

PAS 110:2014

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



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a world without waste



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Contents

0 Introduction	iv
1 Scope	1
2 Normative references	2
3 Terms and definitions	4
4 Quality management system (QMS)	12
5 Hazard analysis and critical control point (HACCP) planning	16
6 Input materials	18
7 Process management, separation and storage	20
8 Process equipment	22
9 Process monitoring	22
10 Sampling of digestates	23
11 Validation	25
Table 1 – Test parameters, upper limit values and declaration parameters for validation	26
Table 2 – Test parameters, upper limit values and declaration parameters for validation of digestates made from the producer's/co-operative's own materials and used by the producer/co-operative	28
12 After validation	30
Table 3 – Minimum digestate testing and quality requirements after validation	31
Table 4 – Minimum frequencies for testing representative samples of digestate after validation	32
Table 5 – Test parameters and upper limit values for use after validation of digestates made from the producer's/co-operative's own materials and used by the producer/co-operative	34
13 Actions in the event of test result failure	36
14 Labelling, marking, dispatch and use of whole digestate, separated liquor and separated fibre	37
Annex A (normative) Minimum anaerobic digestate stability requirements	39
Table A.1 – Anaerobic digestate stability requirement, test parameter and upper limit value	39
Bibliography	40

Foreword

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- Anaerobic Digestion Operators Working Group (ADOWG);
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- Andigestion Ltd
- Biofertiliser Certification Scheme (BCS);
- Chartered Institution of Wastes Management (CIWM);
- Earthcare Technical Ltd;
- Environment Agency;
- Environmental Services Association (ESA);
- Natural Resources Wales;
- NRM Laboratories (a division of Cawood Scientific Ltd);
- Red Tractor Assurance;
- Renewable Energy Association (REA);
- Scottish Environment Protection Agency (SEPA);
- SFQC;
- Welsh Government;
- WRc plc; and
- WRAP.

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 It will be withdrawn upon publication of its content in, or as, a British Standard.

The PAS process enables a specification to be rapidly developed in order to fulfil an immediate need in industry. A PAS can be considered for further

development as a British Standard, or constitute part of the UK input into the development of a European or International Standard.

Supersession

This PAS supercedes PAS 110:2010, which is withdrawn.

Information about this document

Marking "PAS 110:2014" 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.

Use of this document

It has been assumed in the preparation of this PAS that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

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 italic type, and does not constitute a normative element (requirement). 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 PAS cannot confer immunity from legal obligations.

In addition to the requirements of this PAS, attention is drawn to the following statutory requirements, the *Codes of Good Agricultural Practice* and the Anaerobic Digestate Quality Protocol (ADQP), some of which are also referred to in the Introduction:

- Environmental Protection Act 1990 (as amended) [1];
- The Waste (England and Wales) Regulations 2011 [2];
- Regulation (EC) No 1069/2009 of the European Parliament and of the Council of 21 October 2009 laying down health rules as regards animal by-products and derived products not intended for human consumption and repealing Regulation (EC) No 1774/2002 (Animal by-products Regulation) [3];
- Commission Regulation (EU) No 142/2011 of 25 February 2011 implementing Regulation (EC) No 1069/2009 of the European Parliament and of the Council laying down health rules as regards animal by-products and derived products not intended for human consumption and implementing Council Directive 97/78/EC as regards certain samples and items exempt from veterinary checks at the border under that Directive, and subsidiary UK legislation [4];
- *Protecting our Water, Soil and Air – A Code of Good Agricultural Practice for farmers, growers and land managers*, Department for the Environment (England), 2009 [5];
- *The Code of Good Agricultural Practice For the Protection of Water, Soil and Air for Wales*, Welsh Assembly Government (2011 No.20) [6];
- *Prevention of Environmental Pollution from Agricultural Activity, A Code of Good Practice* (PEPFAA Code), Scottish Executive (only applicable in Scotland) [7];
- The Environmental Permitting (England and Wales) Regulations 2010 (and as amended) [8];
- The Pollution Prevention and Control (Scotland) Regulations 2012 [9];
- The Waste Management Licensing (Scotland) Regulations 2011 [10];
- The Waste Management Licensing Regulations (Northern Ireland) 2003 [11];
- The Pollution Prevention and Control Regulations (Northern Ireland) 2003 [12];
- Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives [13];
- *Quality Protocol. Anaerobic digestate. End of waste criteria for the production and use of quality outputs from anaerobic digestion of source-segregated biodegradable waste*, (Environment Agency) [14];
- General requirements (food hygiene). *Codex Alimentarius Principles of the HACCP System*, FAO, 2003 [15].



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 for the use 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 AD and the controlled application of digestates reduces 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 the atmosphere.

The volume of digestates is increasing significantly as industry responds to the latest strategies in the nations of the UK for diverting biowastes from landfill [2], and to other policy initiatives and measures geared to developing 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 digestates. It is an industry specification against which producers can check that the digestates 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 that might be used as fertilizer or soil improver/conditioner. Meeting its quality and other criteria enables the producer to demonstrate compliance with 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 digestates (whole digestate, separated liquor and separated fibre). All producers are required to comply with all applicable legislation, irrespective of whether or not the whole digestate, and any separated liquor and fibre, conforms to this PAS.

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 digestates from environmental or health protection regulations (see references in the Foreword). The production and use of digestates derived from controlled biowastes is subject to environmental permitting or waste management licensing regulations, according to the country in which the AD process is located and the digestate 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 [8] (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 ([9] and [12]) also apply; facilities treating more than a threshold amount of Category 3 animal by-products are to have a Pollution Prevention and Control Permit (PPC).

The use of digestates made from controlled, source-segregated biowastes is subject to environmental permitting (in England and Wales) [8] or waste management licensing regulations (in Scotland) [10]. However, in countries that have adopted the Anaerobic Digestate Quality Protocol (ADQP) [14], there might be a case for digestates to be exempted from the 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 circumstances, land managers should follow the relevant parts of the *Codes of Good Agricultural Practice* for the protection of air, water and soils [5 if in England, 6, if in Wales, or 7, 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 continue in Clause 5 on the topic of hazard analysis and critical control point (HACCP) planning. The subsequent clauses follow a digestate production sequence, beginning with requirements for the input materials, progressing to process management controls and monitoring, and 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.



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1 Scope

This PAS covers whole digestate from an anaerobic digestion (AD) system that accepts only source-segregated biowastes (see 3.68 and 3.8) and/or biodegradable non-waste materials (see 3.7). It also covers liquor and fibre fractions that might be produced by separating whole digestate, after the AD process.

NOTE 1 *Digestates that conform to this PAS should be suitable for use as soil improvers/conditioners, 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 12). Clause 12.1.1 d) requires that the digestate 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 might be applicable. If digestate, 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 AD and associated technologies;
- b) that the AD system is allowed to accept packaged biowastes/biodegradable non-waste materials that are depackaged prior to AD, subject to 6.1;
- c) the minimum quality of whole digestate (see 3.83), separated liquor (see 3.65) and separated fibre (see 3.64);
- d) information that is required to be supplied to digestate (see 3.21) customers (see Clause 14).

This PAS includes a reduced range of test parameters for digestates made from specific input materials that arise within a single [or co-operative's (see 3.16)] premises or holding and that are returned for use entirely within the same premises or holding (see 11.2.4). The producers using such materials are exempt from carrying out a pasteurization step during AD (see 7.2 and 3.53). These provisions have been extended in this edition to include farming/ horticultural/forestry co-operatives (as defined in 3.16).

Exemption from the pasteurization step has also been allowed for specific input materials that arise within a single (or co-operative's) premises or holding, which are co-digested with pasteurized biodegradable materials/ wastes from outside the producer's premises or holding, provided that the digestate is returned to, and used entirely within, the originating single or co-operative's premises or holding in a way consistent with the relevant premises' or holding's animal health plan (see 7.2.5).

NOTE 3 *See 11.2.4 regarding whether the digestate 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 AD.*

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 3.59 and Clause 4) that ensures digestates meet the minimum quality requirements set out in this PAS, and are fit for purpose.

2 Normative references

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

Standards publications

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 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 EN ISO 15587-1:2002, *Water quality – Part 1: Digestion for the determination of selected elements in water – Aqua regia digestion*

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

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

Other publications

[N1] ENVIRONMENT AGENCY, Standing Committee of Analysts. SCA MSS Part 3A. 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). Blue Book No. 190. Environment Agency, 2003. Downloadable from http://www.environment-agency.gov.uk/static/documents/Research/mss2003__part_3_604573.pdf.

[N2] ENVIRONMENT AGENCY, Standing Committee of Analysts. SCA MSS Part 4A. The Microbiology of Sewage Sludge (2004) – Part 4 – Methods for the detection, isolation and enumeration of *Salmonellae*, *Methods for the Examination of Waters and Associated Materials* (A – The detection of *Salmonella spp.* by use of a presence/absence technique). Blue Book No. 195. Environment Agency, 2004. Downloadable from http://www.environment-agency.gov.uk/static/documents/Research/mss2004__part_4_811642.pdf.

[N3] NRM LABORATORIES. NRM method JAS-497/001. *Determination of Physical Contaminants and Stones in Digestate*. NRM Laboratories, 2012. (Previously described as: REA-DM-PC&S. *Methodology for determination of physical contaminants and stones in digestates*. London: Renewable Energy Association.)

[N4] EUROFINS LABORATORIES LTD. SOP Z/004. The determination of ammonium in organic wastes (liquid or solid), Standard Operating Procedure Z/004. Edition 05. Wolverhampton: Eurofins Laboratories Ltd, 2006.¹⁾

NOTE This method of test is based on Method 53 in RB 427, *The Analysis of Agricultural Materials*, Ministry of Agriculture, Fisheries and Food, 1986 (London: HMSO).

[N5] NRM LABORATORIES. NRM Method JAS-083. The determination of ammonium in organic wastes (liquid or solid), NRM Laboratories.²⁾

¹⁾ Broadoak Business Park, Ashburton Rd, Manchester M17 1RW.

²⁾ NRM Ltd, Coopers Bridge, Braziers Lane, Bracknell, Berkshire RG42 6NS.

[N6] WASTE & RESOURCES ACTION PROGRAMME (WRAP). OFW004-005. *Residual biogas potential test for digestates, 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, 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 4.2 of the report). Volatile fatty acids should be determined by gas chromatography; an example specific to the equipment used during development of the residual biogas potential (RBP) test is provided in OFW004-005's Appendix 9.2, which is downloadable from <http://www.wrap.org.uk/sites/files/wrap/Residual%20Biogas%20Potential.pdf>



3 Terms and definitions

For the purposes of this PAS, the following terms and definitions apply.

3.1 agriculture

horticulture (soil-/field-grown), 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

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 Digestates 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 2 and 3 of EU Regulation No 1069/2009 [3] that are not intended for human consumption, including ova, embryos and semen

NOTE Articles 8, 9 and 10 of EU Regulation No 1069/2009 [3] respectively state Category 1, Category 2 and Category 3 ABPs. “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 “former foodstuffs” are Category 3 ABPs, which can be recovered using a digestion process.

3.4 Animal Health

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

3.5 authorization

3.5.1 authorization

<AD activity in England and Wales> environmental permit issued under the Environmental Permitting (England and Wales) Regulations 2010 [8]

3.5.2 authorization

<AD activity in Scotland> licence issued under the Environmental Protection Act 1990, (as amended) [1] and the Waste Management Licensing (Scotland) Regulations 2011 [10], or a Pollution Prevention and Control (PPC) Permit issued under the Pollution Prevention and Control (Scotland) Regulations 2012 [9]

3.5.3 authorization

<AD activity in Northern Ireland> licence issued under the Waste Management Licensing Regulations (Northern Ireland) 2003 [11] or a Pollution Prevention and Control (PPC) Permit issued under the Pollution Prevention and Control Regulations (Northern Ireland) 2003 [12]

3.6 batch or portion of production

unit of whole digestate, separated fibre or separated liquor produced by a single AD 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 retreatment or disposal, should monitoring checks or sample tests necessitate such actions

NOTE Batch or portion of production size is defined by the producer, rather than in this PAS, due to differences between AD system types.

3.7 biodegradable

capable of undergoing biologically mediated decomposition

3.8 biowaste

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

[For the purposes of this PAS, biowaste must be source-segregated (see 3.68)]

NOTE See Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives [13] for further definitions.

3.9 catering waste

3.9.1 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 No 1069/2009 [3] also designates non-meat food fractions as catering wastes, most of which are Category 3 ABPs.

3.9.2 catering waste

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

3.10 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 Anaerobic Digestate Quality Protocol (End of waste criteria for the production and use of quality outputs from anaerobic digestion of source-segregated biodegradable waste (ADQP)) [14], 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).

3.11 certification body

independent 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 digestates to PAS 110.

3.12 chemical oxygen demand (COD)

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 a particular period of time

NOTE In this context, a COD test determines the amount of oxygen consumed per amount of digestate (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 No 1069/2009 [3], 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 for 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

3.14.1 control

<noun>³⁾ state wherein correct procedures are being followed and criteria are being met

3.14.2 control

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

³⁾ Definitions 3.14 to 3.15 and 3.17 to 3.19 are from Codex, Basic Texts On Food Hygiene Codex Alimentarius, Rome: FAO, 2001 (second edition) [15]. Minor changes have been made to some to make them more appropriate within the context of AD. See <http://www.fao.org/docrep/005/Y1579E/Y1579E00.HTM> for more information.

3.15 control measure

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

3.16 co-operative

natural or legal persons who form a group under a written agreement, 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 AD process at one location within the co-operative's holdings

NOTE See 3.37 for definition of "holding".

3.17 corrective action

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

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 digestate

whole digestate resulting from an AD process, and any subsequently separated fibre or liquor fractions

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" (3.83), "separated fibre (3.64) and separated liquor (3.65).

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

[derived from *Protecting our Water, Soil and Air – A Code of Good Agricultural Practice for farmers, growers and land managers* [5]]

3.24 domestic use (amateur horticulture)

use of digestates by members of the public in their own gardens

3.25 duty of care

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 imports, produces, carries, keeps, treats or disposes of controlled waste or, as a broker, has control of such waste" [1], 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) [1] and associated regulations.

3.26 exemption

exemption from the need to hold an authorization

NOTE See 3.5 for definition of "authorization".

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 a horticultural activity.

NOTE 2 See 3.40 for definition of "land manager".

3.28 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 AD process, it means that such material has no physical or chemical properties that would prevent the digestate made from it from being fit for purpose. If depackaging is carried out by the digestate producer, a written supply of agreement for input materials would have to contain a declaration of "fit for purpose", which would limit the supplier's liabilities in terms of any properties that are affected by the AD process producer's depackaging step.

3.29 flow diagram

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

3.30 forestry

art and science of controlling the establishment, growth, composition, health and quality of forests used for cultivating trees, timber and woody biomass crops

NOTE The definition includes plantations and systems other than forests.

3.31 growing medium

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

[derived from PD CR 13456:1999]

3.32 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.

3.33 hazard

potential source of harm

3.34 hazard analysis

process of collecting and evaluating information on hazards and conditions leading to their presence, to decide which are significant in relation to the production of digestates that can be used without harm

NOTE This should be addressed in the HACCP plan.

3.35 hazard analysis and critical control point (HACCP)

system used for the identification, evaluation and control of hazards that are significant in relation to the production of digestates that can be used without harm

3.36 HACCP plan

document prepared in accordance with HACCP principles, to ensure control of hazards that are significant in relation to the production, storage, supply and use of digestates that can be used without harm

3.37 holding

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

3.38 hydraulic retention time (HRT)

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

NOTE Hydraulic retention time can be calculated by dividing the digester working volume by the rate of flow of input materials into the digester, i.e. $HRT \text{ (days)} = \text{digester volume (m}^3\text{)} / \text{influent flow rate (m}^3\text{ per day)}$.

3.39 input material

biodegradable material intended for feeding, or fed, into an AD process

NOTE For the list of European Waste Catalogue input material types acceptable under the Anaerobic Digestate Quality Protocol (End of waste criteria for the production and use of quality outputs from anaerobic digestion of source-segregated biodegradable waste (ADQP)) [14], see this protocol's Appendix B.

3.40 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".

3.41 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 re-vegetation of the land

3.42 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, treatment or stabilization of dangerous substances in order to make the site safe for a specific use, but not necessarily for all possible uses.

3.43 land restoration

includes land reclamation and land remediation

3.44 manure

slurries and solid manures, including farmyard manures and dirty water

NOTE This definition, from the Codes of Good Agricultural Practice [5], [6], [7].

3.45 maceration

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

3.46 maturation

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

3.47 matured

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

3.48 mesophilic

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

3.49 method of test

procedure for testing a sample of digestate

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

3.50 monitor

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

3.51 operating procedures

carried out and documented procedures for producing digestates

3.52 organic loading rate (OLR)

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

NOTE $OLR = \text{kg COD m}^{-3} \text{ day}^{-1}$ or $\text{kg VS m}^{-3} \text{ day}^{-1}$, 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).

3.53 pasteurization

process step during which the numbers of pathogenic bacteria, viruses and other harmful organisms in material undergoing AD 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 AD process or as a separate step. Pasteurization does not aim to achieve sterilization, which destroys all life forms.

NOTE 2 Pasteurized material might contain beneficial and other, unharmed, microorganisms.