20] or a PPC Permit issued under the Pollution Prevention and Control Regulations (Northern Ireland) 2003 [21].

3.6 batch (portion of production)

unit of whole digestate, separated fibre or separated liquor produced by a single anaerobic digestion production process, using uniform critical control points and critical limits – or a number of such units, when stored together – and that can be identified for the purposes of re-treatment or disposal, should monitoring checks or sample tests necessitate such actions

***NOTE 1** Digestion systems that operate on a continuous basis monitor and assess a series of 'portions of production' rather than batches. Under any kind of production system, each batch or portion of production should be assigned a unique code, for quality management purposes.*

***NOTE 2** Batch or portion size is defined by the producer rather than in this PAS due to differences between AD system types and each producer's priorities for process optimization. For an anaerobic digestion production process that complies with ABP regulations, **3.6**'s definition of 'batch' may be superseded by any such definition in the ABP regulations or set by the Animal Health vet for the specific production process.*

3.7 biodegradable

capable of undergoing biologically mediated decomposition

3.8 biowaste

waste of animal or plant origin which can be decomposed by micro-organisms, other larger soil-borne organisms or enzymes

NOTE 1 *Soil material with no significant biowaste content and plant remains from agricultural production falling within the scope of Article 2(1)(f) of the Framework Directive on Waste 75/439/EEC [23] are not biowaste. 'Waste' includes discarded materials, which include those deliberately set out (for example by households, commerce and industry) for separate collection and treatment. Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on waste [22] is the codified version of the Framework Directive on Waste 75/442/EEC (as amended) [23].*

NOTE 2 *See note to* ***3.75*** *regarding sewage sludges and their derivatives, which are not regarded in this PAS as 'source segregated'.*

3.9 catering waste (including meat)

all waste food, including used cooking oil, originating in restaurants, catering facilities and kitchens, including central kitchens and household kitchens

NOTE *Due to the risk of pathogen transfer from meat to non-meat food fractions at catering waste sources, EU Regulation 1774/2002 [5a] also designates non-meat food fractions as catering wastes, most of which are Category 3 ABPs.*

3.10 catering waste (excluding meat)

separately collected catering waste types where measures have been taken with the aim of excluding any meat

3.11 certification

third-party attestation related to products, processes, systems or persons

NOTE 1 *In the context of PAS 110, assessment by a certification body covers all the requirements of PAS 110.*

NOTE 2 *In the context of the 'Quality Protocol for the production and use of quality outputs from anaerobic digestion of source-segregated biowastes', assessment by the approved certification body covers all the requirements of that protocol, including all those in the producer's chosen, approved standard / specification (e.g. PAS 110).*

3.12 chemical oxygen demand (COD)

an indirect measure of the amount of organic compounds in a substance, in which a sample of the substance is incubated with a strong chemical oxidant under specific temperature conditions and for particular period of time

NOTE *In this context, a COD test determines the amount oxygen consumed per amount of digested material (sample), and is normally expressed in mg/l or parts per million (ppm) in older references. The chemical oxidant is not specific to oxygen-consuming chemicals that are organic or inorganic, so both of these sources of oxygen demand are measured in a COD test.*

3.13 competent authority

central authority of a Member State competent to ensure compliance with the requirements of the EU Animal By-products Regulation 1774/2002 [5a] as amended [5b] or any authority to which that central authority has delegated that competence

NOTE *In England, Wales and Scotland, the competent authority is 'Animal Health' the executive agency of the Department of Environment, Food and Rural Affairs (Defra) and the Scottish Government. Animal Health was formerly named the State Veterinary Service. In Northern Ireland the competent authority is the Department of Agriculture and Rural Development and within that, the Veterinary Service.*

3.14 control (noun)[6)]

the state wherein correct procedures are being followed and criteria are being met

3.15 control (verb)

to take all necessary actions to ensure and maintain compliance with criteria established in the HACCP plan

3.16 corrective action

any action to be taken when the results of monitoring at the critical control point (CCP) indicate a loss of control

3.17 control measure

any action and activity that can be used to prevent or eliminate a digestate safety hazard or reduce it to an acceptable level

3.18 critical control point (CCP)

last step at which control can be applied and is essential to prevent or eliminate a hazard or reduce it to an acceptable level of risk

3.19 critical limit (CL)

criterion which separates acceptability from unacceptability

3.20 deviation

failure to meet a critical limit

3.21 digested materials

whole digestate resulting from an anaerobic digestion process, and any subsequently separated fibre or liquor

NOTE 1 *Includes any separated fibre that undergoes a subsequent aerobic maturation step, without addition of further materials.*

NOTE 2 *See definitions of terms, whole digestate (**3.88**), separated fibre (**3.70**) and separated liquor (**3.71**).*

6) Definitions **3.14** to **3.19** are from Codex (1997) Basic Texts On Food Hygiene Codex Alimentarius, FAO, Rome, June 1997 [27]. Minor changes have been made to some to make them more appropriate within the context of anaerobic digestion. See www.fao.org/DOCREP/005/Y1579E/y1579e03.htm#bm3 for more information.

3.22 digester

closed vessel system in which biodegradable materials decompose under anaerobic conditions

3.23 dirty water

dilute washings from dairy and milking parlours and run-off from yard areas lightly contaminated by manure, slurry or used animal bedding

3.24 domestic use (amateur horticulture)

use of digested materials by members of the public in their own gardens

3.25 duty of care

the responsibility of persons concerned with controlled waste to ensure that the waste, is managed properly, is recovered or disposed of safely, does not cause harm to human health or pollution of the environment, and is transferred only to someone who is authorized to receive it

NOTE *Duty of care applies to any person who produces, imports, carries, keeps, treats or disposes of controlled waste or, as a broker, has control of such waste, i.e. it applies to anyone who is the holder of controlled waste. It is a requirement in section 34 of the Environmental Protection Act 1990 (as amended) [3] and associated regulations.*

3.26 exemption

an exemption from the need to hold an authorization

NOTE *See **3.5** for definition of authorization; see **3.89** for definition of waste management licence and **3.90** for definition of waste management licence / environmental permit exemption.*

3.27 farmer

natural or legal person, or a group of natural or legal persons, whatever legal status is granted to the group and its members by national law, whose holding is situated within the EU and who exercises an agricultural activity

NOTE 1 *A similar meaning is intended for any horticulturist who raises plants commercially on land used for an horticultural activity.*

NOTE 2 *See **3.44** for definition of land manager.*

3.28 farming / horticultural / forestry co-operative

natural or legal persons who form a group under a written agreement, whatever legal status is granted to the group and its members by national law, who exercise only agricultural, soil/field grown horticultural or forestry activities within the countries of the UK, and who as a group, carry out one anaerobic digestion process at one location within the co-operative's holdings

***NOTE** See **3.38** for definition of 'holding'.*

3.29 fit for purpose

material that does not have any properties or characteristics that prevent it from being suitable for its intended use(s)

***NOTE** Where this term is applied to input material to an anaerobic digestion process, it means that such material has no physical or chemical properties that would prevent the digested material made from it from being fit for purpose. If depackaging is carried out by the digested material producer, a written supply of agreement for input materials would have to contain a declaration of 'fit for purpose' which limits the supplier's liabilities in terms of any properties that are affected by the anaerobic digestion process producer's depackaging step.*

3.30 flow diagram

systematic representation of the sequence of steps or operations used in the process for production of whole digestate and any subsequently separated liquor or fibre

3.31 forestry

the art and science of controlling the establishment, growth, composition, health, and quality of forests

***NOTE** The definition includes plantations and systems other than 'forests' for cultivating trees, timber and biomass crops.*

3.32 growing medium

material, other than soil in situ, in which plants are grown

[derived from PD CR 13456:1999]

3.33 harm

physical injury to, or damage to the health of people, or damage to property, or to the environment

[derived from ISO/IEC Guide 51]

***NOTE** In the context of this PAS, harm also includes injury or damage to the health of animals and plants. Harm can be caused by one or more unwanted biological, chemical or physical agents in or by misuse of whole digestate, separated liquor or separated fibre.*

3.34 hazard

potential source of harm

3.35 hazard analysis

process of collecting and evaluating information on hazards and conditions leading to their presence to decide which are significant for the production of safe digested materials

***NOTE** This should be addressed in the HACCP plan.*

3.36 hazard analysis and critical control point (HACCP)

system used for the identification, evaluation and control of hazards which are significant for the production of digested materials that can be used without harm

3.37 HACCP plan

document prepared in accordance with HACCP principles, to ensure control of hazards that are significant for the production, storage, supply and use of digested material without harm

3.38 holding

all the land units managed by a farmer / land manager within the UK

3.39 horticulture (container grown / hydroponic systems)

raising of plants in containers and growing media or by use of hydroponic systems

***NOTE** Includes the commercial raising of vegetables for human consumption, fruit, flowers and bulbs, hardy and other nursery stock, herbs and any other protected crops grown under cover in containers or using hydroponic systems.*

3.40 horticulture (soil- / field-grown)

raising of plants in soil in-situ, in a field or under protective cover

NOTE *Includes the commercial raising of plants referred to in the definition of 'agriculture' and some types of vegetables, fruit, flowers and bulbs, hardy and other nursery stock, herbs as well as some protected crops grown in soil in-situ. Excludes amateur or hobby gardening and similar uses because digestate quality standards may not be suitable for potentially high rate applications.*

3.41 hydraulic retention time (HRT)

average time that material stays in the digester vessel, determined by the loading rate and operational digester capacity

NOTE *Retention time can be calculated by dividing the digester working volume by the rate of flow of input materials into the digester, i.e. HRT (days) = digester volume (m^3) / influent flow rate (m^3 per day).*

3.42 (independent) certification body

organization responsible for assessing and certifying the conformity of production systems, products or other materials to one or more relevant standards

NOTE *In this context, conformity of digested materials to PAS 110.*

3.43 input material

biodegradable material intended for feeding, or fed, into an anaerobic digestion process

NOTE *For the list of European Waste Catalogue input material types acceptable under the 'Quality protocol for the production of quality outputs from anaerobic digestion', see this protocol's Appendix B.*

3.44 land manager

natural or legal person, or a group of natural or legal persons, whatever legal status is granted to the group and its members by national law, whose holding is situated within the EU and who exercises a land management activity.

NOTE *See **3.27** for definition of farmer.*

3.45 land restoration

includes land reclamation and land remediation

3.46 land reclamation

recovery of land from a brownfield or underutilized state to make it suitable for reuse achieved through the stabilization, contouring, maintenance, conditioning, reconstruction and revegetation of the land

3.47 land remediation

process of making a site fit for purpose through the destruction, removal or containment of contaminants

NOTE *Environmental damage can be ameliorated through the management, removal, sealing or treatment of dangerous substances or stabilization in order to make the site safe for a specific use, but not necessarily for all possible uses.*

3.48 livestock manure

slurries and solid manures, including farmyard manures

NOTE *This definition, from the Codes of Good Agricultural Practice, includes 'dirty water' (see **3.23**).*

3.49 maceration

to make biodegradable input materials into a more consistent and readily flowable and pumpable mixture by means of shredding, chopping, crushing or mincing the input materials and / or soaking them in a liquid

3.50 maturation

optional period of treatment or storage of separated fibre under predominantly aerobic conditions

3.51 mature, maturity

state of separated fibre which exhibits a low rate of biodegradation and which is unlikely to be phytotoxic when used as per good practice

3.52 mesophilic organisms

organisms for which optimum growth temperatures are within the range 30 °C to 45 °C

3.53 methods of test

procedures for testing samples of digested materials

NOTE *Where available for any one or more parameters, this PAS specifies recognized national, European Community or international standards published by the British Standards Institution (BSI), the European Committee for Standardization (CEN) and the International Organization for Standardization (ISO).*

3.54 monitor

act of conducting a planned sequence of observations or measurements of control parameters to assess whether a CCP is under control

3.55 mulch

material spread and allowed to remain on the soil surface to conserve soil moisture, suppress weeds and shield soil particles from the erosive forces of raindrops and runoff

[derived from PD CR 13456:1999]

NOTE *Nutrients in the mulch will subsequently become available to plants, although the total amount and rate of their release is influenced by the materials the mulch is derived from and its proportion of soil size particles.*

3.56 operating procedures

carried out and documented procedures for producing digested materials

3.57 organic loading rate (OLR)

weight of organic matter fed to a unit volume of the digester per unit time

NOTE *OLR = kg COD m^{-3} day^{-1} or kg VS m^{-3} day^{-1}, where COD is chemical oxygen demand and VS is volatile solids. A similar way to describe OLR is weight of organic dry matter added per day (kg VS d^{-1}) divided by digester volume (m^3).*

3.58 pasteurization

process step during which the numbers of pathogenic bacteria, viruses and other harmful organisms in material undergoing anaerobic digestion are significantly reduced or eliminated by heating the material to a critical temperature for a minimum specified period of time

NOTE 1 *Pasteurization could occur either as part of the anaerobic digestion process or as a separate step. Pasteurization does not aim to achieve sterilization, which destroys all life forms. In the context of anaerobic digestion, 'pasteurization' has the same meaning as 'sanitization' (see **3.68**).*

NOTE 2 *Pasteurized material may contain beneficial and other unharmful micro-organisms.*

3.59 phytotoxin

substance that is toxic to plants

NOTE *Toxicity effects might include delayed seed germination or inhibited plant development and rate of growth.*

3.60 potentially toxic element (PTE)

chemical element that has potential to have toxic effects on humans, flora or fauna

NOTE *Lead, cadmium, chromium, mercury, copper, zinc and nickel are the seven PTEs included in **11.2** and **12.2** of this PAS.*

3.61 producer

business enterprise, organization, community initiative or person(s) responsible for the production of digested materials

3.62 putrescible

material that has the capability to become putrid

NOTE *In this context, those fractions of biowaste or biodegradable material with relatively high proportions of readily biodegradable carbon-based molecules and moisture.*

3.63 quality control

part of quality management focused on fulfilling quality requirements

NOTE *Implemented through a series of systems and activities, which are integrated in daily work, and enable frequent, or continuous, verification of product quality. Examples are checks on process conditions throughout every processing step, digested material sample test results and the effects of any corrective actions taken.*

3.64 quality management system (QMS)

management system to direct and control an organization with regard to quality

NOTE *In the context of anaerobic digestion, it is a system for planning, achieving and demonstrating effective control of all operations and associated quality management activities necessary to achieve digested materials that are fit for purpose. Where specific controls are applied, they should be monitored and recorded, and their efficacy evaluated both during and after process validation. Corrective actions should be defined.*

3.65 Quality Protocol (QP)

set of criteria for the production, placement on the market, storage and use of products derived from suitable types and sources of waste, such that any risks to the environment and to human and animal health are acceptably low when any such product may, under certain circumstances, be used without waste regulatory controls, in those countries in which the QP applies

NOTE *A Quality Protocol also sets out how compliance with its criteria should be demonstrated. Products should be used in accordance with good practice, and appropriate guidance is referred to where available and suitable for use of those products in end markets allowed by that specific QP. Enquiries about QP applicability in a specific country should be addressed to its agency responsible for protecting the environment.*

3.66 risk

combination of the probability of occurrence of harm and the severity of that harm

[derived from ISO/IEC Guide 51]

NOTE *Can mean the potential realization of unwanted, adverse consequences to human life, health, property or the environment associated with a hazard.*

3.67 sanitary, sanitized

degree of processing and biodegradation at which human, animal and plant pathogens present have been reduced to acceptable levels

3.68 sanitization

biological processes, that may be supplemented with auxiliary heat, that eradicate or reduce pathogens to acceptably low, sanitary levels

NOTE *In the context of anaerobic digestion, sanitization is a process step and 'pasteurization' has the same meaning as 'sanitization'.*

3.69 senior management

an individual, or team of individuals, at the highest level of organizational management who have the day-to-day responsibilities of managing an organization, and who hold(s) specific executive powers conferred onto him / her / them with and by authority of the organization's board of directors and / or its shareholders

3.70 separated fibre

fibrous fraction of material derived by separating the coarse fibres from whole digestate

NOTE *At least 15 % of its mass should be dry matter in order that the sample is suitable for laboratory tests as a 'solid' material. It should contain sufficient dry matter to be capable of being stacked in a heap if it undergoes an aerobic maturation step; 23 % mass/mass fresh matter is a guideline figure.*

3.71 separated liquor

liquid fraction of material remaining after separating coarse fibres from whole digestate

NOTE *It is normally separated using a separator or centrifuge to remove coarse fibres. Less than 15 % of its mass should be dry matter in order that the sample is suitable for laboratory tests as a 'liquid' material. It should contain sufficient moisture to be pumpable; a suitable % m/m dry matter content should be determined in practice and the dry matter result declared for any tested portion of production. If the user desires that no significant solids residue remains on crop leaves after applying separated liquor, it should contain no more than 4 % m/m dry matter.*

3.72 sharps

man-made contaminants that are greater than 2 mm in any dimension that may cause physical injury to a person who handles digested materials without protective gloves or to a person or animal who comes into contact with these materials

NOTE *Organic components such as twigs and woody fragments can puncture skin but this risk is considered acceptably low and so has been omitted from this sharps definition. Omitted also are rock-derived 'mineral' particles and aggregated particles of all sizes, including for example gravel and stones.*

3.73 soil improver / conditioner

material added to soil in situ primarily to maintain or improve its physical properties, and which may improve its chemical or biological properties or activity

[derived from PD CR 13456:1999]

3.74 soft landscape operations

preparation and cultivation of soils in-situ or ex-situ and use of growing media, turf dressings, root zone media and similar materials for establishing and maintaining plants and turf in soft landscapes

NOTE *Includes the use of soil improvers and mulches, although in this context the specifiable application is the use of digested material for soil improvement, particularly separated fibre.*

3.75 source segregated

materials or biowastes of the types and sources sought, that are stored, collected and not subsequently combined with any non-biodegradable wastes, or any potentially polluting or toxic materials or products, during treatment or storage (whether storage is before or after treatment)

NOTE *Source segregated materials can include collection of a mixture of biowaste / biodegradable material types, from more than one source. Such materials do not include sewage sludges and their derivatives. It is acknowledged that low levels of physical contamination may occur, which may trigger rejection of an input material load or physical contaminant removal prior to loading the biowaste / biodegradable material into the working digester. See* ***6.1*** *regarding packaged biowastes / biodegradable materials.*

3.76 stable, stabilized, stability

degree of processing and biodegradation at which the rate of biological activity has slowed to an acceptably low and consistent level and will not significantly increase under favourable, altered conditions

NOTE *Stable digestate should not be attractive to vermin or wild animals and should not be so odorous that its storage or use causes nuisance to humans. In a stable but immature state, it may still contain insufficiently biodegraded natural or man-made substances that exert phytotoxic effects in some applications; this should be taken into account in guidelines for digestate use.*

3.77 stabilization

biological and chemical processes that together with conditions in the material being treated aim to achieve stable, treated material

NOTE *After stabilization, biodegradation will continue to occur, albeit at a slower rate.*

3.78 step

point, procedure, operation or step in the digestate chain including raw materials, from primary production to final use of digested materials and the consumption of food or fodder grown on land that has received such material

3.79 stones

extraneous, hard mineral matter greater than 5 mm in any dimension

NOTE *Does not include glass, plastic or metal, but does include pebbles and pieces of aggregate, concrete, and pottery.*

3.80 supply agreement

agreement between an anaerobic digestion facility operator and a supplier of digestable input materials, that specifies suitable material types, quality, options and actions to be taken in the event of contamination, and other criteria that facilitate input material control

3.81 thermophilic organisms

organisms for which optimum growth temperatures are within the range 45 °C to 80 °C

3.82 topsoil

material with a mineral base which will perform the functions of natural topsoil and in which plants will grow healthily

[derived from BS 3882:2007]

***NOTE** In this context it is man-made topsoil that includes digested material.*

3.83 user(s)

individuals or organizations that obtain digested materials from a producer or third party with the intention of using them

3.84 validation, validate

obtaining and evaluating evidence that the elements of the HACCP plan are effective

***NOTE 1** In the context of PAS 110, this includes obtaining and evaluating evidence that the Quality Management System is effective for producing digested materials of the quality to which the producer has committed in the Quality Policy.*

***NOTE 2** See Clause **11** for validation requirements. It will take time to generate evidence of consistently sufficient digested material quality.*

3.85 verification, verify

application of methods, procedures, tests and other evaluations, in addition to monitoring to determine compliance with the HACCP plan

3.86 volatile fatty acids (VFA)

fatty acids with a carbon chain of six carbons or fewer

NOTE Also referred to as organic acids, VFAs are important in anaerobic digestion for two reasons: (a) organic acids (particularly acetic) are the immediate precursors in the metabolic chain leading to methane formation and (b) if present in high concentration, acids are known to cause stress in the microbial population and can ultimately lead to complete process failure. In PAS 110, digested material samples are characterised in terms of their VFA content, as the screening step that influences whether a sample is subsequently tested in terms of its Residual Biogas Potential (RBP). See Note 1 to Table 1 for further guidance.

3.87 volatile solids (VS)

those solids in a sample of material that are lost on ignition of the dry solids at 550 °C

***NOTE 1** Volatile solids are also referred to as loss on ignition (LOI), which is a measure of organic matter (OM). See BS EN 15169 for the method of test.*

***NOTE 2** Dry solids are also referred to as total solids (TS), or dry matter (DM). See BS EN 14346 in for the method of test.*

3.88 whole digestate

material resulting from a digestion process and that has not undergone a post-digestion separation step to derive separated liquor and separated fibre

***NOTE** Less than 15 % of its mass should be dry matter in order that the sample is suitable for laboratory tests as a 'liquid' material. It should contain sufficient moisture to be pumpable; a suitable % m/m dry matter content should be determined in practice and the dry matter result declared for any tested portion of production.*

3.89 waste management licence (WML)

licence issued by the regulator, under the Environmental Protection Act 1990 (as amended) [3] and the Waste Management Licensing Regulations (as amended) [4] in England and Wales / Waste Management Licensing Amendment (Scotland) Regulations 1994 (as amended) [19], that allows a person(s) or organization to undertake an activity involving the deposit, keeping, treating or disposal of a controlled waste

***NOTE 1** Regulators are the Environment Agency in England and Wales, the Scottish Environment Protection Agency in Scotland, and the Environment and Heritage Service in Northern Ireland. Controlled wastes arising in the nations of the UK are defined in section 75 of Part II of the Environmental Protection Act 1990 as amended [3]. In England and Wales, WMLs were superseded by Environmental Permits in 2007 (see **3.5**).*

***NOTE 2** See **3.5** for definition of authorization.*

3.90 waste management licence / environmental permit exemption

exemption from the need for an environmental permit or waste management licence, allowed by the regulator in certain circumstances

NOTE 1 *In England and Wales, an anaerobic digestion activity may be allowed to be exempt from having an environmental permit; check with the regulator on interpretation of the regulations and availability of documents for applying for an exemption. In Scotland, an anaerobic digestion activity is allowed to be exempt from waste management licensing if it meets the requirements of regulation 18 and Schedule 3 of the Waste Management Licensing Regulations 1994 (as amended) [4]. The exempt activity should be registered with the regulator. Separate exemptions exist in the nations / provinces / administrations of the UK for spreading digested, controlled biowastes on land.*

NOTE 2 *See **3.26** for definition of exemption.*

3.91 waste regulatory controls

controls under legislation that govern the transfer, transport, storage, handling, treatment, recovery and disposal of waste

4 Quality management system (QMS)

4.1 General

NOTE *The requirements in PAS 110 cover those requirements in* ***BS EN ISO 9001*** *that are relevant to the production of digested materials that are fit for purpose, from a single anaerobic digestion process. For more information, producers should refer* ***BS EN ISO 9001*** *and also* ***BS EN ISO 9000*** *as which sets out QMS fundamentals and vocabulary (see the Standards publications section in bibliography).*

4.1.1 A quality management system (QMS) specific to a defined digestion process and its resulting whole digestate, and any separated liquor and separated fibre, shall be established and maintained.

4.1.2 Digested materials placed on the market shall be one or more of whole digestate, separated liquor or separated fibre, as determined appropriate by the producer. Any of these digested material output types placed on the market as PAS 110 compliant shall comply with the requirements of this PAS.

NOTE *See Clause* ***3*** *for definitions of the terms whole digestate, separated liquor and separated fibre. The producer may choose to check the PAS 110 compliance of one or more of these digested material output types.*

4.1.3 Senior management shall:

a) ensure sufficient resources (people, infrastructure, equipment, work environment) for the establishment, implementation, maintenance and improvement of the QMS;

b) ensure that responsibilities and authorities are defined, utilizing at least a staff organogram, and that these are communicated within the organization;

c) establish a quality policy for digested material produced under this QMS (see **4.2**);

d) communicate to the organisation that the digested material produced under this QMS shall be fit for purpose (see **4.2.2** c) and **3.29**);

e) ensure that appropriate communication processes are established within the organization and that communication takes place regarding the effectiveness of the QMS; and

f) conduct management reviews.

4.1.4 Senior management shall appoint a member of the organization's management who, irrespective of other responsibilities, shall have responsibility and authority that includes:

a) ensuring that QMS processes are established, implemented and maintained;

b) report to senior management on the performance of the QMS and any need for improvement; and

c) ensuring the promotion of awareness of customer requirements throughout the organization.

NOTE *This role may fit well with the role of technical competence to operate a biowaste management facility, under an authorization. See **4.8** for requirements about review of the QMS.*

4.2 Quality policy

4.2.1 For each digested material type for which PAS 110 conformance is claimed, or is intended to be claimed, the producer shall:

a) check whether digestate users have any requirements in addition to the minimum quality requirements set in this PAS (see **4.2.2** c), **11.2** and **12.2**); and

b) ensure that the market ready digested material is fit for purpose (see **3.29**), which includes meeting any extra quality requirements specified by the user.

NOTE *Apart from use as a soil improver in a range of markets, it may be necessary to process whole digestate, separated liquor and separated fibre further to achieve suitable characteristics for specialist uses. Product fitness for purpose is the key aim of a QMS and why this PAS requires one.*

4.2.2 The producer's quality policy shall include:

a) clear identification of the location of the digestion site, the type(s) of processes employed, and what digested material output types (whole digestate and any separated fibre or liquid fractions) are produced;

b) for each digested material type for which PAS 110 conformance is claimed, or intended to be claimed, the producer's commitment to achieving the corresponding minimum quality specified in **11.2** and **12.2**; and

c) for each digested material type for which PAS 110 conformance is claimed, or is intended to be claimed, the producer's commitment to fulfilling customers' requirements regarding its fitness for purpose.

4.3 Communication, awareness, training and competence

4.3.1 The quality policy and relevant parts of the QMS shall be communicated to all personnel whose activities affect digested material quality. They shall be made aware of the relevance and importance of their activities and how those activities contribute to the achievement of the producer's commitments in their quality policy.

4.3.2 The producer (senior management and/or manager with QMS responsibilities) shall determine the necessary competence for personnel performing work affecting digested material quality.

4.3.3 Each person, whose duties affect digestate quality shall be trained, instructed and supervised commensurate with those duties, such that he/she is competent. Training shall include the subjects of quality management systems and HACCP, at least for the competent person(s) with overall responsibility for the QMS, who also leads or participates in the HACCP team. His / her training on QMS and HACCP shall be carried out by a formal training provider.

4.3.4 For each person, including the competent person(s) with overall responsibility for the QMS, a record shall be kept of the:

a) training topic;

b) training date or period;

c) name and role of the person who received the training on that topic;

d) person and organization who delivered the training (which can be the producer); and

e) any certificate or qualification achieved.

4.4 Documents and document control

4.4.1 Documents appropriate to the scope of the QMS shall be established, used and subject to document control.

NOTE *Existing documentation and records may be used as part of the QMS if they meet the requirements of this PAS.*

4.4.2 Each document of internal origin that is in use within the QMS shall be the current version approved as adequate by the person with responsibility for document control. Each such document shall be legible, available at its relevant place(s) of use and include:

a) a title;

b) a version number;

c) a date of issue; and

d) the name of the person who issued it.

4.4.3 Records generated by a weighbridge system which relies on software programming that the producer is not easily or cost-effectively able to change is exempt from the requirements in **4.4.2**. This exemption is also conditional upon each weighbridge system record being assigned a unique record number.

4.4.4 Any document of external origin in use within the QMS shall be identified and its distribution shall be controlled.

4.4.5 Any obsolete document version shall be promptly removed from all places where it is used and, where appropriate, replaced with the current revised and approved version. Any obsolete document retained for any purpose shall be identified as obsolete.

4.4.6 The producer shall maintain records specified within this PAS that demonstrate effective control of input materials, production and storage of digested materials.

4.4.7 The records shall be:

a) readily identifiable;

b) legible;

c) genuine;

d) collated and maintained such that they are readily retrievable; and

e) stored in good condition for at least two years.

NOTE *Specific record types that PAS 110 requires to be established and information they are required to include are specified within other clauses in this PAS, in connection with the activity to be recorded.*

4.5 Incidents and accidents

The producer shall record all accidents and other incidents that occur on site, the known or suspected cause(s), and the actions taken. The need for preventive action shall be considered, and any such action taken shall be recorded.

4.6 Complaints and concerns

4.6.1 The producer shall decide and implement any necessary action in response to any complaints or concerns expressed by interested parties, including operatives, customers, clients and regulatory authorities about quality or usability of the whole digestate, and any separated liquor and separated fibre fractions.

4.6.2 The producer shall record the:

a) name and contact details of the person who expressed concern or made a complaint;

b) specific subject(s) of the concern or complaint;

c) date and time communicated to the producer and name of the person to whom it was communicated;

d) nature and date(s) of any actions and checks and who carried them out;

e) nature and date of any response to the person who expressed a concern or made the complaint; and

f) name of the person who communicated the response.

4.7 Internal audit of the QMS

4.7.1 The producer shall conduct and record internal audits at planned intervals, at least annually, to determine whether the QMS actually conforms to their QMS plan for production of digested materials that are fit for purpose and that the QMS is effectively implemented and maintained.

4.7.2 An audit programme shall be planned, taking into consideration the status and importance of the processes and areas to be audited, as well as the results of previous audits. The audit criteria, scope, frequency and methods shall be defined. The selection of auditors and conduct of audits shall ensure objectivity and impartiality of the audit process. Each auditor shall not audit his/her own work.

4.7.3 Internal auditing shall cover QMS procedures (processes) as well as evaluation of the digestate

production process, the 'operating procedures' that describe it and the digested material quality. Procedures relating to the allocation of QMS responsibilities, human resources, training, infrastructure, customer-related processes, data handling, communications and procedures for improvement of the QMS shall also be internally audited.

***NOTE** PAS 110 includes numerous specific requirements relating to evaluation of the digestate production process and quality of the digested material, particularly in clauses **11** and **12**.*

4.7.4 A procedure that defines the responsibilities and requirements for planning and conducting audits, establishing records and reporting results shall be established and documented.

4.7.5 The management responsible for the area being audited shall ensure that any necessary corrections and corrective actions are taken without undue delay to eliminate detected nonconformities and their causes. Follow-up activities shall include verification of the actions taken and reporting and recording of verification results.

4.8 Management review of the QMS

4.8.1 The producer's senior management shall review whether the QMS and HACCP plans continue to be effective.

4.8.2 A formal, recorded review shall be undertaken at least once per year, or sooner than scheduled if triggered by significant change before the scheduled date.

4.8.3 Inputs to each review shall include:

a) results of audits by the producer's personnel and any external auditors;

b) anaerobic digestion process performance;

c) quality of digested materials (i.e. their conformance to the quality policy, including fitness for purpose);

d) status of preventive and corrective actions;

e) follow-up actions from previous management reviews;

f) the continuing suitability of the QMS (including the HACCP plan, CCPs and CLs, and operating procedures) in relation to changing conditions and information;

g) any complaints and concerns expressed by interested parties, including operatives, customers, clients and regulatory authorities, and their outcomes;

h) recommendations for improvements.

4.8.4 The output from the management review shall include any decisions and actions related to:

a) improvement of the effectiveness of the QMS including its procedures;

b) improvement of digested material quality as per customer/user requirements; and

c) resource needs.

4.8.5 If any significant, non-temporary, change in input materials, production process management or required quality of digested materials occurs, the production process shall be re-validated. An addition or removal of one or more input material types represents a significant, non-temporary change (see note for guidance).

The significance and temporary or non-temporary nature of any change the producer is aware of shall be reviewed and recorded, the record including the producer's justification for each decision.

***NOTE** to **4.8.2** and **4.8.5** Significant change is a matter of interpretation, and can relate to input materials, production process management, required quality of digested materials or other factors that affect their quality. If the producer has applied to a certification body for initial or renewal certification, an interpretation of the certification scheme rules may be sought.*

In the event of significant, temporary changes, the producer shall sample and test the relevant digested material output types (see Clause **11** if working towards validation, or Clause **12** if operating after validation) as appropriate for determining the effects of those changes on the digested material(s).

5 Hazard Analysis and Critical Control Point (HACCP) system

***NOTE** HACCP planning is a basis for process design and operation that identifies which hazards and associated risks should be reduced to acceptable levels; in this context;, in order that digested materials are safe to use and fit for purpose. For general guidance, refer to the Commission's relevant publication [27] and organizations that own certification schemes and provide services for assessing conformance to PAS 110. Clause 5 covers HACCP planning within the context of digestate production and PAS 110's scope.*

5.1 HACCP planning and activities shall be carried out in accordance with the Codex Alimentarius Commission's 'Principles of the HACCP System', namely:

- Principle 1 – conduct a hazard analysis (see **5.2**);
- Principle 2 – determine the Critical Control Points (CCPs) (see **5.3**);
- Principle 3 – establish critical limit(s) (CLs) (see **5.3**);
- Principle 4 – establish a system to monitor control of the CCP (see Clause **7**, **11.1.2** and **12.1**);
- Principle 5 – establish the corrective action to be taken when monitoring indicates that a particular CCP is not under control (i.e. outside its CL(s), see **7.3.1** n));
- Principle 6 – establish procedures for verification to confirm that the HACCP system is working effectively (see **5.6**, **11.1.2** and **12.1**); and
- Principle 7 – establish documentation concerning all procedures and records appropriate to these principles and their application (see **7.3.1**, **11.1.2**, **12.1**, **5.6** and **4.8**).

5.2 A systematic assessment of human-, animal- and plant-health hazards associated with intended uses of the digested material output type(s) for which PAS 110 conformance is claimed, or intended to be claimed, shall be carried out. The hazards assessed shall include:

a) pathogens and toxins that adversely affect human and animal health;

b) odours offensive to people who live or work in close proximity to the location of use;

***NOTE** Input materials should be digested to such an extent that when digestate is spread as per good practice, by the producer or a different user, the activity does not release offensive odours that are deemed by the regulator or other relevant authority to be a 'statutory nuisance'.*

c) stones and any man-made particles that may damage equipment for handling, mixing or applying digestate, or blended materials that contain it; and

d) sharps that may adversely affect human and animal health.

5.3 For hazard a) in **5.2**, one critical control point (CCP) in the digestate production process shall be identified and the Critical Limits (CLs) of the control measure(s) at the CCP shall be established. The same requirement applies to each further hazard specified in **5.2** and any other hazards identified by the producer.

***NOTE** All steps of the digesate production process, from input material receipt to digestate dispatch, should be considered when identifying the CCP for a specific hazard. This does not mean that every step in the production process is a CCP. More than one control measure may be required to control a specific hazard and more than one hazard may be controlled by a specific control measure. 'Acceptable level' means achieving at least the minimum quality required in this PAS for digested materials and any additional criteria that the producer has committed to meeting in the quality policy.*

5.4 All whole digestate shall undergo the CCP for each hazard applicable to whole digestate. At each CCP, operating conditions shall be monitored and maintained within the CCP's CLs.

***NOTE** Hazards **5.2** a) to d) inclusive apply, as well as any others the producer has identified relevant to whole digestate. This requirement applies both during and after process validation.*

5.5 For each CCP applicable to separated fibre or separated liquor, for which PAS 110 conformance is claimed, operating conditions shall be monitored and maintained within the CCP's CLs.

***NOTE** Clause **9** of this PAS specifies requirements relating to monitoring. Checks on whether the process is operating within the defined CLs are required in **11.1.2** and **12.1.1**. See **7.3.1**'s requirement to define corrective action(s) that should be taken in the event that a CL is exceeded.*

5.6 Procedures shall be established for verification that the HACCP plan and its implemented CCPs and CLs are under control and the HACCP system is working

effectively. The HACCP plan and related procedures shall be documented and reviewed as part of the QMS review, as instructed in **4.8**.

NOTE *Requirements relating to complaints are specified in* ***4.6*** *and review of complaints is required in* ***4.8****, as part of the QMS review.*

6 Input materials

6.1 Input materials shall be source segregated (see **3.75**) biowastes (see **3.8**) and/or source segregated biodegradable materials (see note to **3.8**). Input materials to the digestion system shall not include contaminated wastes, products or materials.

Packaged former foodstuffs, catering wastes, other types of ABP and non-ABP food wastes shall only be accepted for pre-treatment by the producer if they comply with the input materials supply agreement (see **6.2**). The pre-treatment shall remove any non-biodegradable packaging prior to loading those biowastes / biodegradable materials into the digestion system.

NOTE *This requirement means that the biowaste / biodegradable material inputs to the digester should not contain any physical contaminants or sharps. Risk assessment may necessitate exclusion of biowastes / biodegradable materials packaged in glass. See Clause **5**, which requires HACCP planning. In a country which has adopted the ADQP, if PAS 110 digested material is used as a product in that country or any other country which has adopted the ADQP, it may only be derived from the ADQP's list of allowed input material types and sources.*

6.2 A written supply agreement for the input materials shall be agreed with each input material supplier, before any loads are delivered, unless the source is from within the digestate producer's own premises or holding. The agreement shall include:

a) the type and specific source location(s) of the material;

b) a brief description of the source type(s) and any associated process from which it arose (e.g. for food waste, 'dedicated bins for this commercial, municipal waste type from back of store retail outlets');

c) a brief description of its physical form (e.g. typical percentage of suspended solids or moisture content, and whether it is pumpable);

d) criteria for input material delivery acceptance, which may be qualitative (e.g. visual assessment) or quantitative (e.g. by testing samples), or both;

NOTE *Detailed guidance on appropriate test parameters and test result limits for samples of different input material types should be available from certification scheme owners or certification bodies who assess conformance to this PAS.*

e) any additional arrangements associated with actions that would be taken to remove or reduce physical contaminants or any other unsuitable content prior to shredding or digestion;

f) criteria that trigger input material rejection and the procedure to be followed if rejected;

NOTE *Criteria that could trigger input delivery rejection include the material being of a type not included in the producer's authorization, or physical contaminants being present at levels that would adversely affect the digestion process and that cannot be cost-effective removed.*

g) a requirement for duty of care on the supplier relating to quality control;

h) a requirement that any significant change in the quality of input material will be notified to the producer before delivery; and

i) declarations that each input material type from each source covered by the supply agreement is fit for purpose.

NOTE *See **3.29** and in particular, its note.*

NOTE *The regulator's relevant position statement or briefing note should be checked regarding the circumstances in which waste regulatory controls do not apply to agricultural manures and slurries, and crops grown specifically for anaerobic digestion.*

6.3 In exception to the requirements in **6.2**, a written supply agreement shall not be required where a farming / horticultural / forestry co-operative (see **3.28**) produces digested material only from manure, unprocessed crops, processed crops, crop residues, and/or used animal bedding that arises within the co-operative's premises or holdings. This exception is also conditional upon the co-operative's digested material being used entirely within the same co-operative's premises or holdings. Under the circumstances described in **7.2.4**, exception to the requirements in **6.2** is only allowed if input material from any source outside the producer's premises or holding is manure, unprocessed crops, processed crops, crop residues, glycerol, and/or used animal bedding that has arisen within the premises or holdings of the co-operative that the producer is part of.

6.4 Before use, the animal bedding (see **6.3**) is allowed to come from a different premise or holding, provided that it has not come into contact with livestock other than those within the premise or holding where it is used as animal bedding. Such material shall not contain any non-biodegradable materials or residues of any toxic substances that represent unacceptable risk to human or animal health, or the environment, before and after digestion.

NOTE *Examples of non-biodegradable materials are veneer, paint, laminate and formica. Many wood preservatives contain toxins, residual amounts of which can be detected when the treated wood is discarded after use. Under this PAS, treated wood is not allowed, even if used as or in animal bedding.*

6.5 The producer shall ensure that each supplier of input materials understands the importance and requirements of the supply agreement for the input materials.

6.6 For each vehicle's load of input material delivered, the producer shall make and keep a record of the:

a) input material type(s) and European Waste Catalogue code(s);

b) source;

c) amount;

d) date delivered;

e) acceptance; and

f) delivery location on site.

NOTE *For example, this may be the number of the tank into which the input material is discharged.*

6.7 The only exception to the requirement in **6.6 f)** is when the producer's site only has one delivery location and it is identified in the operating procedures, or elsewhere in QMS documentation.

6.8 Each delivery of input material shall be visually inspected at a location where there is no risk that the delivery will cross-contaminate any other input materials accepted for treatment, materials undergoing treatment or fully treated materials in storage. The only exception is for a delivery that cannot be visually inspected without unacceptable risk to human health, after all practicable measures have been taken into account.

NOTE *Visual inspection should be at the point of acceptance or after the load has been discharged, as appropriate to the facility layout and its digestion system. See **7.1.1** for further requirements on the prevention of cross-contamination.*

6.9 For each of any input material load or part-load rejected after delivery, the producer shall make and keep a record of the:

a) input material type(s) and European Waste Catalogue code(s);

b) source;

c) amount;

d) date rejected;

e) reason for rejection; and

f) where it was sent.

6.10 Exception to the requirements in **6.9 a)**, **b)** and **e)** shall be allowed for the periodic container loads of physical contaminants removed from numerous accepted input material deliveries that are sent to a disposal facility.

NOTE *The sources of the physical contaminants (**6.9 a**) and reason for rejection (**6.9 b**) do not have to be recorded for those container loads because the sources are many and the material is rejected because it consists of physical contaminants. Re-recording the input material type(s) and European Waste Catalogue code(s) (**6.9 a**) is also not necessary because the load consigned for disposal consists of physical contaminants and is not an input material to the anaerobic digestion process.*

7 Process management, separation and storage

7.1 General

NOTE *An appropriate mix of suitable input materials and the maintenance of an effective AD process with a sufficient hydraulic retention time (HRT, see **3.41**) for the volumetric solids load to the system are the most important factors for producing digested materials of consistent and adequate quality. The organic loading rate (OLR, see **3.57**) is an operating term that the producer can use to work out a suitable balance between the maximum loading rate and the minimum necessary retention time in the digester(s). Apart from the input material characteristics and capacity of the AD vessel(s), the OLR will also be influenced by the operational temperature critical limits and any mixing of the material while undergoing anaerobic digestion.*

7.1.1 The input materials, the process and steps used to make the whole digestate and any separated liquor and separated fibre fractions, and their stores shall be kept separate from any other materials, processes and stores on the same site.

7.1.2 The site, digestate production system, storage and dispatch of treated and rejected materials shall be designed and managed such that:

a) rejected materials and any materials being stored awaiting rejection do not contaminate any other materials on site;

b) material suitable for treatment flows one way through the system;

c) partially treated material is not contaminated by untreated or re-contaminated material; and

d) fully treated whole digestate, and any separated liquor or separated fibre is not contaminated by untreated, partially treated or re-contaminated material.

NOTE *Digested material may be re-circulated through one or more steps in the AD process, as appropriate for process optimization or efficient use of liquid resources.*

7.1.3 If any one of the digested material types is not compliant with PAS 110 (see **4.1.2**), the producer shall ensure that PAS 110 compliant digested material is not contaminated by the non PAS compliant digested material or any other material at the production facility.

7.1.4 Each treatment and storage vessel and area shall be clearly labelled, and correspond with the production process described in the document system, including the process flow diagram.

7.1.5 Any portion of whole digestate and any separated liquor or separated fibre fractions for which PAS 110 conformance is claimed shall be stored under cover at the digestion facility until the producer has dispatched it for use outside the producer's premises or holding. Any such digested material shall have been fully processed and completed any minimum applicable maturation or storage time before dispatch for use. Where such materials are to be used within the producer's or farming / horticultural / forestry co-operative's premises or holding they shall be stored under cover until the production process is complete, after which they may be moved to uncovered storage before use.

NOTE *Covered storage at the AD facility will minimize the risk of recontamination of digested materials with pathogens and reduce gaseous emissions (e.g. ammonia and methane) from the digested materials to the environment. A floating layer of material would be an acceptable cover for a store of whole digestate or separated liquor. It may consist of any type of material that will not adversely affect the quality of the digested material. It is for the producer to decide whether a maturation step (see **3.50** for definition) is applied to separated fibre. If further biowaste / biodegradable material is added to separated fibre at the start of or during maturation, such activity is outside the scope of this PAS (see Note 2 in Clause **1**).*

7.2 Pasteurization step

7.2.1 Digested materials shall be produced by an anaerobic digestion process that includes:

a) one of the combinations of pasteurization criteria specified in the most appropriate ABP Regulation [6], [7], [8] and [9], even if not digesting any ABPs (see Annex A); or

b) the specific pasteurization criteria approved by the Competent Authority (Animal Health vet) for digesting ABPs.

NOTE *Where animal by-products are accepted as input materials, their treatment and any applicable storage procedures are approved by the Animal Health vet.*

7.2.2 Digested materials made only from manure, unprocessed crops, processed crops, crop residues, glycerol, and/or used animal bedding that arise within the producer's premises or holding and that are used entirely within the same premises or holding are exempt from the pasteurization step (**7.2.1**). However, the producer shall determine the process steps, the CCP and its CLs (e.g. minimum timescale and suitable mesophilic temperature range) that are effective for producing digested materials of the quality required in this PAS. This clause does not apply to a farming / horticultural / forestry co-operative (see **3.28**).

NOTE *The regulator's relevant position statement or briefing note should be checked regarding the circumstances in which waste regulatory controls do not apply to agricultural manures and slurries, and crops grown specifically for anaerobic digestion.*

7.2.3 Before use, the animal bedding referred to in **7.2.2** is allowed to come from a different premise or holding, provided that it has not come into contact with livestock other than those within the premise or holding where it is used as animal bedding. Such material shall not contain any non-biodegradable materials or residues of any toxic substances that represent unacceptable risk to human or animal health, or the environment, before and after digestion.

NOTE *Examples of non-biodegradable materials are veneer, paint, laminate and formica. Many wood preservatives contain toxins, residual amounts of which can be detected when the treated wood is discarded after use.Under this PAS, treated wood is not allowed, even if used as or in animal bedding.*

7.2.4 Exemption from the pasteurization step (**7.2.1**) is also allowed for manure, unprocessed crops, processed crops, crop residues, glycerol, and/or used animal bedding (see **7.2.3** for allowed source before use) that arises within the producer's premises or holding, if such input materials are co-digested with pasteurized biodegradable materials / wastes from any source(s) outside the producer's premises or holding. This material source-specific exemption from pasteurization is conditional upon all the digested material being used within the producer's premises or holding, irrespective of whether it is part of a farming / horticultural / forestry co-operative (see **3.28**). The producer shall determine the process steps, the CCP and its CLs that are effective for producing digested materials of the quality required in this PAS.

7.3 Documents on process management, separation and storage

7.3.1 The producer shall write and implement operating procedures that cover as a minimum:

a) a written description and annotated flow diagram of the production system;

b) input material storage;

c) reception area;

d) any input material preparation prior to digestion (e.g. pasteurization, cleaning, maceration);

e) the steps for producing digested materials at the digestion facility;

f) which steps consist of or include control measures that represent a CCP and the CLs (operating conditions / parameters) of each CCP;

NOTE *The CLs should take account of the maximum OLR (see **3.57**) that is effective for achieving sufficient quality of the digested materials, given the minimum HRT used (see **3.41**).*

g) the monitoring points and parameters monitored;

h) any applicable step for separating whole digestate;

i) storage of whole digestate and/or separated liquor, and any applicable storage conditions and minimum timescales;

NOTE *This part also applies in any circumstance where fully treated digested material is stored at a separate location owned, rented or managed by the producer's business. Waste regulatory controls require that digested materials that are 'waste' are stored in accordance with an authorization or exemption.*

j) any maturation step and storage for separated fibre;

k) any recirculation of whole digestate or separated liquor;

l) the digested material sampling points;

m) process management evaluation;

n) corrective actions to be followed in the event of deviation from CLs at any CCP (i.e. if any CL is exceeded), quality failure of a sampled portion of production, or any other occurrence that causes,

or may cause quality failure;

o) dispatch of digested materials from the digestion facility;

p) process inspection and maintenance, from acceptance of input materials to dispatch of digested materials and reject materials;

q) procedures to be followed in the event of system failure, equipment failure, and accidents or incidents that affect the digestion process or the quality of digested materials;

r) description of a procedure for establishing the corrective action(s) appropriate for a previously unforeseen circumstance that does, or could, result in digested material quality failure(s);

s) control of vermin; and

t) a statement of the known or estimated input material throughput and quantities of digested material outputs for the last 12 month period.

NOTE 1 *The operating procedures take account of the HACCP plan and other requirements of this PAS. To avoid duplication, wherever appropriate producers should cross-reference specific parts of an authorization, exemption, ABP document, working plan, the HACCP plan or other current documents.*

NOTE 2 *It is recommended that the producer establishes and implements a plan for minimizing and managing odours that arise at the anaerobic digestion facility. Odour minimization and its emissions are within the regulator's remit to check and enforce legal requirements. Compliance with PAS 110 cannot confer immunity from legal obligations (see Foreword and **0.3**). This PAS does not set controls on digestate production odours however **5.2 b)** sets a related requirement.*

NOTE 3 *The list above does not necessarily cover all actions that should be recorded within QMS documents, so should be carefully reviewed by the producer. Parts of the system relating to biogas, its treatment and conversion to renewable energy are not included in the list above as this PAS only covers those parts of the system that affect quality of digested materials. The producer's QMS documents may, for completeness, cover biogas aspects, including any biogas quality criteria set by the producer. Emergency response procedures are amongst the requirements of the Waste Management Licensing / Environmental Permitting / Pollution Prevention and Control Regulations.*

7.3.2 The producer shall record all actions taken relating to operation of the anaerobic digestion process.

8 Process equipment

8.1 The producer's document system shall identify the equipment required to maintain and monitor the process.

***NOTE** to **8.1** and **8.2** For example, this information could be included in the operating procedures document or others specifically about equipment.*

8.2 The producer's document system shall state how often equipment shall be checked, what checks shall be carried out and the contingency arrangements in the event of equipment failure. The results of each check shall be recorded.

8.3 The producer shall maintain in good working order all equipment required to manage and monitor the digestion process.

9 Process monitoring

9.1 General

***NOTE** Monitoring is a planned sequence of observations or measurements of control parameters to assess whether a CCP (see **3.18**) is under control (see **3.14** and **3.15**). CCPs and CLs (see **3.19**) for AD systems operated as per good practice should minimize odorous and potentially polluting gaseous emissions, minimize variation in digested material quality, and consistently produce digested materials that are safe to use and fit for purpose. The health and safety of personnel is covered by regulations, so is not within the scope of this PAS.*

9.1.1 The producer's document system shall state the:

a) monitoring points, including which are for CL parameters;

b) parameters monitored and calculated (e.g. temperature, OLR and HRT);

c) monitoring methods;

d) monitoring and calculated parameter frequencies;

e) acceptable range of results for each monitored parameter; and

f) information that shall be recorded.

9.1.2 The producer shall monitor the process steps and keep process monitoring records that include monitoring results, corresponding dates and identification of the relevant monitoring points.

10 Sampling of digested materials

10.1 In the context of compliance with this PAS, sampling of whole digestate, separated liquor or separated fibre as required in Clause **10** is only applicable to the output types that are, or are intended to be, placed on the market as PAS 110 compliant.

10.2 Whole digestate shall be sampled after full treatment, when it is ready for use. Each final sample shall be representative of the portion of production (see **3.6**) sampled.

NOTE *If a minimum storage period does not apply to whole digestate, sampling upon completion of full treatment may be done via one or more sampling access points appropriately located in the digestate production system. If a minimum storage period is necessary before the whole digestate is ready for use, it should be sampled after it has completed the minimum storage period and preferably before any more recently produced whole digestate enters the same storage tank. If sampled from a storage tank, thorough mixing should immediately precede sampling. Regarding animal by-products, see* ***10.5****.*

10.3 Separated liquor shall be sampled after full treatment and separation from whole digestate, when it is ready for use. Each final sample shall be representative of the portion(s) of production sampled.

NOTE *See the note to* ***10.2*** *for guidance also applicable to separated liquor.*

10.4 Separated fibre shall be sampled after full treatment and separation from whole digestate, and after any maturation step and/or a minimum storage period under any conditions that the producer has deemed applicable (see **7.3.1**). Each final sample shall be representative of the portion(s) of production sampled.

NOTE 1 *It is recommended that separated fibre undergoes a maturation step before sampling. Maturation should achieve significant loss of the free ammonia that separated fibre contains when separated from whole digestate. Free ammonia can impair plant germination and growth. Regarding animal by-products (see* ***10.5****).*

NOTE 2 *[in connection with* ***10.2****,* ***10.3*** *and* ***10.4****]*
See ***11.2*** *and* ***12.2*** *for minimum required sampling and testing frequencies for process validation and afterwards.*

NOTE 3 *[in connection with* ***10.2****,* ***10.3*** *and* ***10.4****]*
The competent authority, regulator, an appropriate certification scheme owner, certification body, consultant or AD system manufacturer/supplier may provide guidance on how to obtain a representative sample from a portion of whole digestate or separated liquor production. ***BS EN 12579****, Soil improvers and growing media – Sampling, provides guidance on how to obtain a representative sample of separated fibre. To obtain a representative sample of whole digestate or separated liquor, it is recommended that producers follow the guidance in the adapted version of Bundesgütemeinschaft Kompost e.V.'s 'Sampling liquid digested materials' document (see other publications section of bibliography [26]).*

10.5 Any sample taken and the test results obtained for ABP Regulation [6], [7], [8] and [9] purposes shall only count as evidence towards compliance with this PAS if the sample is taken as required in Clause **10** of this PAS, and is tested as required in **11.2** before validation, or **12.2** after validation. In particular, the sample shall be taken at a time that corresponds with **10.2**'s, **10.3**'s or **10.4**'s respective criteria for whole digestate, separated liquor or separated fibre. Any ABP Regulation / Animal Health vet's instructions regarding the number and locations of sub-samples that constitute the final sample for the laboratory to test and the amount required for carrying out human and animal pathogen indicator tests may take precedence if the timing and location of sample taking is as specified in clause **10** of this PAS.

10.6 The minimum time between taking each representative sample from a portion of production shall not be less than the minimum necessary retention time in the digester.

NOTE *The minimum necessary retention time is determined by the producer, or perhaps the Animal Health vet in the case of animal by-products, as appropriate to the AD system and the nature and loading rates of the input materials that it treats. The HRT and/or OLR operated by the producer partly reflect and influence the minimum necessary retention time in the digester. The producer may use the AD system's minimum HRT or maximum OLR figure as a surrogate for 'minimum necessary retention time'. (See **3.41** and **3.57** for definitions of HRT and OLR respectively).*

10.7 For each sample, the producer shall record, keep a copy of and inform the laboratory of the:

a) sampling date;

b) sample type (whole digestate, separated digestate liquor or separated digestate fibre as applicable);

c) code for or reference to the sampled portion of production;

d) digestion facility name; and

e) name of the person who carried out the sampling.

10.8 The requirement in **10.7** also applies to any sample taken by any party other than the producer, who may record sampling and supply information to the laboratory on the producer's behalf.

10.9 Each sample tested in order to demonstrate compliance with this PAS shall be tested by a laboratory that has no conflict of interest with the producer.

11 Validation

11.1 General

11.1.1 The characteristics and proportions of input materials may vary. Consequently, the validation timescale shall be sufficient for checks that any whole digestate, separated liquor or separated fibre output types for which PAS 110 conformance is claimed meet the requirements of this PAS.

11.1.2 In order to validate the efficacy of the elements of the HACCP plan and verify that the digestion process is under control (as per the HACCP plan) and achieving the required digestate quality results, the producer shall:

a) ensure that the quality and proportions of input materials are within the plant design and operation parameters;

b) operate all of the CCPs within their CLs;

c) check that monitoring results show that the process is performing as planned, particularly at the CCPs;

d) if there is deviation beyond any CL, carry out corrective action in time to avoid adverse changes in output quality;

e) where feasible, identify the cause when a CCP operates outside of its CLs or a quality failure occurs, record the cause and the corrective action taken,

f) send samples of whole digestate, and any separated liquor and fibre fraction samples for testing, as specified in **11.2**;

g) check that test results of whole digestate, and any separated liquor or separated fibre fractions comply with the corresponding minimum quality requirements specified in **11.2** and any additional specifications the producer has committed to meeting in the quality policy (see **4.2.2** c)), i.e. the digested material is fit for purpose;

h) change the HACCP plan if the process is under control (CCPs operating within their CLs) but is not producing sufficient quality whole digestate, separated liquor and/or separated fibre, and

i) repeat **11.1.2** a) to g) inclusive if **11.1.2** h) is carried out.

NOTE *Requirements in **11.1.2** f) and g) apply to those digested material output types for which PAS 110 compliance is intended to be claimed, or is claimed.*

11.1.3 Before validation, claim of PAS 110 conformance to minimum quality requirements shall only be made in connection with the sampled portion(s) of digested material if the test results of the corresponding sample demonstrate that it is at least the minimum quality required in this PAS and it meets any additional quality characteristics the producer has committed to meeting in the quality policy.

11.2 Minimum testing of the digested material and quality requirements for validation

11.2.1 The production process and any one or more whole digestate, separated liquor or separated fibre output types for which PAS 110 conformance is claimed shall be validated as required in **11.2**. When achieved, validation shall be recorded.

11.2.2 For each parameter in Table 1, the three most recent digested material sample test results shall not exceed the corresponding upper limit. This requirement applies to each digested material output type for which PAS 110 conformance is claimed (whole digestate, separated fibre and/or separated liquor), but see **13.2** for the exception allowed for PTEs in whole digestate / separated liquor.

11.2.3 Exception to **11.2.2**'s 'three most recent' requirement shall be allowed for whole digestate derived from ABPs if its quality, in terms of human and animal pathogen indicator species, is validated by the competent authority / Animal Health vet, provided that the samples are taken as required in Clause **10**. The same is allowed for separated fibre and separated liquor derived from ABPs.

NOTE *ABP regulations require five samples to be tested in terms of human and animal pathogen indicator species. Upper limits for some sample test results may not match those set in this PAS for non-ABP digestates, according to whether sampling and testing is for the purpose of process monitoring or checking digestate quality 'during or on withdrawal from storage at the biogas plant'. Consequently, this PAS allows ABP requirements to take precedence, subject to taking each sample as specified in Clause **10**.*

11.2.4 If the competent authority / Animal Health vet does not specify and check the requirements for each digested material output type for which PAS 110 conformance is claimed (whole digestate, separated fibre and/or separated liquor), each output type not specified and checked by the competent authority / Animal Health vet shall be subject to the requirements in **11.2.1** and **11.2.2** (see also **10.5**).

NOTE *This means that if a digestion process produces separated fibre and separated liquor as well as whole digestate and the producer claims PAS 110 conformance for each output type, if the competent authority / Animal Health vet has only specified and checked the production and quality of the whole digestate the separated fibre and separated liquor are subject to PAS 110's requirements in **11.2.1**, **11.2.2** and **10.5**. It is anticipated that in most cases the competent authority / Animal Health vet would evaluate each output type.*

Table 1 – Test parameters, upper limit values and declaration parameters for validation

Parameter	Method of test	Upper limit and unit
Pathogens (human and animal indicator species) in WD / SL / SF		
ABP digestate: human and animal pathogen indicator species	As per appropriate ABP regulation or any other method approved by the competent authority / Animal Health vet / Veterinary Service vet	As specified by the competent authority / Animal Health vet / Veterinary Service vet in the 'approval in principal' or 'full approval'
Non-ABP digestate: *E. coli*	**SCA MSS Part 3A** or **BS ISO 16649-2**	1000 CFU / g fresh matter
Non-ABP digestate: *Salmonella* spp	Method as specified by appropriate ABP regulation, according to nation in which digested material is produced, or SCA MSS Part 4A	Absent in 25 g fresh matter
Potentially Toxic Elements in WD / SL / SF. **If necessary, WD and SL may utilize the exemption provisions in clauses 13.2, 14.1.6 and 14.1.7 with the declarations required under the * provision below in this table**		
Cadmium (Cd)	**BS EN 13650** (soluble in aqua regia)	1.5 mg / kg dry matter
Chromium (Cr)	**BS EN 13650** (soluble in aqua regia)	100 mg / kg dry matter
Copper (Cu)	**BS EN 13650** (soluble in aqua regia)	200 mg / kg dry matter
Lead (Pb)	**BS EN 13650** (soluble in aqua regia)	200 mg / kg dry matter
Mercury (Hg)	**BS ISO 16772**	1.0 mg / kg dry matter
Nickel (Ni)	**BS EN 13650** (soluble in aqua regia)	50 mg / kg dry matter
Zinc (Zn)	**BS EN 13650** (soluble in aqua regia)	400 mg / kg dry matter
Stability of WD / SL / SF		
Volatile Fatty Acids	Gas chromatography (example provided in **OFW004-005**)	Screening value: 0.43 g COD / g VS
Residual Biogas Potential	**OFW004-005** (WRAP)	0.25 l / g VS
Physical contaminants in WD / SL / SF		
Total glass, metal, plastic and any 'other' non-stone, man-made fragments > 2 mm	**REA-DM-PC&S**	0.5 % m/m dry matter, of which none are 'sharps' (see **3.72**)
Stones > 5 mm	**REA-DM-PC&S**	8 % m/m dry matter

***NOTE** Separated liquor is exempt from physical contaminants tests only if the separation technology used by the producer results in all particles < 2 mm in the separated liquor fraction.*

Table 1 – Test parameters, upper limit values and declaration parameters for validation *(continued)*

Parameter	Method of test	Declaration and unit
Characteristics of WD / SL / SF for declaration, without limit values, that influence application rates		
pH	**BS EN 13037**	Declare result as part of typical or actual characteristics
Total nitrogen (N)	**BS EN 13654-1** (Kjeldahl) or **BS EN 13654-2** (Dumas)	Declare result as part of typical or actual characteristics, units as appropriate (e.g. kg m^{-3} fresh matter and nutrient units per 1000 gallons fresh matter)
Total phosphorus (P)	**BS EN 13650** (soluble in aqua regia)	
Total potassium (K)	**BS EN 13650** (soluble in aqua regia)	
Ammoniacal nitrogen (NH_4-N) **extractable in potassium chloride**	**SOP Z/004** (soluble in potassium chloride)	
Water soluble chloride (Cl^-)	**BS EN 13652** (soluble in water)	
Water soluble sodium (Na)	**BS EN 13652** (soluble in water)	
Dry matter (also referred to as total solids)	**BS EN 14346**	Declare result as part of typical or actual characteristics, % m/m of fresh sample
Loss on ignition (also referred to as volatile solids and a measure of organic matter)	**BS EN 15169**	Declare result as part of typical or actual characteristics, units as appropriate
*** Characteristics of WD / SL for declaration when PTE limit values are exceeded, that influence application rates (see 13.2, 14.1.6 and 14.1.7)**		
Potentially toxic elements (Cd, Cr, Cu, Pb, Hg, Ni, Zn) **in whole digestate or separated liquor if the digested material type exceeds any PTE limit in this table**	As specified above in this table for the appropriate PTE	If any PTE limit in this table is exceeded in whole digestate or separated liquor, declare results for all PTEs in the digested material type, either as actual results for the sampled portion of production or as part of typical characteristics (see **13.2**), in mg / kg dry matter

NOTE 1 *If a digestate sample's VFA result exceeds the VFA 'screening value' above, this will be assumed indicative of the sample failing the RBP test. In such circumstance, the RBP test is not required to be carried out and the sample has failed the digestate 'stability' test. Assessment of RBP test pass or fail should use the average of the triplicate RBP values that each sample test generates.*

NOTE 2 *PAS 110 does not require testing and declaration of digested material particle size. If such information is desired, the maximum particle size and the > 2 mm particle size distribution of digested material can be tested according to the method 'Kapitel II. A 3.1, 1. Lfg. 9/2006, BGK' [25].*

NOTE 3 *PAS 110 does not require testing and declaration of all water soluble nutrients and elements. If further nutrient and element information is desired, digested material can be tested according to the method in* ***BS EN 13652*** *(see Clause* ***2****).*

11.2.5 Table 2 provides an alternative to Table 1 for digested material made only from manure, unprocessed crops, processed crops, crop residues, glycerol, and/or used animal bedding that arises within the producer's premises or holding. The digested material shall be used entirely within the same premises or holding. The provisions in this clause and Table 2 also apply to farming / horticultural / forestry co-operatives (see for **3.28**) that produce digested material only from manure, unprocessed crops, processed crops, crop residues, glycerol, and/or used animal bedding that arises within the co-operative's premises or holdings. The co-operative's digested material shall be used entirely within the same co-operative's premises or holdings.

NOTE 1 *In the case of digested materials produced and used as specified in **7.2.4**, the Table 2 alternative to Table 1 only applies if the input material from any source outside the producer's premises or holding is manure, unprocessed crops, processed crops, crop residues, glycerol, and/or used animal bedding that has arisen within the premises or holdings of the co-operative that the producer is part of.*

NOTE 2 *Check the regulator's relevant position statement or briefing note regarding the circumstances in which waste regulatory controls do not apply to agricultural manures and slurries, and crops grown specifically for anaerobic digestion.*

11.2.6 Before use, the animal bedding referred to in **11.2.5** is allowed to come from a different premise or holding, provided that it has not come into contact with livestock other than those within the premise or holding where it is used as animal bedding. Such material shall not contain any non-biodegradable materials or residues of any toxic substances that represent unacceptable risk to human or animal health, or the environment, before and after digestion.

NOTE *Examples of non-biodegradable materials are veneer, paint, laminate and formica. Many wood preservatives contain toxins, residual amounts of which can be detected when the treated wood is discarded after use. Under this PAS, treated wood is not allowed, even if used as or in animal bedding.*

11.2.7 In the case of digested materials made from input materials arising within the producer's premises and that are entirely used within the producer's premises, the human and animal pathogen indicator species tests are only required if any input material contains, or is at risk of containing, human and/or animal pathogens. In the case of a farming / horticultural / forestry co-operative the human and animal pathogen indicator species tests are required in any circumstance.

NOTE *Under the circumstances described in **11.2.5**, Note 1 the human and animal pathogen indicator species tests are also required.*

Table 2 – Test parameters, upper limit values and declaration parameters for validation of digested materials made from the producer's / co-operative's own materials and used by the producer / co-operative

Parameter	Method of test	Upper limit and unit
Pathogens (human and animal indicator species) in WD / SL / SF		
ABP digestate: human and animal pathogen indicator species	As per appropriate ABP regulation or any other method approved by the competent authority / Animal Health vet	As specified by the competent authority / Animal Health vet / Veterinary Service vet in the 'approval in principal' or 'full approval'
Non-ABP digestate: *E. coli*	SCA MSS Part 3A or **BS ISO 16649-2**	1000 CFU / g fresh matter
Non-ABP digestate: *Salmonella* spp	Method as specified by appropriate ABP regulation, according to nation in which digested material is produced, or SCA MSS Part 4A	Absent in 25 g fresh matter
Potentially Toxic Elements in WD / SL / SF. **If necessary, WD and SL may utilize the exemption provisions in clauses 13.2, 14.1.6 and 14.1.7 with the declarations required under the * provision below in this table**		
Copper (Cu)	**BS EN 13650** (soluble in aqua regia)	200 mg / kg dry matter
Zinc (Zn)	**BS EN 13650** (soluble in aqua regia)	400 mg / kg dry matter
Stability of WD / SL / SF		
Volatile Fatty Acids	Gas chromatography (example provided in **OFW004-005**)	Screening value: 0.43 g COD / g VS
Residual Biogas Potential	**OFW004-005** (WRAP)	0.25 l / g VS
Parameter	**Method of test**	**Declaration and unit**
Characteristics of WD / SL / SF for declaration, without limit values, that influence application rates		
pH	**BS EN 13037**	Declare as part of typical or actual characteristics
Total nitrogen (N)	**BS EN 13654-1** (Kjeldahl) or **BS EN 13654-2** (Dumas)	Declare as part of typical or actual characteristics, units as appropriate (e.g. kg m^{-3} fresh matter and nutrient units per 1000 gallons fresh matter)
Total phosphorus (P)	**BS EN 13650** (soluble in aqua regia)	
Total potassium (K)	**BS EN 13650** (soluble in aqua regia)	

Table 2 – Test parameters, upper limit values and declaration parameters for validation of digested materials made from the producer's / co-operative's own materials and used by the producer / co-operative *(continued)*

Parameter	Method of test	Declaration and unit
Ammoniacal nitrogen (NH_4-N) **extractable in potassium chloride**	**SOP Z/004** (soluble in potassium chloride)	Declare as part of typical or actual characteristics, units as appropriate (e.g. kg m^{-3} fresh matter and nutrient units per 1000 gallons fresh matter)
Water soluble chloride (Cl^-)	**BS EN 13652** (soluble in water)	
Water soluble sodium (Na)	**BS EN 13652** (soluble in water)	
Dry matter (also referred to as total solids)	**BS EN 14346**	Declare as part of typical or actual characteristics, % m/m of fresh sample
Loss on ignition (also referred to as volatile solids and a measure of organic matter)	**BS EN 15169**	Declare as part of typical or actual characteristics, units as appropriate
*** Characteristics of WD / SL for declaration when PTE limit values are exceeded, that influence application rates (see 13.2, 14.1.6 and 14.1.7)**		
Potentially toxic elements (Cu and Zn) **in whole digestate or separated liquor if the digested material type exceeds any PTE limit in this table**	As specified above in this table for the appropriate PTE	If any PTE limit in this table is exceeded in whole digestate or separated liquor, declare results for Cu and Zn in the digested material type, either as actual results for the sampled portion of production or as typical characteristics (see **13.2**), in mg / kg dry matter

NOTE 1 *If a digestate sample's VFA result exceeds the VFA 'screening value' above, this will be assumed indicative the sample failing the RBP test. In such circumstance, the RBP test is not required to be carried out and the sample has failed the digestate 'stability' test. Assessment of RBP test pass or fail should use the average of the triplicate RBP values that each sample test generates.*

NOTE 2 *PAS 110 does not require testing and declaraion of digested material particle size. If such information is desired, the maximum particle size and the > 2 mm particle size distribution of digested material can be tested according to the method 'Kapitel II. A 3.1, 1. Lfg. 9/2006, BGK' [25].*

NOTE 3 *PAS 110 does not require testing and declaration of all water soluble nutrients and elements. If further nutrient and element information is desired, digested material can be tested according to the method* ***BS EN 13652*** *(see Clause* ***2****).*

12 After validation

12.1 General

12.1.1 The producer shall continue to monitor and evaluate process efficacy and digested material quality by:

a) maintaining operations within the validated CLs for each CCP;

b) continuing to monitor and record process conditions and management as specified in Clause **9**;

c) sending samples of whole digestate, and any separated liquor and fibre fraction samples for testing as specified in **12.2**;

d) checking that test results of any whole digestate, separated liquor and fibre for which PAS 110 compliance is claimed continue to comply with the corresponding minimum quality requirements specified in **12.2** any additional specifications the producer has committed to meeting in the quality policy (see **4.2.2** c)), i.e. the digested material is fit for purpose;

e) taking corrective action in the event of any CCP operating outside of its critical limits, quality failure of a sampled portion of production, or any other occurrence that causes, or may cause, quality failure; and

f) where feasible, identifying the cause when a CCP operates outside of its CLs or a quality failure occurs, and recording the cause and the corrective action taken.

***NOTE** [to **12.1.1** c), d) and e)]. The requirements apply to digested material output types for which PAS 110 conformance is claimed.*

***NOTE** [to f)] See **4.8.5** regarding process re-validation in the event of any significant change(s).*

12.1.2 In the event of **12.1.1** e), if there is concern or certainty that digested material quality has been adversely affected, testing of a representative sample of the affected portion of production shall be undertaken, as appropriate for determining the efficacy of the corrective action.

***NOTE** Such circumstances may include resampling and retesting a batch / portion of production.*

12.2 Minimum testing of digested materials and quality requirements after validation

12.2.1 For each parameter in Table 3, the three most recent digested material sample test results shall not exceed the corresponding upper limit. Samples of digested material shall be tested at least at the minimum frequencies specified in Table 4. These requirements apply to each digested material output type for which PAS 110 conformance is claimed (whole digestate, separated fibre and/or separated liquor), but see **13.2** for the exception allowed for PTEs in whole digestate / separated liquor.

***NOTE** For each portion of production from which a sample is not taken for testing, the records of input materials accepted, management of the AD process, any applicable additional process steps and storage periods, and any corrective actions taken in the event of deviation(s) from Critical Limits are the indirect evidence that the producer evaluates to determine whether that portion of production conforms to this PAS.*

12.2.2 Exception to **12.2.1**'s 'three most recent' requirement is allowed for whole digestate derived from ABPs on condition that its quality, in terms of human and animal pathogen indicator species, is validated by the competent authority / Animal Health vet, and on condition that the samples are taken as required in Clause **10**. The same is allowed for separated fibre and separated liquor derived from ABPs.

***NOTE** ABP regulations require five samples to be tested in terms of human and animal pathogen indicator species. Upper limits for some sample test results may not match those set in this PAS for non-ABP digestates, according to whether sampling and testing is for the purpose of process monitoring or checking digestate quality 'during or on withdrawal from storage at the biogas plant'. Consequently, this PAS allows ABP requirements to take precedence, subject to taking each sample as specified in Clause **10**.*

12.2.3 If the competent authority / Animal Health vet does not specify and check the requirements for each digested material output type for which PAS 110 conformance is claimed (whole digestate, separated fibre and/or separated liquor), each output type not specified and checked by the competent authority / Animal Health vet shall be subject to the requirements of **12.2.1** (see also **10.5**).

***NOTE** This means that if a digestion process produces separated fibre and separated liquor as well as whole digestate and the producer claims PAS 110 conformance for each output type, if the competent authority / Animal Health vet has only specified and checked the production and quality of the whole digestate the separated fibre and separated liquor are subject to PAS 110's requirements in **11.2.1, 11.2.2** and **10.5**. It is anticipated that in most cases the competent authority / Animal Health vet would evaluate each output type.*

Table 3 – Minimum digested material testing and quality requirements after validation

Parameter	Method of test	Upper limit and unit
Pathogens (human and animal indicator species) in WD / SL / SF		
ABP digestate: human and animal pathogen indicator species	As per appropriate ABP regulation or any other method approved by the competent authority / Animal Health vet / Veterinary Service vet	As specified by the competent authority / Animal Health vet / Veterinary Service vet in the 'approval in principal' or 'full approval'
Non-ABP digestate: *E. coli*	SCA MSS Part 3A or **BS ISO 16649-2**	1000 CFU / g fresh matter
Non-ABP digestate: *Salmonella* spp	Method as specified by appropriate ABP regulation, according to nation in which digested material is produced, or SCA MSS Part 4A	Absent in 25 g fresh matter
Potentially Toxic Elements in WD / SL / SF. **If necessary, WD and SL may utilize the exemption provisions in 13.2, 14.1.6 and 14.1.7 with the declarations required under the * provision below in this table**		
Cadmium (Cd)	**BS EN 13650** (soluble in aqua regia)	1.5 mg / kg dry matter
Chromium (Cr)	**BS EN 13650** (soluble in aqua regia)	100 mg / kg dry matter
Copper (Cu)	**BS EN 13650** (soluble in aqua regia)	200 mg / kg dry matter
Lead (Pb)	**BS EN 13650** (soluble in aqua regia)	200 mg / kg dry matter
Mercury (Hg)	**BS ISO 16772**	1.0 mg / kg dry matter
Nickel (Ni)	**BS EN 13650** (soluble in aqua regia)	50 mg / kg dry matter
Zinc (Zn)	**BS EN 13650** (soluble in aqua regia)	400 mg / kg dry matter
Stability of WD / SL / SF		
Volatile Fatty Acids	Gas chromatography (example provided in **OFW004-005**)	Screening value: 0.43 g COD / g VS
Residual Biogas Potential	**OFW004-005** (WRAP)	0.25 l / g VS
Physical contaminants in WD / SL / SF		
Total glass, metal, plastic and any 'other' non-stone, man-made fragments > 2 mm	**REA-DM-PC&S**	0.5 % m/m dry matter, of which none are 'sharps' (see **3.72**)
Stones > 5 mm	**REA-DM-PC&S**	8 % m/m dry matter

***NOTE** Separated liquor is exempt from physical contaminants tests only if the separation technology used by the producer results in all particles < 2 mm in the separated liquor fraction.*

Parameter	Method of test	Declaration and unit
Characteristics of WD / SL / SF for declaration, without limit values, that influence application rates		
pH	**BS EN 13037**	Declare as part of typical or actual characteristics
Total nitrogen (N)	**BS EN 13654-1** (Kjeldahl) or **BS EN 13654-2** (Dumas)	Declare as part of typical or actual characteristics, units as appropriate (e.g. kg m^{-3} fresh matter and nutrient units per 1000 gallons fresh matter)
Total phosphorus (P)	**BS EN 13650** (soluble in aqua regia)	
Total potassium (K)	**BS EN 13650** (soluble in aqua regia)	
Ammonical nitrogen (NH_4-N) **extractable in potassium chloride**	SOP Z/004 (soluble in potassium chloride)	
Water soluble chloride (Cl^-)	BS EN 13652 (soluble in water)	
Water soluble sodium (Na)	**BS EN 13652** (soluble in water)	
Dry matter (also referred to as total solids)	**BS EN 14346**	Declare as part of typical or actual characteristics, % m/m of fresh sample
Loss on ignition (also referred to as volatile solids and a measure of organic matter)	**BS EN 15169**	Declare as part of typical or actual characteristics, units as appropriate
*** Characteristics of WD / SL for declaration when PTE limit values are exceeded, that influence application rates (see 13.2, 14.1.6 and 14.1.7)**		
Potentially toxic elements (Cd, Cr, Cu, Pb, Hg, Ni, Zn) **in whole digestate or separated liquor if the digested material type exceeds any PTE limit in this table**	As specified above in this table for the appropriate PTE	If any PTE limit in this table is exceeded in whole digestate or separated liquor, declare results for all PTEs in the digested material type, either as actual results for the sampled portion of production or as typical characteristics (see **13.2**), in mg / kg dry matter

NOTE 1 *If a digestate sample's VFA result exceeds the VFA 'screening value' above, this will be assumed indicative of the sample failing the RBP test. In such circumstance, the RBP test is not required to be carried out and the sample has failed the digestate 'stability' test. Assessment of RBP test pass or fail should use the average of the triplicate RBP values that each sample test generates.*

NOTE 2 *PAS 110 does not require testing and declaration of digested material particle size. If such information is desired, the maximum particle size and the > 2 mm particle size distribution of digested material can be tested according to the method 'Kapitel II. A 3.1, 1. Lfg. 9/2006, BGK' [25].*

NOTE 3 *PAS 110 does not require testing and declaration of all water soluble nutrients and elements. If further nutrient and element information is desired, digested material can be tested according to the method* ***BS EN 13652*** *(see Clause* ***2****).*

Table 4 – Minimum frequencies for testing representative samples of digested material after validation

Parameter	Minimum frequencies for testing representative samples
If ABP digested material: human and animal pathogen indicator species	As specified by the competent authority / Animal Health vet in the 'approval in principal' or 'full approval'
If non ABP digested material: *E. coli*	1 per 5,000 m^3 of WD / SF / SL produced, or 1 per 3 months whichever is the soonest
If non ABP digested material: *Salmonella* spp	1 per 5,000 m^3 of WD / SF / SL produced, or 1 per 3 months whichever is the soonest
Potentially Toxic Elements	1 per 6,000 m^3 of WD / SF / SL produced, or 1 per 3 months whichever is the soonest
Stability (Volatile Fatty Acids and Residual Biogas Potential, subject to Note 1 to Tables 3 and 5)	2 per 12 months and not within 3 months of each other, or sooner if and when significant change occurs (see **4.8.5**)
Physical contaminants	1 per 6,000 m^3 of WD / SF / SL produced, or 1 per 3 months whichever is the soonest
pH	1 per 6,000 m^3 of WD / SF / SL produced, or 1 per 3 months whichever is the soonest
Total N, P & K	1 per 6,000 m^3 of WD / SF / SL produced, or 1 per 3 months whichever is the soonest
Ammoniacal nitrogen, water soluble chloride, water soluble sodium	1 per 6,000 m^3 of WD / SF / SL produced, or 1 per 3 months whichever is the soonest
Dry matter (total solids)	1 per 6,000 m^3 of WD / SF / SL produced, or 1 per 3 months whichever is the soonest
Loss on ignition (measure of organic matter)	1 per 6,000 m^3 of WD / SF / SL produced, or 1 per 3 months whichever is the soonest

12.2.4 Table 5 provides an alternative to Table 3 for digested material made only from manure, processed crops, unprocessed crops, crop residues, glycerol, and/or used animal bedding that arises within the producer's premises or holding. The digested material shall be used entirely within the same premises or holding. The provisions in this clause and Table 5 also apply to farming / horticultural / forestry co-operatives (see **3.28**) that produce digested material only from manure, crops, crop residues, glycerol, and/or used animal bedding that arises within the co-operative's premises or holdings. The co-operative's digested material shall be used entirely within the same co-operative's premises or holdings.

NOTE 1 *In the case of digested materials produced and used as specified in **7.2.4**, the Table 5 alternative to Table 3 only applies if the input material from any source outside the producer's premises or holding is manure, unprocessed crops, processed crops, crop residues, glycerol, and/or used animal bedding that has arisen within the premises or holdings of the co-operative that the producer is part of.*

NOTE 2 *Check the regulator's relevant position statement or briefing note regarding the circumstances in which waste regulatory controls do not apply to agricultural manures and slurries, and crops grown specifically for anaerobic digestion.*

12.2.5 Before use, the animal bedding referred to in **12.2.4** is allowed to come from a different premise or holding, provided that it has not come into contact with livestock other than those within the premise or holding where it is used as animal bedding. Such material shall not contain any non-biodegradable materials or residues of any toxic substances that represent unacceptable risk to human or animal health, or the environment, before and after digestion.

NOTE *Examples of non-biodegradable materials are veneer, paint, laminate and formica. Many wood preservatives contain toxins, residual amounts of which can be detected when the treated wood is discarded after use. Under this PAS, treated wood is not allowed, even if used as or in animal bedding.*

12.2.6 In the case of digested materials made from input materials arising within the producer's premises and that are entirely used within the producer's premises, the human and animal pathogen indicator species tests are only required if any input material contains, or is at risk of containing, human and/or animal pathogens. In the case of a farming / horticultural / forestry co-operative the human and animal pathogen indicator species tests are required in any circumstance.

NOTE *Under the circumstances described in **12.2.4**, Note 1 the human and animal pathogen indicator species tests are also required.*

Table 5 – Test parameters and upper limit values for use after validation of digested materials made from the producer's / co-operative's own materials and used by the producer / co-operative

Parameter	Method of test	Upper limit and unit
Pathogens (human and animal indicator species) **in WD / SL / SF**		
ABP digestate: human and animal pathogen indicator species	As per appropriate ABP regulation or any other method approved by the competent authority / Animal Health vet / Veterinary Service vet	As specified by the competent authority / Animal Health vet / Veterinary Service vet in the 'approval in principal' or 'full approval'
Non-ABP digestate: *E. coli*	SCA MSS Part 3A or **BS ISO 16649-2**	1000 CFU / g fresh matter
Non-ABP digestate: *Salmonella* spp	Method as specified by appropriate ABP regulation, according to nation in which digested material is produced, or SCA MSS Part 4A	Absent in 25 g fresh matter
Potentially Toxic Elements in WD / SL / SF. **If necessary, WD and SL may utilize the exemption provisions in clauses 13.2, 14.1.6 and 14.1.7 with the declarations required under the * provision below in this table**		
Copper (Cu)	**BS EN 13650** (soluble in aqua regia)	200 mg / kg dry matter
Zinc (Zn)	**BS EN 13650** (soluble in aqua regia)	400 mg / kg dry matter
Stability of WD / SL / SF		
Volatile Fatty Acids	Gas chromatography (example provided in **OFW004-005**)	Screening value: 0.43 g COD / g VS
Residual Biogas Potential	**OFW004-005** (WRAP)	0.25 l / g VS
Parameter	**Method of test**	**Declaration and unit**
Characteristics of WD / SL / SF for declaration, without limit values, that influence application rates		
pH	**BS EN 13037**	Declare as part of typical or actual characteristics
Total nitrogen (N)	**BS EN 13654-1** (Kjeldahl) or **BS EN 13654-2** (Dumas)	Declare as part of typical or actual characteristics, units as appropriate (e.g. kg m^{-3} fresh matter and nutrient units per 1000 gallons fresh matter)
Total phosphorus (P)	**BS EN 13650** (soluble in aqua regia)	
Total potassium (K)	**BS EN 13650** (soluble in aqua regia)	
Ammoniacal nitrogen (NH_4-N) **extractable in potassium chloride**	**SOP Z/004**	

Table 5 – Test parameters and upper limit values for use after validation of digested materials made from the producer's / co-operative's own materials and used by the producer / co-operative *(continued)*

Parameter	Method of test	Declaration and unit
Water soluble chloride (Cl^-)	**BS EN 13652** (soluble in water)	Declare as part of typical or actual characteristics, units as appropriate (e.g. kg m^{-3} fresh matter and nutrient units per 1000 gallons fresh matter)
Water soluble sodium (Na)	**BS EN 13652** (soluble in water)	
Dry matter (also referred to as total solids)	**BS EN 14346**	Declare as part of typical or actual characteristics, % m/m of fresh sample.
Loss on ignition (also referred to as volatile solids and a measure of organic matter)	**BS EN 15169**	Declare as part of typical or actual characteristics, units as appropriate.
*** Characteristics of WD / SL for declaration when PTE limit values are exceeded, that influence application rates** (see **13.2**, **14.1.6** and **14.1.7**)		
Potentially toxic elements (Cu and Zn) **in whole digestate or separated liquor if the digested material type exceeds any PTE limit in this table**	As specified above in this table for the appropriate PTE	If any PTE limit in this table is exceeded in whole digestate or separated liquor, declare results for Cu and Zn in the digested material type, either as actual results for the sampled portion of production or as typical characteristics (see **13.2**), in mg / kg dry matter

NOTE 1 *If a digestate sample's VFA result exceeds the VFA 'screening value' above, this will be assumed indicative of the sample failing the RBP test. In such circumstance, the RBP test is not required to be carried out and the sample has failed the digestate 'stability' test. Assessment of RBP test pass or fail should use the average of the triplicate RBP values that each sample test generates.*

NOTE 2 *PAS 110 does not require testing and declaration of digested material particle size. If such information is desired, the maximum particle size and the > 2 mm particle size distribution of digested material can be tested according to the method 'Kapitel II. A 3.1, 1. Lfg. 9/2006, BGK' [25].*

NOTE 3 *PAS 110 does not require testing and declaration of all water soluble nutrients and elements. If further nutrient and element information is desired, digested material can be tested according to the method* ***BS EN 13652*** *(see Clause* ***2****).*

13 Actions in the event of test result failure

13.1 If any tested sample fails any one or more of the applicable limits specified in **11.2** before validation or **12.2** after validation, the producer shall:

a) dispatch the sampled portion as non-PAS 110 material; or

b) take appropriate corrective action and gain evidence of conformance to this PAS before dispatching it for use.

13.2 PTE limits in Tables 1, 2, 3 and 5 shall not apply to any portion of whole digestate / separated liquor production used as specified in **14.1.6** and **14.1.7**. Consequently that portion of production's PTE results do not trigger the additional sampling and testing referred to in **13.7** for validation or **13.8** after validation. However, any portion of whole digestate / separated liquor used as specified in **14.1.6** and **14.1.7** shall either be PTE tested as required in the appropriate table, before use, or shall be used taking account of the moving average result ('typical' result) for each relevant PTE in the whole digestate / separated liquor.

***NOTE** The provisions of **13.2, 14.1.6** and **14.1.7** provide a controlled means for using any portion of whole digestate / separated liquor production that does not comply with one or more of PAS 110's PTE limits on land, **14.1.7** specifying records that have to be made and checks on soil PTEs and PTE loading rates that have to be carried out. The moving average result should be calculated from a number of samples that are representative of variations in PTE concentrations that occur, taking into account how much variation occurs in the whole digesate / separated liquor. The producer may choose which type of moving average is most appropriate. Any digested controlled wastes that do not conform to this PAS, and the ADQP in any country in which it applies, may have 'waste' status. Evidence would be reviewed and a 'waste' or 'product' status decision made by the regulator. If 'waste', its transportation, storage and use after dispatch by the producer would be subject to waste regulatory controls.*

13.3 Any extra sampling and testing carried out on a failed portion of production shall correspond with the failure parameter(s).

***NOTE** to **13.4** and **13.5**. Specify the circumstances in which further samples and tests associated with that failed portion count towards **11.2.2**'s requirements for validation or **12.2.1**'s requirements for after validation.*

13.4 If a sample representative of all the whole digestate / separated liquor in a storage tank fails a test and the producer chooses to take corrective action (**13.1** b)), an additional portion of digested material that has completed its minimum necessary retention time in the digester (see **10.6**) may be pumped into the tank. After thorough mixing, a sample representative of the tank's content may be sampled for testing. The producer shall take its test results into account when evaluating compliance with **11.2.2**'s requirements for validation or **12.2.1**'s requirements for after validation.

***NOTE** to **13.4** and **13.5**. See **11.1.3** and **14.1.2** for claim of conformance to PAS 110 before validation. After validation, see **12.1.1** d), **12.2.1** and its note, and **14.1.2**.*

13.5 If a sample representative of a portion of separated fibre fails a test and the producer chooses to take corrective action (**13.1** b)), that portion should be resampled after the corrective action and before any other portion of separated fibre is added to it. Its VFA, RBP and pathogen indicator species (e.g. *E. coli* and *Salmonella* spp) test results shall not be taken into account when evaluating compliance with **11.2.2**'s requirements for validation or **12.2.1**'s requirements for after validation. In the event that a failed portion of production has one or more additional portions of production added to it and then a representative sample is taken from those combined portions, that sample shall be regarded as a resample when evaluating compliance with **11.2.2**'s requirements for validation or **12.2.1**'s requirements for after validation.

13.6 After validation, if any tested sample fails any one or more of the applicable limits specified in **12.2** and the sampled portion of production has been dispatched for use before the test results are evaluated, the producer shall inform the digested material customer(s) and appropriate regulator and/or competent authority of the nature of the failure.

***NOTE** Any digested controlled wastes that do not conform to this PAS, and the ADQP in any country in which it applies, may have 'waste' status. Evidence would be reviewed and a 'waste' or 'product' status decision made by the regulator. If 'waste', its transportation, storage and use after dispatch by the producer would be subject to waste regulatory controls. Results from any further tests, including any on an archived portion of sample from the same portion of production, may be taken into account when*

deciding whether waste regulatory controls apply or enforcement action should be taken. Consequently, it is strongly recommended that any sampled portion of production is not dispatched for use until after the test results have been checked for conformance to PAS 110.

13.7 Before validation, any test result pass associated with the circumstances described in **13.4** or **13.5** that is allowed to be taken into account when evaluating compliance with **11.2.2**'s requirements for validation shall be regarded as the first of the 'three most recent' sample test result passes required in those clauses (note the exceptions allowed in **11.2.3**, **11.2.5**, **11.2.7**, and **13.2**). The additional portions of production that will have to be sampled, tested and evaluated in order to validate the efficacy of the production process shall be sampled and tested promptly.

13.8 After validation, any test result pass associated with the circumstances described in **13.4** or **13.5** that is allowed to be taken into account when evaluating compliance with the requirements of **12.2.1** for after validation shall be regarded as the first of the 'three most recent' sample test result passes required in those clauses (note the exceptions allowed in **12.2.2**, **12.2.4**, **12.2.6** and **13.2**). The additional portions of production that will have to be sampled, tested and evaluated in order to demonstrate the continued efficacy of the production process shall be sampled and tested promptly.

14 Dispatch, labelling, marking and use of whole digestate, separated liquor and separated fibre

14.1 General

14.1.1 The producer shall record the amount, type, date and location of where any portion of digested material production is used within the producer's premises or holding. This requirement also applies to any portion of digested material production used within the premises or holdings of the farming / horticultural / forestry co-operative that the farm with the digester is part of. In a co-operative's case, the digested material shall be derived only from manure, unprocessed crops, processed crops, crop residues, and/or used animal bedding that arose within the co-operative's premises or holdings.

NOTE 1 *The other requirements in Clause **14** do not apply to any portion of production used within the producer's premises or holding, nor to any portion of production produced by a farming / horticultural / forestry co-operative from its own biodegradable materials, as specified in this PAS, that is used within the same co-operative.*

NOTE 2 *If the portion of production is one that is sampled and tested, the producer will have and keep a copy of the laboratory test results.*

NOTE 3 *Check the regulator's relevant position statement or briefing note regarding the circumstances in which waste regulatory controls do not apply to agricultural manures and slurries, and crops grown specifically for anaerobic digestion.*

14.1.2 For each consignment of whole digestate, separated liquor or separated fibre that conforms to this PAS, which is dispatched for a use other than disposal, the producer shall supply the following information to the customer as a document, or in part of a document:

a) producer name and contact details;

b) digestate process address, or process identification code, if code is matched with process elsewhere in the QMS documents;

c) statement of whether whole digestate, separated digestate liquor or separated digestate fibre is supplied;

d) statement of the approximate particle size range of the whole digestate, separated digestate liquor or separated digestate fibre supplied;

NOTE *This can be the producer's qualitative assessment of the digestate, e.g. 0 to 10 mm for separated fibre.*

e) typical characteristics, or laboratory test results, if all or part of the sampled portion of production is supplied;

f) if derived in whole or in part from ABP material, that it contains or consists of treated ABP material and a warning that the user will have committed an offence if he/she does not comply with ABP Regulation [6], [7], [8] and [9] requirements; and

NOTE *Attention is drawn to the ABP Regulations [6], [7], [8], and [9]. The requirements include placement of digested materials made from catering or other ABP source segregated biowastes on the market, livestock grazing ban periods after spreading such materials (21 days in this context), records that should be made and kept by the user, and obligations associated with any transfrontier shipment of animal by-product wastes, whether treated or untreated.*

g) statement "Conforms to PAS 110:2010".

NOTE *Marking PAS 110:2010 on or in relation to whole digestate, separated liquor or separated fibre, represents a producer's declaration of conformity, i.e. a claim by or on behalf of the producer that the requirements of this PAS have been met. The accuracy of the claim is therefore solely the responsibility of the person or organization making the claim. Such a declaration is different from third party certification of conformity, which is recommended.*

NOTE 1 *to **14.1.2** For farmers and land mangers, the information should include recommendations that the digested material is used in accordance with the relevant Codes of Good Agricultural Practice [11 for England], [12,13 and 14 for Wales] and [15 for Scotland], and any documents that supersede them.*

NOTE 2 *to **14.1.2** For any consignment of digested material that does not conform to this PAS, that is dispatched for disposal or a suitable use as a low quality material, the producer should supply information to the customer and make and keep a copy of each consignment record as required in appropriate regulations. Environmental Permitting [17] / Waste Management Licensing Regulation [4] and Duty of Care requirements apply in the case of controlled biowastes and ABP Regulations [6], [7], [8], and [9] include requirements for when placing treated ABP on the market.*

14.1.3 Separated fibre supplied for amateur horticulture / domestic use is exempt from **14.1.2** e)'s requirement.

NOTE *The ADQP does not allow the use of digestate for amateur horticulture / domestic use (e.g. matured separated fibre as a growing medium ingredient). Growing media are precisely formulated, taking account of the characteristics of all bulky substrates and other ingredients. In any country where the ADQP does not apply, matured separated fibre could be used in a growing medium if it complies with PAS 110's requirements and any further ones specified by the growing media manufacturer, e.g. matured and tested with results that demonstrate conformance to the manufacturer's quality specification.*

14.1.4 The producer shall make and keep a copy of the record for each consignment of whole digestate, separated liquor or separated fibre, which shall include:

a) the customer name and contact details, or customer identification code if codes are matched with customer details elsewhere in the QMS documents, and delivery address;

b) quantity dispatched, by weight or volume; and

c) date of dispatch.

14.1.5 Information supplied to each digested material customer shall include the typical characteristics or laboratory test results corresponding with the portion of production dispatched, and include:

a) PTE concentrations;

b) pH;

c) total nitrogen;

d) total phosphorus;

e) total potassium;

f) ammoniacal nitrogen (NH4-N);

g) water soluble chloride;

h) water soluble sodium;

i) dry matter (also referred to as total solids); and

j) loss on ignition (also referred to as volatile solids, and a measure of organic matter).

NOTE *An appropriate certification scheme owner, certification body or consultant may be contacted for guidance on additional parameter test results that users of digested materials may want to know and templates for records of digested material dispatch for use.*

14.1.6 If a sampled portion of whole digestate / separated liquor has exceeded any PTE limit specified in the relevant table in this PAS, the soil to which the whole digestate / separated liquor is applied:

a) shall not receive more than the maximum permissible annual average rate of PTE addition over a 10 year period, as specified in the Code of Practice for Agricultural Use of Sewage Sludge [16]; and

b) shall not exceed any soil PTE concentration, as specified in the same Code.

14.1.7 In the event that the provisions of **14.1.6** are utilized, the producer shall:

a) inform the recipient of the whole digestate / separated liquor of the relevant requirements of the Code of Practice for Agricultural Use of Sewage Sludge; and

b) within 12 months of supply of each whole digestate / separated liquor delivery, obtain evidence and check that the requirements in **14.1.6** have been met.

NOTE *to **14.1.6** and **14.1.7**. Any non-conformance with any requirement in **14.1.6** and **14.1.7** means non-conformance with this PAS. In the case of using farm and farming / horticultural / forestry co-operatives digestated materials referred to in **11.2.5** or **12.2.4**, **14.1.6**'s provisions apply to copper and zinc, but not cadmium, chromium, lead, mercury and nickel. In the case of digested materials produced and used as specified in **7.2.4**, see **11.2.5**, Note 1 and **12.2.4**, Note 1 regarding circumstances in which a reduced range of test parameters is allowed, and see note to **11.2.7** and **12.2.6**.*

Annex A (normative)
Minimum anaerobic digestion pasteurization requirements

A.1 General

Table A.1 sets out the key provisions in the animal by-products regulations that can be regarded as a pasteurization step, or part of the anaerobic digestion process, within the context of PAS 110.

Table A.1 – Minimum anaerobic digestion requirements specified in the animal by-products regulations

System	National ABP Regulations, option for catering waste only	National ABP Regulations, option for catering waste only	EU ABP regulation 1774/2002 [5a] (See Note 4)
Treatment technology	Closed reactor	Closed reactor	Closed reactor
Maximum particle size	50 mm	60 mm	12 mm
Minimum temperature	57 °C	70 °C	70 °C
Minimum time spent at the minimum temperature	5 hours	1 hour	1 hour
Additional requirements	Followed by storage for an average of 18 days if digestate is made from catering wastes that include meat		No post treatment minimum storage period specified

NOTE 1 *National ABP Regulations [6], [7], [8] and [9] do not set a minimum storage period after treatment if digested material is made from catering wastes that exclude meat. Table A.1 includes the treatment options specified in the national ABP regulations for catering waste only; the operator should select one of these options or may seek approval for an alternative (see Note 2 and 3).*

NOTE 2 *The competent authority, or in the case of national ABP Regulations [6], [7], [8] and [9], the Secretary of State may approve an alternative to the criteria in Table A.1, as appropriate to the categories of ABP input materials and digestion system.*

NOTE 3 *EU ABP Regulation 208/2006 [5b] that amends EU ABP Regulation 1774/2002 [5a] allows alternative treatment systems and minimum treatment conditions to those approvable under EU ABP Regulation 1774/2002. The amendment regulation allows different minimum treatment, provided it is demonstrated that the treatment process achieves sufficient pathogen destruction (at least a 5 log reduction).*

NOTE 4 *Even if digested material made from ABPs is used, or intended for use, only within the producer's premises or holding the producer is required by ABP Regulations [5a and 5b] or [6], [7], [8] or [9] to achieve appropriate minimum treatment criteria.*

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