Quality Protocol

Biomethane from waste

End of waste criteria for the production and use of biomethane from landfill gas and anaerobic digestion (AD) biogases.

This Quality Protocol was developed by the Environment Agency and WRAP (Waste & Resources Action Programme) in consultation with Defra, industry and other regulatory stakeholders. The Quality Protocol is applicable in England and Wales. It sets out the end of waste criteria for the production and use of biomethane arising from the degradation of organic wastes in a landfill site or anaerobic digestion plant, for injection into the gas grid or use in an appliance suitably designed and operated for natural gas.

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Foreword

Background

Uncertainty over the point at which waste has been fully recovered and ceases to be waste within the meaning of Article 3(1) of the EU Waste Framework Directive (WFD) (2008/98/EC) has inhibited the development and marketing of materials produced from waste which could otherwise be used beneficially without damaging human health and the environment. In some cases, this uncertainity has also inhibited the recovery and recycling of waste and its diversion from landfill.

Interpretation of legislation is ultimately a matter for the courts and there is now a substantial body of case law on the interpretation of the definition of waste. In accordance with Article 3 (1) of the WFD, and drawing on the principles established in this case law, it is possible to identify the point at which certain wastes cease to be waste and thus when the WFD waste management controls no longer apply.

More specifically, depending on the circumstances of the waste concerned, the aim is to achieve the following outcomes:

- To produce a Quality Protocol identifying the point at which waste, having been fully recovered, may be regarded as a non-waste product that can be either reused by business or industry, or supplied to other markets, enabling it to be used without the need for waste management controls; and/or
- To produce a statement that confirms to the business community what waste management controls they must comply with.

What is a Quality Protocol?

A Quality Protocol sets out end of waste criteria for the production and use of a product from a specific waste type. Compliance with these criteria is sufficient to demonstrate that the fully recovered product may be used without undermining the effectiveness of the WFD and without the need for waste management controls.

In addition, a Quality Protocol indicates how compliance may be demonstrated.

A Quality Protocol further aims to provide increased market confidence in the quality of products made from waste and so encourage greater recovery and recycling.

1. Introduction

Definitions of terms that appear in *italics* when they are first used in this Quality Protocol are given in Appendix A.

1.1. What is this Quality Protocol?

1.1.1 This Quality Protocol has been developed by the *Environment Agency* and *WRAP* (Waste and Resources Action Programme) in consultation with industry and other regulatory stakeholders. It is applicable in England and Wales.

1.1.2 The Quality Protocol sets out end of waste criteria for the production and use of *biomethane* arising from the degradation of organic wastes in a *landfill* site or *anaerobic digestion* plant, for injection into the gas grid or use in an appliance suitably designed and operated for natural gas. If these criteria are met, the biomethane will normally be regarded as having been fully recovered and to have ceased to be waste.

1.1.3 *Producers*, *processors* and *users* are not obliged to comply with the Quality Protocol. If they do not, the material will normally be considered to be waste and waste management controls will apply to its storage, handling, transport and application[1].

1.1.4 This Quality Protocol does not affect the obligation on producers and processors to hold an *environmental permit* and to comply with its conditions when processing and storing waste.

1.1.5 Producers should note that biogas (and, therefore, biomethane) is exempt, under the terms of Annex V, from the requirement for registration under the REACH Regulations[2].

1.2 The purpose of this Quality Protocol

1.2.1 This Quality Protocol has four main purposes:

- To clarify the point at which *waste management controls* are no longer required;
- To provide users with confidence that the biomethane they use conforms to an *approved product standard* and, if specified, a customer specification;
- To provide users with confidence that the material is suitable for use in the designated applications; and
- To protect human health and the environment.

1.3 Complying with the Quality Protocol

1.3.1 The requirements that must be met for biomethane to comply with this Quality Protocol and be regarded as having ceased to be waste vary depending on the designated application.

For the purpose of this Quality Protocol there are two designated applications which are:

A. **Biomethane for injection into the gas grid** (also referred to as Biomethane to Grid or BtG) as described in Section 4.
B. **Biomethane for use as a fuel in an appliance (BfA) suitably designed and operated for natural gas** as described in Section 4

[1] The material will remain a waste unless it has been demonstrated to have been completely recovered on a case-by-case basis having regard to the aims of the end of waste criteria set out in the Waste Framework Directive and the need to ensure that the Directive's effectiveness is not undermined.

[2] http://www.hse.gov.uk/reach/resources/waste.pdf and http://www.hse.gov.uk/reach/resources/exemptions.pdf.

1.3.2 Biomethane used in accord with A or B above will normally be regarded as having ceased to be waste and, therefore, no longer subject to waste management controls, provided it:

- Requires no further processing before its use; and
- Complies with the criteria set out in Section 2.2.

1.3.3 This Quality Protocol will be adopted as a technical regulation under the *Technical Standards and Regulations Directive 98/34/EC* as amended. We recognise that there may be codes of practice or standards which apply in *European Economic Area* (EEA) States other than the UK, setting out requirements for the production and use of biomethane. We accept that biomethane may cease to be waste provided that it has been produced in compliance with:

- A relevant standard or code of practice of a national standards body or equivalent body of any EEA state; or
- Any relevant international standard recognised for use in any EEA State; or
- Any relevant technical regulation with mandatory or de facto mandatory application for marketing or use in any EEA State.

These must give levels of product performance, protection to human health and the environment which are equivalent to those required by this Quality Protocol.

1.3.4 An outline of the main stages and control mechanisms of the Quality Protocol is presented in Figure 1.

1.4 When Quality Protocol compliant material may become waste

1.4.1 Processors and users of biomethane should note that compliance with this Quality Protocol does not prevent the status of the material reverting to a waste, if it is at any stage:

- Disposed of; or
- Stored indefinitely with little prospect of being used.

1.4.2 If Quality Protocol compliant biomethane gas is mixed with any waste (for example, the mixing of two gases or dissolving the gas within a liquid) the resulting mix will be considered to be a waste and subject to waste management controls. If Quality Protocol compliant biomethane is mixed with non-waste materials, the resulting mix will not, as a result of this, be waste.

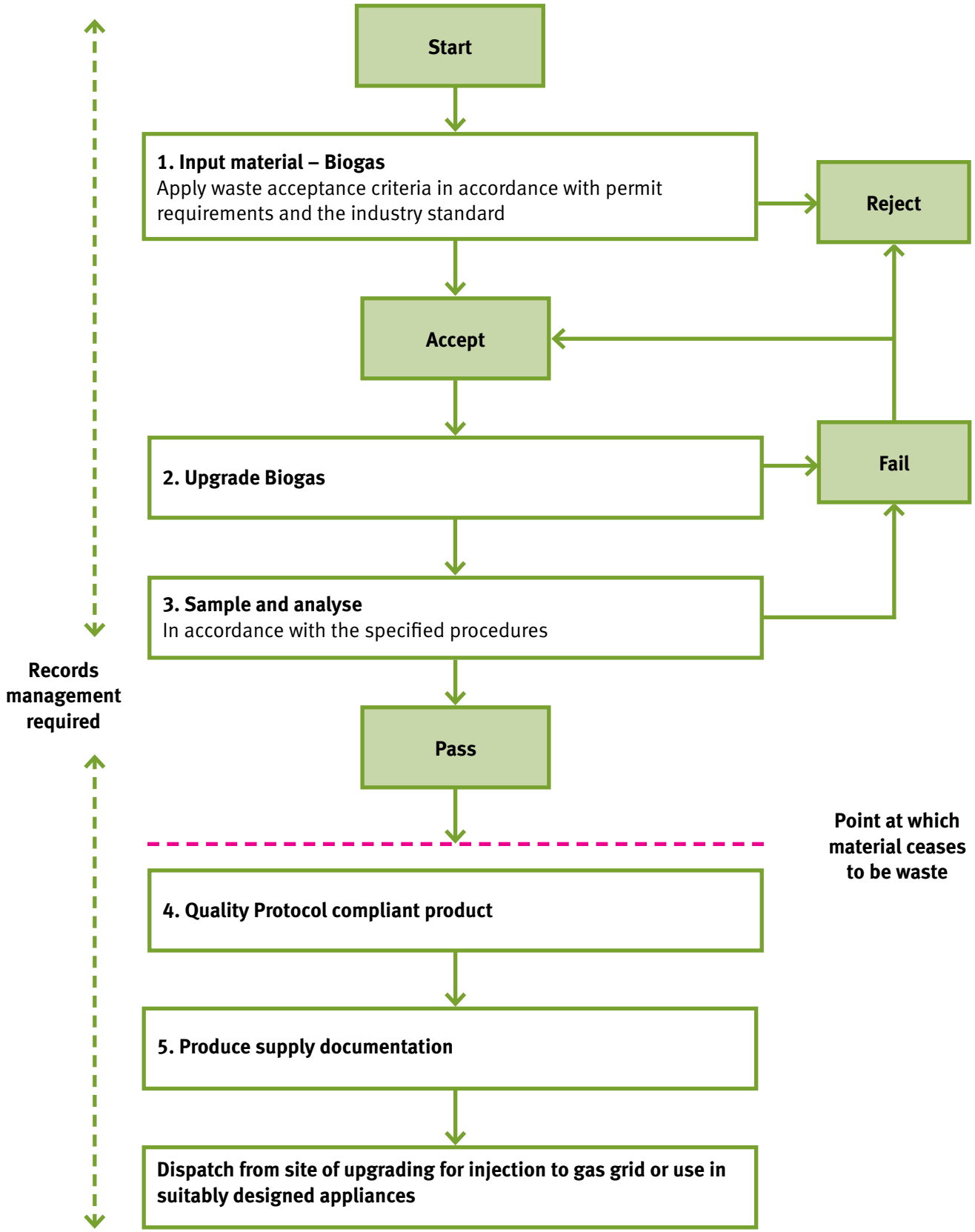
1.5 Failure to comply with the Quality Protocol

1.5.1 Where this Quality Protocol is not complied with (e.g., the biomethane does not meet a specified product standard, or the processor cannot demonstrate evidence of compliance), the biomethane will be considered to be waste[3]. In such circumstances, the processor or user must comply with the appropriate waste management controls for the transportation, storage and use of the biomethane and may be committing an offence if they do not do so.

1.5.2 Detailed guidance on waste management controls can be obtained from the Environment Agency's National Customer Contact Centre on 03708 506 506 or from the website www.environment-agency.gov.uk/waste or from from Natural Resources Wales website enquiries@naturalresourceswales.gov.uk.

[3] Unless it has been demonstrated to have been completely recovered on a case by case basis having regard to the Article 6 of the Waste Framework Directive.

Figure 1: Main stages and control mechanisms of the Quality Protocol



1.6 Updating the Quality Protocol

1.6.1 We will review and update this document as we consider appropriate.

1.6.2 Triggers for a review could include:

- Pollution incidents;
- A change in the market;
- A change in legislation or case law;
- A shift in understanding of the chemical composition or physical properties of biomethane; or
- A significant change to the processes or technologies for upgrading biogas to produce biomethane.

1.6.3 This Quality Protocol may be withdrawn by the Environment Agency if it becomes apparent that it is generally being misapplied and/or misused.

1.7 Importing and exporting Quality Protocol compliant material

1.7.1 Processors intending to export biomethane that complies with this Quality Protocol should be aware that, although the biomethane may cease to be waste in England and Wales, the country of destination may take a different view. If the competent authority in the country of destination considers the biomethane to be waste, the shipment will be subject to the controls set out in the Waste Shipment Regulation (EC No 1013/2006).

1.7.2 Those intending to import Quality Protocol compliant biomethane into England or Wales should be aware that, if the country of despatch regards the biomethane as waste, the controls set out in the Waste Shipment Regulation will apply to the shipment. This is the case, even though the biomethane may be regarded as having ceased to be waste in England and Wales.

1.7.3 Before importing or exporting such material it is prudent to check with the competent authority for the country of despatch or destination. A list of the competent authorities can be found here[4].

[4] http://ec.europa.eu/environment/waste/shipments/lists.htm

2. Producing biomethane

2.1 Regulating the production process

2.1.1 The collection of *biogas* and the *upgrading* of that gas to biomethane are subject to control under an environmental permit. This Quality Protocol does not affect the obligation on producers to comply with all the conditions of an environmental permit that applies to the generation, collection and treatment of biogas.

2.1.2 Biomethane may be subject to additional processing in order to meet the requirements of an approved product specification and, if required, a customer specification. This could be to:

- Remove trace contaminants;
- Adjust the calorific value of the gas; or
- Convert the form of the gas into a condition ready for use in an appliance or vehicle.

Such processing is classified as a waste recovery operation and is subject to the waste management controls in the WFD and domestic legislation.

2.1.3 This Quality Protocol does not affect the obligation on processors to:

- Hold an environmental permit or operate under an exemption within the environmental permitting regulations that controls the storage and treatment of biogas; and
- Comply with any relevant conditions under the permit or exemption.

2.2 Criteria for producing biomethane that ceases to be waste

2.2.1 To comply with this Quality Protocol, biomethane must meet the requirements as set out below.

2.2.2 **Biomethane to Grid**: In order for biomethane to cease to be waste when injected into the gas grid (as described in Section 4), it must:

- Be destined for use as a fuel or raw material delivered through the gas grid as described in Section 4;
- Meet an approved product standard specified for the particular end use (see Section 2.3 below and Appendix B);
- Comply with the requirements of the Gas Safety (Management) Regulations 1996[5], including complying with any further amendments to or replacement of those regulations;
- Be supplied under a *Network Entry Agreement* (NEA) that has been drawn up by a gas transporter under the Uniform Network Code[6]; and
- Be accompanied by evidence of compliance through records management as detailed in Section 3.

2.2.3 **Biomethane for use in an appliance suitably designed and operated for natural gas**: In order for biomethane to cease to be waste and used as fuel in an appliance (as described in Section 4) it must:

- Meet an approved product standard for the particular designated application (see Section 2.3 below and Appendix B);
- Comply with the requirements of the appliance manufacturer's warranty, if required;

[5] Gas Safety (Management) Regulations 1996 http://www.legislation.gov.uk/uksi/1996/551/contents/made
Guidance on compliance can be found at: http://www.hse.gov.uk/pubns/books/l80.htm
HSE guidance on gas supply can be found at: http://www.hse.gov.uk/gas/supply/index.htm

[6] For more information see the website of the Joint Office of Gas Transporters http://www.gasgovernance.co.uk/

- Be accompanied by evidence of compliance through records management as detailed in Section 3; and
- Be accompanied by evidence of compliance with operational requirements contained in the warranty, or other operating instructions, through records management as detailed in Section 3.

Note that use of biomethane in an appliance suitably designed and operated for natural gas covers the use in vehicles.

2.3 Meeting the requirements of approved product standards

2.3.1 The producer must comply with all the requirements of an approved product standard for one of the designated applications to which this Quality Protocol applies (see Section 4).

2.3.2 As there are currently no published approved product standards in England and Wales relating to production or use of biomethane for the designated applications, compliance with this Quality Protocol requires that biomethane meets the product specification for the designated application as set out in Appendix B. This specification is based on a detailed analysis of biogas composition and an environmental and health risk assessment of biomethane use in the designated applications.

2.3.3 Appendix B is current as of the date of publication of this Quality Protocol. Standards are subject to regular review and processors must ensure they comply with the latest version and any applicable requirements. Where additional standards are developed in the future, these will need to be approved by the Environment Agency for inclusion in this Quality Protocol when it is reviewed (see Section 1.6 above).

2.3.4 Customers may set additional specifications for biomethane. Such specifications may relate to the composition of the gas or additional performance standards of the fuel. Where required, the producer must meet these additional customer specifications.

3 Providing evidence of compliance with the Quality Protocol

3.1 Evidence of compliance with this Quality Protocol

3.1.1 Processors who choose to use this Quality Protocol must be able to demonstrate compliance with its requirements. If they are unable to do so, the material they produce will be considered a waste.[7]

3.1.2 Some of the records specified below may already be required as part of the processor's environmental permit conditions.

3.1.3 This Quality Protocol does not affect the obligations on processors to comply with environmental permit conditions.

3.1.4 The record-keeping requirements are additional to any statutory record-keeping obligations. However, some records may be used to fulfil both a regulatory obligation and evidence of compliance with the Quality Protocol.

3.2 Records management

3.2.1 In order to be able to demonstrate compliance with the Quality Protocol, processors must retain and supply appropriate records.

3.2.2 The records must at least include:

3.2.3 For batched supplies:

- Date of supply;
- Customer's name, contact details and nature of business;
- Processor's name and contact details (including the address of the processing site);
- Details of the designated application for which the biomethane is destined (see Section 4), including any applicable warranty conditions;
- Quantity supplied by volume;
- A copy of the material safety data sheet (MSDS) if required by other legislation;[8] and
- A copy of the Statement of Conformity (see 3.2.4 below).

For continuous supplies:

- As above but giving the dates for a given period of supply instead of date of supply.

3.2.4 The Statement of Conformity must give the following information:

- A statement that the biomethane was produced in compliance with this Quality Protocol (a template Statement of Conformity is included as Appendix C).

3.2.5 The processor shall retain records of all inspection and testing carried out (see Appendix B).

3.3 Retention of records

3.3.1 The processor must:

- Keep and retain all the above specified records for a minimum of two years; and
- Make them available for inspection by the regulator (if required).

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[7] Unless it has been demonstrated to have been completely recovered on a case by case basis having regard to aims of the Waste Framework Directive (in particular Article 6) and the need to ensure that the Directives effectiveness is not undermined.

[8] For additional guidance, refer to the Health and Safety Executive (HSE) Approved code of Practice: The compliance of safety data sheets (3rd edition), L130, ISBN 0717623718, HSE Books, 2002. For further information, contact the HSE Info Line on 0845 345 0055 or visit the www.hse.gov.uk

4. Uses of Quality Protocol compliant biomethane

4.1.1 To comply with this Quality Protocol, biomethane can only be used under the following two designated applications:

- As a fuel or raw material supplied for injection into the national gas grid, which is of a quality acceptable to the grid, meeting the requirements of a Network Entry Agreement and the Gas Safety (Management) Regulations 1996. The gas grid includes the national gas transmissions system, local gas transmission systems and local gas distribution networks.
- Use as a fuel in an appliance that is suitably designed and operated for natural gas which includes :
  - compression and spark ignition engines;
  - gas turbines;
  - fuel cells; and
  - heating appliances.

Note that use of biomethane as a fuel in suitably designed appliances covers its use in vehicles.

Appendix A Definitions

In this Quality Protocol, the words and phrases below have the following meanings.

Anaerobic digestion: Means the mesophilic and thermophilic biological decomposition and stabilisation of biodegradable waste which:

a. is carried on under controlled anaerobic conditions, and
b. results in stable sanitised material that can be applied to land for the benefit of agriculture or to improve the soil structure or nutrients in land[9]

Approved product standard: Any standard or specification included in Appendix B and any other standard(s) approved by the Environment Agency for inclusion in this Quality Protocol.

Biogas: An organic methane-rich gas produced from the biodegradation of organic wastes under anaerobic conditions.

Biomethane to Grid (BtG): Waste-derived biogas that has been treated in an upgrading process to a quality that is acceptable to the gas grid, meeting the requirements of a Network Entry Agreement and the Gas Safety (Management) Regulations1996. The gas grid includes: the national gas transmission system, local gas transmission systems and local gas distribution networks.

Biomethane for use as a fuel in an appliance suitably designed for natural gas (BfA): Waste-derived biogas that has been treated in an upgrading process that meets the requirements of appliances that are suitably designed and operated for natural gas as follows: compression and spark ignition engines; gas turbines; fuel cells and heating appliances. Note that use of biomethane as a fuel in suitably designed appliances covers its use in vehicles.

Environment Agency: The Environment Agency is the leading public body for protecting and improving the environment in England and Wales. Its job is to make sure that air, land and water are looked after by everyone in today's society, so that tomorrow's generation inherit a cleaner, healthier world.

Environmental Permit: Environmental permits or exemptions issued or exemptions registered under the Environmental Permitting (England and Wales) Regulations 2010.

European Economic Area (EEA): The EEA states comprise members of the EU (Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, The Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and the UK) together with Iceland, Liechtenstein, Norway and Switzerland. Although the Channel Islands and the Isle of Man are part of the UK, they are not part of the EU and businesses registered there are subject to different licensing legislation.

Landfill: A site designed and operated for the disposal of waste into or onto land as defined within the Landfill Directive (1991/31/EC).

Material safety data sheet (MSDS): A document containing data regarding the properties of a particular substance, including health and safety information. It includes the chemical and common names of all the ingredients that have been determined to be health hazards if they constitute 1% or greater of product composition (0.1% for carcinogens). Also includes precautionary guidelines and emergency procedures for handling the product.

Natural Resources Wales (NRW): NRW is the public body in Wales and its purpose is to ensure that the natural resources of Wales are sustainably maintained, enhanced and used, now and in the future.

[9] From Schedule 2, para 3(1)(a) Environmerntal Permitting Regulations 2007

Network Entry Agreement (NEA): A legal agreement between a gas producer and a gas transporter for the supply of gas into the national gas transmission system, local gas transmission systems and local gas distribution networks.

Processing biogas: The process of treating biogas to produce biomethane, this can include:

- upgrading the gas;
- cleaning the gas to remove contaminants;
- adding propane to the gas to improve calorific value; or
- adding an odorant to the gas.

Processor: An individual or organisation who treats biogas (including the upgrading or cleaning of the biogas) for the purpose of producing biomethane.

Producer: A person who produces biogas. This can be the operator of a landfill site or an anaerobic digestion plant.

Technical Standards and Regulations Directive 98/34/EC (TSD): The Technical Standards and Regulations Directive 98/34/EC seeks to ensure the transparency of technical regulations and is intended to help avoid the creation of new technical barriers to trade within the European Community.

Upgrading: The process of treating biogas to increase the concentration of methane.

Users: Individuals or organisations that obtain biomethane from a processor or a third party with the intention of using the gas for a specified action.

Waste management controls: Controls under legislation that govern the treatment, handling, containment and storage, transportation and use of waste.

WRAP (Waste and Resources Action Programme): WRAP's vision is a world without waste, where resources are used sustainably. WRAP works with businesses and individuals to help them reap the benefits of reducing waste, develop sustainable products and use resources in an efficient way.

Appendix B Standards and specifications

B1.0 Producers of Quality Protocol compliant biomethane must have the facility to analyse biomethane for all test parameters specified, either through in-house resources or through an external service provider. Techniques used for sampling and analysis should be in accordance with Environment Agency guidance for the monitoring of trace components in landfill gas[10]. Alternative sampling or testing regimes that can be demonstrated to meet the requirements of this Quality Protocol may be considered by the Environment Agency on a case by case basis.

Commissioning testing

B2.0 When a plant for the production of Quality Protocol compliant biomethane is developed or materially changed, initial commissioning testing must be carried out to characterise the gas produced. Once steady state gas production is reached, gas samples must be taken and analysed to demonstrate compliance with this Quality Protocol and to assess operational monitoring requirements in accordance with the next paragraph. One output from the gas characterisation study shall be demonstration that the biomethane produced does not include levels of compounds that are materially different to those set out in Table B1below.

Operational monitoring

B3.0 As part of the gas characterisation, an operational monitoring regime (including sampling methods, frequency, analytical method and report keeping) must be defined for the compounds specified in Table B1below. The minimum frequency of sampling and analysis will be annual in all cases. Where the compositional analysis demonstrates that the risk of inaccuracy and imprecision of annual sampling are not material to demonstrating conformance with limits in Table B1, then annual sampling and analysis may be continued. Where this cannot be demonstrated, then the frequency of sampling and analysis must be increased to to a level to provide confidence that the biomethane conforms with the required limits.

Specification for Biomethane

B4.0 The composition of biomethane for injection into the gas grid and for use in appliances must comply with the requirements of Table B1 below. The Limits are expressed as the concentration of the components in biomethane at a temperature of 288 K, 101.3 kPa, 5% v/v oxygen and dry gas (0% v/v moisture).

Table B1: Specification for biomethane for injection into the gas grid and for use in appliances

Property	Limit (max)
Sulphur containing compounds	
Total Sulphur	30 mg m^{-3}
Hydrogen Sulphide	5 mg m^{-3}
Inorganic Gases	
Ammonia	20 mg m^{-3}
Hydrogen Chloride	1.5mg m^{-3}
Hydrogen Fluoride	5 mg m^{-3}
Halogenated Hydrocarbons	
Total halogenated hydrocarbons	1.5 mg m^{-3}
Atomic Hydrocarbons	
Xylenes (all isomers)	100 mg m^{-3}
Metals	
Arsenic	0.1 mg m^{-3}

[10] Environment Agency (2010) Guidance for monitoring trace components in landfill gas. LFTGN04 v3.0.

Appendix C Statement of Conformity

An example template showing the minimum information that should be supplied by the producer for Biomethane to Grid (BtG) and Biomethane for Appliances (BfA)

Producer Organisation Name:

Address:

Post Code:

Telephone:

Email:

Site of Production:

Date of Supply:

Customer Name & Contact Details:

Customer Nature of Business:

Delivery Address (if different from above):

Quantity Supplied (volume):

Batch/Identification Number (if applicable):

This product has been produced in accordance with the following industry standards:

This product has been produced in compliance with the Biomethane Quality Protocol.

Further information on the use and application of biomethane can be found on the Environment Agency's web site.

Analysis of Product and Comparison with Quality Protocol Requirements

Date of Analysis:

Batch Number Analysed (if applicable):

Analysing Laboratory:

Address:

Telephone:

Email:

Analysis Results

Analyte	QP Requirement (mg m-3)	Analysis Result (mg m-3)	Pass/Fail	Analytical Method	Limit of Detection
Total Sulphur	30				
Hydrogen Sulphide	5				
Ammonia	20				
Hydrogen Chloride	1.5				
Hydrogen Fluoride	5				
Halogenated Hydrocarbons	1.5				
Xylene	100				
Arsenic	0.1				

Waste & Resources Action Programme

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recycle