wrap
Material change for a better environment

Environment Agency

Quality Protocol

Biodiesel

The quality protocol for the production and use of biodiesel derived from waste cooking oil and rendered animal fat (quality biodiesel).

NIEA Northern Ireland Environment Agency
www.ni-environment.gov.uk

This Quality Protocol was funded by Defra, the Welsh Assembly Government (WAG) and the Northern Ireland Environment Agency (NIEA) as a business resource efficiency activity.
It was developed by the Environment Agency and WRAP (Waste & Resources Action Programme) in consultation with Defra,WAG, NIEA, industry, and other regulatory stakeholders. It is applicable in both England and Wales and Northern Ireland. It sets out criteria
for the production and use of biodiesel derived from waste cooking oil and rendered animal fat (quality biodiesel).

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Foreword

Background

The Waste Protocols Project is a joint initiative between the Environment Agency and WRAP (Waste & Resources Action Programme). It is funded by the Department for Environment, Food and Rural Affairs (Defra), the Welsh Assembly Government (WAG) and the Northern Ireland Environment Agency (NIEA) as a business resource efficiency activity.

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 (2008/98/EC) has inhibited the development and marketing of materials produced from waste which could be used beneficially without damaging human health and the environment. In some cases, this uncertainty has also inhibited the recovery and recycling of waste and its diversion from landfill.

Interpretation of EU legislation is ultimately a matter for the Court of Justice of the European Union and there is now a substantial body of case law on the interpretation of the definition of waste in Article 1(1) (a) of the WFD. 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's waste management controls no longer apply. This identification is the purpose of the Waste Protocols Project.

More specifically, depending on the circumstances of the waste stream concerned, the project seeks to achieve the following outcomes:

- to produce a Quality Protocol identifying the point at which waste, having been the subject of a complete recovery operation, may become a non-waste product or material that can be either reused by business or industry, or supplied into other markets, enabling such fully recovered products to be used without the need for waste management controls; and
- to produce a statement that confirms to the business community what legal obligations they must comply with to use the treated waste material.

In November 2006 the High Court issued a legal ruling[1] which appeared to mean that waste-derived biodiesel could not cease to be waste until it had been burnt in an engine for energy recovery. Because of this it was concluded that a Quality Protocol could not be achieved at that time. The Environment Agency's view remained that although waste-derived biodiesel remained a waste until used as a fuel, it could be stored and used as a motor fuel in accordance with the Environment Agency's Standard Low Impact Biodiesel permit.

The 2007 Court of Appeal ruling[2] overruled the decision made by the High Court and made it clear that in principle waste intended for use as a fuel could cease to be waste before the point of energy recovery provided that it has been converted into a distinct, marketable product which can be used in exactly the same way as an ordinary fuel, and with no worse environmental effects. This ruling has made it possible to develop this Quality Protocol.

What is a Quality Protocol?

A Quality Protocol sets out criteria for the production of a product from a specific waste type. Compliance with these criteria is considered sufficient to ensure that the fully recovered product may be used without harm to human health or the environment and therefore without the need for waste management controls. In addition, the Quality Protocol indicates how compliance may be demonstrated and points to best practice for the use of the fully recovered product.

The 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 Solvent Resource Management Limited -and- Environment Agency; and OSS Group Ltd -and- Environment Agency [2006] EWHC 3023 (Admin)

2 R(OSS Group Limited) -and- Environment Agency and Ors [2007] EWCA Civ 611

1. Introduction

1.1 What is this Quality Protocol?

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

1.1.2 The Quality Protocol sets out end of waste criteria for the production and use of biodiesel derived from *waste cooking oil* and *rendered animal fat (quality biodiesel)*. If these criteria are met, quality biodiesel will normally be regarded as having been fully recovered and to have ceased to be waste when it complies with the requirements of an *approved standard*.

1.1.3 *Producers* and *users* are not obliged to comply with the Quality Protocol. If they do not, the quality biodiesel will be considered to be waste and *waste management controls* will apply to its handling, transport and application.

1.1.4 Producers of quality biodiesel should also note that by producing a fully recovered product they may be subject to further legal obligations, e.g. the registration of substances under REACH[3].

1.1.5 Definitions for terms that appear in *italics* when they are first used in the Quality Protocol are provided in Appendix A.

1.2 The purpose of the Quality Protocol

1.2.1 This Quality Protocol has three main purposes:

- to clarify the point at which waste management controls are no longer required;
- to provide users with confidence that the quality biodiesel they purchase conforms to an approved standard comparable with those of biodiesel made from virgin oil of a non-waste origin; and
- to protect human health and the environment (including soil) by setting standards for the production and use of quality biodiesel as automotive or heating fuel and describing acceptable good practice for its use.

1.3 Complying with the Quality Protocol

1.3.1 Quality biodiesel will normally be regarded as having been fully recovered and to have ceased to be waste, and therefore no longer subject to waste management controls, provided it:

- has been produced using only those input materials specified in section 2.3.2;
- has been produced via a chemical process in accordance with section 2;
- meets the requirements of an approved standard so requires no further processing before use;
- is destined for combustion as an automotive or heating fuel[4,5]; and
- is not used in such a way as to adversely affect human health or the environment, thus not undermining the aims of the Waste Framework Directive and Water Framework Directive.

1.3.2 Producers of quality biodiesel must demonstrate that these criteria have been met. They can do this in the ways set out in section 3, that is by producing and keeping copies of customer supply documentation that include a *declaration of conformance* with this Quality Protocol.

1.3.3 Producers of quality biodiesel should note that, regardless of whether the criteria set out in 1.3.1 are met, the processing of quality biodiesel on the site of production will continue to be covered by a *environmental permit or a waste management licence,*

3 Waste is exempted from REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) (Regulation (EC) No 1907/2006) as it is covered by separate waste management controls. However, once waste has been fully recovered and ceases to be waste, waste management controls cease to apply and REACH may apply instead at that point. Unless specifically exempted (e.g. because a substance has already been registered), producers may need to register substances recovered from waste and placed back on the market and make available appropriate hazard and safety information, for example a suitable safety data sheet. Further information on REACH is available at the REACH UK Competent Authority website www.hse.gov.uk/reach or Helpdesk on 0845 408 9575 or email ukreachca@hse.gov.uk.

exemption or Pollution Prevention and Control (PPC) permit if in Northern Ireland. However, if quality biodiesel is produced and used in accordance with this Quality Protocol it will cease to be waste and waste management controls will not apply once it complies with the requirements of an approved standard.

1.3.4 If quality biodiesel is blended with waste materials, all output will be considered to be a waste and subject to waste management controls.

1.3.5 If quality biodiesel which is compliant with Quality Protocol is blended with non-waste materials the blend will not be waste.

1.3.6 Although waste management controls will not be required for the transfer of quality biodiesel from the site of production to the site where it will undergo *physical blending* with non-waste materials, other regulatory controls may apply to the blending activity.

1.3.7 Producers should also note that the process of biodiesel production remains subject to any relevant controls under Animal By-Product Regulations (ABPR).

1.3.8 Provision must be made for final product storage including storage location and conditions that are suitable and are in full compliance with the requirements of the:

- Control of Pollution (Oil Storage) (England) Regulations 2001[6].
- Control of Pollution (Oil Storage) Regulations (Northern Ireland) 2010

1.3.9 An outline of the main stages and control mechanisms of the Quality Protocol is presented in Figure 1. These are described further in sections 2 and 3.

1.4 Failure to comply with the Quality Protocol

1.4.1 Where this Quality Protocol is not complied with, for example the quality biodiesel is not produced to an approved standard or the producer cannot demonstrate evidence of compliance, the quality biodiesel produced will be considered to be waste. In such circumstances, the producer/user must comply with the appropriate waste management controls[7] for the transportation, storage and use of the quality biodiesel and failure to do so would constitute an offence.

1.4.2 Detailed guidance on waste management controls can be obtained from the Environment Agency's National Customer Contact Centre on 08708 506506 and from NIEA'S website at *http://www.ni-environment.gov.uk/waste-home.htm* .

1.4.3 It must be demonstrated that the biodiesel will actually be used as an automotive or heating fuel. Producers and users of quality biodiesel should note that, even if the Quality Protocol is complied with, the material will still be waste and subject to waste management controls if, for example, it is at any stage:

- disposed of;
- used in any market other than for combustion in *automotive engines* or as a heating fuel; or
- stored indefinitely with little prospect of being used.

1.5 Updating the Quality Protocol

1.5.1 We plan to review and update this document every two years from the date of final publication.

1.5.2 However, this document may be subject to change before these review dates. Triggers for such a change could include pollution incidents, a change in the market or a change in legislation or case law.

4 The burning of fuel in an appliance requires a permit under the Environmental Permitting Regulations, Schedule 1 whether the fuel is waste or not. An Environment Agency permit is required if the appliance has a rated thermal input of 3-50 megawatts (MW) and a local authority permit is required if the rated thermal input is 0.4-3 MW. In Northern Ireland a Pollution Prevention and Control (PPC) permit , Schedule 1 of the Pollution Prevention and Control Regulations (Northern Ireland) if the net rated thermal input is at least 0.4MW.

5 The Waste Incineration Directive (2000/76/EC) does not apply if the heating fuel complies with the requirements of BS EN 14213:2003 and this Quality Protocol and has ceased to be waste.

1.5.3 This Quality Protocol may be withdrawn if it becomes apparent that it is generally being misused and/or misapplied.

1.5.4 This Quality Protocol will be adopted as a technical regulation under *Technical Standards and Regulations Directive 98/34/EC* (as amended)[8]. 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 quality biodiesel. We accept that quality biodiesel may cease to be waste when despatched to a customer, including appropriate use on site, provided 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;
- 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 and protection of human health and the environment which are equivalent to those required in this Quality Protocol.

1.6 Importing and exporting quality protocol complaint material

1.6.1 Producers intending to export quality protocol compliant materials should be aware that, although the material may cease to be waste in England, Wales and Northern Ireland, the country of destination may take a different view. Under the Waste Shipment Regulation (EC/1013/2006), if the competent authority in the country of destination considers the material to be waste, the controls specified in that Regulation will apply to the shipment.

1.6.2 Producers intending to import quality protocol compliant materials to England, Wales and Northern Ireland should be aware that if the country of dispatch regards the material as waste the controls set out in the Waste Shipment Regulation will apply to the shipment, even though the material may be regarded as having ceased to be waste in England, Wales and Northern Ireland.

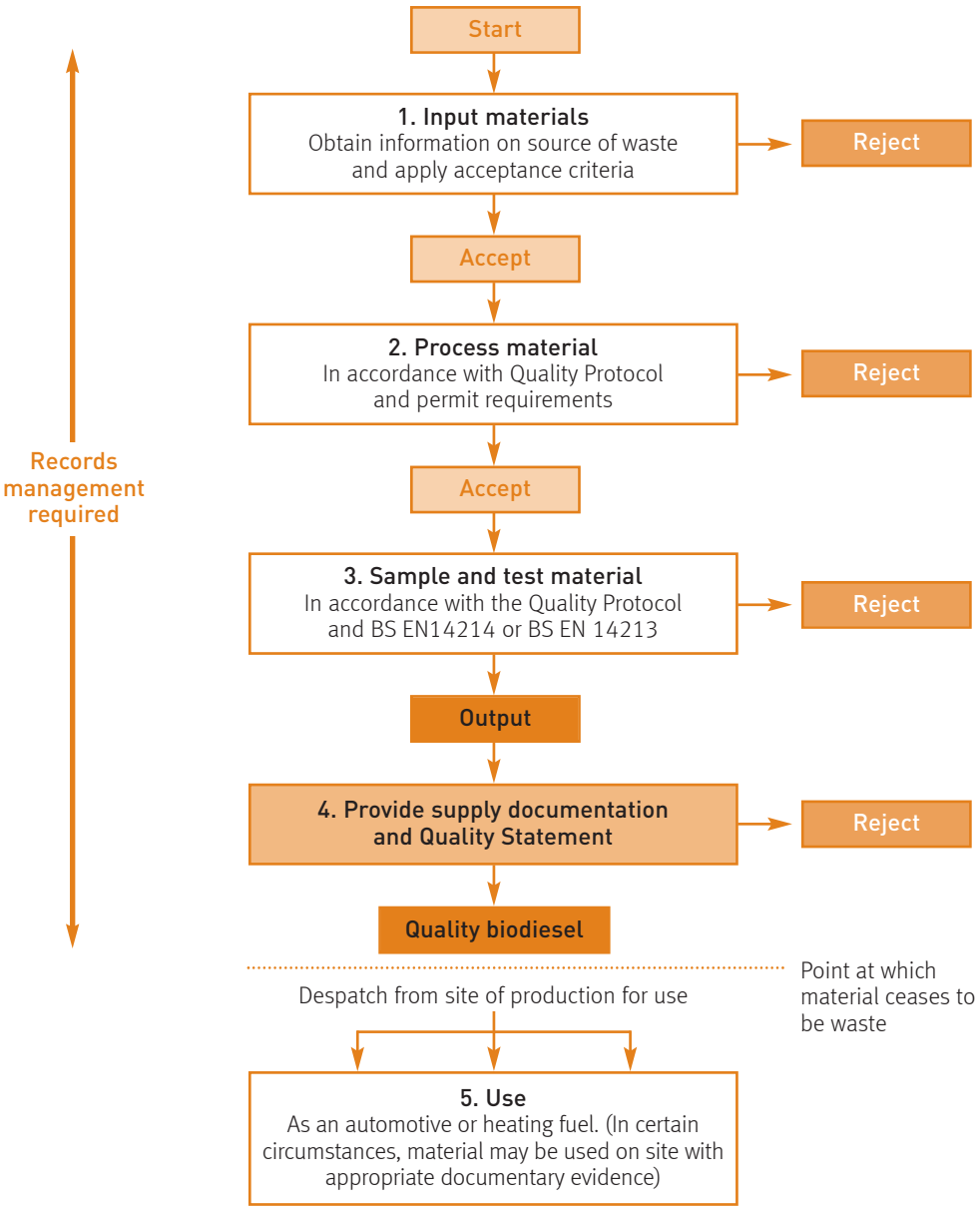
1.6.3 As such it is prudent to check with the competent authority for the county of despatch or destination before importing or exporting quality biodiesel. A list of the relevant European competent authorities can be found at http://ec.europa.eu/environment/waste/shipments/

6 Paragraph 2(2)(d)(iii) states that the Regulations do not apply to the storage of oil on any premises "for the onwards distribution of oil to other places". The Quality Protocol however requires producers to comply with the requirements of the Regulations by way of best practice.

7 For example, persons who collect and transport the waste will need to be registered waste carriers.

8 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.

Figure 1 Main stages and control mechanisms of the Quality Protocol



9 Regulation (EC) No 1774/2002 laying down health rules concerning animal by-products not intended for human consumption.
10 Regulation (EC) No 92/2005 implementing Regulation (EC) No 1774/2002.
11 Waste classified under EWC code 20.01.25 is classified as catering waste (category 3 animal by-products) and therefore if not destined for use in a biogas plant or for composting is not controlled under ABPR.
12 Waste cooking oils classified under EWC code 02.02.99 (e.g. from factories) are classified as former foodstuffs and are category 3 animal by-products controlled under ABPR. Rendered animal fat (tallow) classified under EWC code 02.02.99 are category 1 or 2 animal by-products controlled under ABPR.

2. Producing quality biodiesel

2.1 Regulating the quality biodiesel production process

2.1.1 The process of turning waste into quality biodiesel is classified as a waste recovery operation and is subject to the waste management controls in the Water Framework Directive. This Quality Protocol does not affect the obligation to hold an environmental permit (or waste management licence, exemption or PPC permit if in Northern Ireland) that authorises the storage and processing of waste cooking oil and rendered animal fat and to comply with its conditions.

2.2 Criteria for producing quality biodiesel that has been fully recovered and ceased to be waste

2.2.1 The following criteria must be met in order to produce quality biodiesel that will normally be regarded as having been fully recovered and to have ceased to be waste when it complies with the requirements of an approved standard.

2.3 Input materials

2.3.1 Known and defined input materials must be used. These are waste cooking oil, rendered animal fat (tallow) and chemical catalysts (typically sodium hydroxide or potassium hydroxide).

2.3.2 Wastes that are suitable for *biodiesel production* are classified under the following *European Waste Catalogue (EWC) codes*. Please note that not all wastes classified under these codes may be suitable for processing:

- 20.01.25: waste cooking oil originating in restaurants, catering facilities and kitchens (municipal wastes (household waste and similar commercial, industrial and institutional wastes) including separately collected fractions: edible oil and fat); and
- 02.02.99: rendered animal fat and waste cooking oil (wastes from the preparation and processing of animal carcasses, meat, fish and other foods of animal and vegetable origin other than from the sources listed at 20.01.25: wastes not otherwise specified).

2.3.3 The input wastes in 2.3.2 are classified as animal by-products under the EU Animal By-Products Regulations (ABPR)[9] and the UK legislation making provision for the administration and enforcement of the Regulation[10]. However, the process of turning waste classified under EWC code 20.01.25 into quality biodiesel is not controlled under ABPR[11].

2.3.4 The process of turning waste classified under EWC code 02.02.99 into quality biodiesel (with the exception of waste of vegetable origin where it can be demonstrated that such waste has been kept separate from waste of animal origin) is controlled under ABPR and as such must take place at premises subject to approval under Article 13 ABPR[11]. Processing must be in accordance with the requirements of Annex V Chapter III ABPR and Annex IV Regulation (EC) No 92/2005.

2.3.5 In certain instances quality biodiesel may be blended with other biodiesel made from virgin oil at the site of manufacture. Provided that the biodiesel meets the specifications defined in BS EN 14214 in the case of biodiesel intended for use as an automotive fuel, or BS EN 14213 in the case of biodiesel intended for use as a heating fuel, this is acceptable.

2.3.6 To ensure that only appropriate input materials are used in the manufacture of quality biodiesel, the producer must have and maintain procedures in the form of acceptance criteria.

2.3.7 The acceptance criteria must specify:

- the types of waste cooking oils and rendered animal fats that are accepted;
- the quantity and method of acceptance; and
- the date of delivery and source of the waste cooking oil and rendered animal fats.

2.3.8 Input materials must be stored at the site of quality biodiesel production in accordance

with all relevant regulatory controls, which include the Control of Pollution (Oil Storage) (England) Regulations 2001 [or Control of Pollution (Oil Storage) Regulations (Northern Ireland) 2010 if in Northern Ireland].

2.4 Production process

2.4.1 The processing of waste cooking oil and rendered animal fat into biodiesel via a chemical process called *transesterification* is subject to regulatory controls. This Quality Protocol does not affect the obligation to comply with any permit (or PPC permit, waste management licence or exemption if in Northern Ireland) that applies to biodiesel production from waste cooking oil and rendered animal fat.

2.4.2 Biodiesel producers must have a clearly defined quality policy.

2.4.3 Biodiesel producers must undertake a suitable and sufficient risk assessment incorporating adequate hazard identification, such as a *Hazard and Operability (HAZOP) analysis*. This applies to new and existing plant and for modifications to plant, procedures and organisations.

2.4.4 Biodiesel producers must have clearly defined *Standard Operating Procedures* (SOPs) covering quality management aspects of the biodiesel manufacturing process.

2.4.5 All staff must be appropriately trained and supervised.

2.4.6 A process control system supported by accurate record keeping and document control procedures must be in operation throughout the biodiesel manufacturing process. This is to include details of heating control, pump control, level control, wash control and safe shut-down.

2.4.7 The process control system must be reviewed on an ongoing basis whenever any changes to the process have taken place and updated as appropriate.

2.4.8 The quality policy, process control systems and SOPs must be designed to deliver a product that meets the requirements of this Quality Protocol.

2.4.9 The typical production process and quality controls that must be undertaken in order to produce quality biodiesel that reaches either BS EN 14214 or BS EN 14213, as appropriate, and this Quality Protocol are detailed in Appendix B.

2.4.10 Some of the controls specified in this Quality Protocol may already be required as part of the conditions of the permit required (or PPC permit, waste management licence or exemption if in Northern Ireland) for the processing of waste cooking oil and rendered animal fat into biodiesel. Producers must comply with these conditions.

2.5 Outputs

2.5.1 In the case of biodiesel that is intended for use as a heating fuel, the specifications defined in BS EN 14213 must be fully met.

2.5.2 In the case of biodiesel intended for use as an automotive fuel, the specifications defined in BS EN 14214 must be fully met with the following exceptions:

- the determination of the methyl ester content can be made using either the EN 14103 *test method* specified in BS EN 14214 or the alternative test method BS EN 14078:2003; and
- if the specification for *cold filter plugging point* (CFPP) listed in BS EN 14214 cannot be met, the producer must specify the actual CFPP in order to allow the customer to make an informed choice based on the intended use of the fuel (e.g. as a blend with regular diesel fuel).

2.5.3 Testing in accordance with BS EN 14214 in the case of biodiesel intended for use as an automotive fuel, or BS EN 14213 in the case of biodiesel intended for use as a heating fuel, should be carried out once every 10 product batches and at least once per calendar month.

2.5.4 Testing in accordance with BS EN 14214 must also be supported by in-house testing of every product batch (except for those subjected to full BS EN14214), including for CFPP and viscosity as a minimum. A sample should be retained from every product batch for a period of 12 months. The sample should be of a sufficient size to enable retrospective analysis if requested by the customer.

2.5.5 Testing in accordance with BS EN 14214 or BS EN 14213 as appropriate, should be carried out for the first product batch for which compliance with this Quality Protocol is claimed. This provides evidence that the producer is manufacturing biodiesel to the required specification from the outset.

2.5.6 In the event of a test failure, the producer should reassess the main stages and control mechanisms as set out in Figure 1 making any necessary adjustments. They should then retest every subsequent batch until a pass is achieved. The failed batch should either be sold as a waste and subjected to the relevant waste management controls, or may be re-refined to a level where it would pass the relevant test.

2.5.7 Further information and good practice for the production of quality biodiesel is shown in Appendix D.

3. Providing evidence of compliance with the Quality Protocol

3.1 Records management

3.1.1 Evidence of compliance with the requirements of this Quality Protocol may be provided by retaining copies of supply documentation issued to the customer. It is expected that this will include documents which show:

- date;
- quantity by weight/volume and batch;
- name and address of receiving business/establishment;
- nature of receiving business/establishment;
- date of last test to BS EN 14214 or BS EN 14213 as appropriate; and
- a copy of the quality statement.

3.1.2 The Quality Statement must give the following information:

- a declaration that the quality biodiesel was produced in conformance with this Quality Protocol and as such is compliant with BS EN 14214 or BS EN 14213 as appropriate;
- details of the quality biodiesel's Cold Filter Plugging Point (CFPP) in the case of biodiesel intended for use as automotive fuel; and
- the quality biodiesel batch number.

3.1.3 Records must also be kept of incoming wastes. Specifically, a record of each load delivered to site must be kept giving:

- date;
- European Waste Catalogue (EWC) code and description;
- place of origin (where known);
- quantity by weight/volume;
- *registered waste carrier*;
- supplier; and
- whether the load was accepted.

3.1.4 These input records may already be required as part of the processing permit conditions (or relevant waste authorisation in Northern Ireland). This Quality Protocol does not effect the obligations on producers to comply with these permit conditions.

3.1.5 Producers must retain records of all inspection and testing carried out in accordance with BS EN 14214 and BS EN 14078 in the case of biodiesel intended for use as an automotive fuel, or BS EN 14213 in the case of biodiesel intended for use as a heating fuel.

3.1.6 Records should be made of all test failures and adjustments made to the main stages and control mechanisms (see Figure 1) to achieve a test pass.

3.1.7 Producers must maintain a record of all quality statements issued against each batch of quality biodiesel. A sample from every batch should be retained for a period of 12 months. The sample should be of a sufficient size to enable retrospective analysis on request.

3.1.8 All records must be available to the producer and must be retained for a minimum of two years.

Appendix A: Definitions

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

Term	Description
Approved standard	Any standard or specification included in Appendix C and any other standard approved by the regulator for inclusion in this Quality Protocol.
Automotive engines	An engine (e.g. car, aviation, rail or marine engine) that converts energy into mechanical force or motion by use of a fuel.
Biodiesel	A *diesel quality* liquid fuel derived from biomass or waste cooking oils or rendered animal fat, the ester content of which is not less than 96.5% by weight; and the sulphur content of which does not exceed 0.0001% (1mg/kg) or is nil.
Biodiesel production	The process of chemical modification under managed conditions to produce biodiesel from waste cooking oil and rendered animal fat.
Biofuel	A fuel derived from renewable resources, especially plant biomass, such as ethanol made from sugarcane or grains.
Cold Filter Plugging Point (CFPP)	This indicates the low temperature operability of fuels. It is the highest temperature at which a given volume of fuel fails to pass through a standardised filtration device in a specified time, when cooled under standardised conditions.
Declaration of conformance	A statement issued by the producer to state that the material to which the declaration applies has been produced according to the Quality Protocol.
Diesel quality	This is defined in the *Hydrocarbon Oil Duties* Act 1979 as a fuel that capable of being used for the same purposes as heavy oil.
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 generations inherit a cleaner, healthier world.
Environmental Permit	Environmental permits or exemptions issued under the Environmental Permitting (England and Wales) Regulations 2007, which came into force on 6 April 2008, or a position adopted by the Environment Agency in accordance with its guidance on the regulation of low-risk activities. From 6 April 2008, the following automatically became environmental permits: ■ PPC permits issued under the Pollution Prevention and Control (England and Wales) Regulations 2000 (as amended); and ■ Waste Management Licences (WMLs) issued under the Environmental Protection Act 1990 (as amended). Exemptions from the need for a Waste Management Licence, registered under Regulation 18 and Schedule 3 of the Waste Management Licensing Regulations 1994 (as amended) will now come under schedule 3 of the Environmental Permitting (England and Wales) Regulations 2007.
European Economic Area (EEA)	The EEA States consist of the 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. Switzerland is not part of the EEA, but linked through a series of bilateral agreements. Although the Channel Islands and the Isle of Man are UK Crown dependencies, .
European Waste Catalogue (EWC) code	European Waste Catalogue (EWC 2002 and amendments) – comprehensive list of waste codes and descriptions based on waste source and type.
Hazard and Operability (HAZOP) analysis	A structured technique in which a multi-discipline team performs a systematic study of a process using guide words to discover how deviations from the design intent can occur in equipment, actions, or materials, and whether the consequences of these deviations can result in a hazard.
Hydrocarbon oils	Oils from a mineral source, including petroleum and diesel, rather than from plant or animal origin. The terms 'hydrocarbon oils' and 'mineral oils' are interchangeable.

continued

Northern Ireland Environment Agency (NIEA)	Northern Ireland Environment Agency-NIEA is the leading public body in Northern Ireland responsible for protecting, conserving and promoting the natural environment and built heritage in Northern Ireland.
Physical blending	The blending of different substances that does not undergo chemical change.
PPC Permit (Northern Ireland)	A permit issued under the Pollution Prevention and Control Regulations (Northern Ireland) S.R. 2003/46. Establishes a pollution control regime for certain installations or mobile plants and includes combustion activities.
Producers	The operator who undertakes the biodiesel production process.
Quality biodiesel	For the purposes of this document, quality biodiesel is one that meets all the requirements of this Quality Protocol.
Registered waste carrier	A carrier of waste who is registered under the Controlled Waste (Registration of Carriers and Seizure of Vehicles) Regulations 1991.
Rendered animal fat	Rendered animal fat, or tallow, is hard fat obtained from the whole or part of any dead animal through the process of rendering.
Rendering	The separation of tallow from proteinaceous material and the removal of water by cooking animal by-products at high temperatures, sometimes under pressure.
Standard Operating Procedures (SOPs)	A set of instructions having the force of a directive, covering those features of operations that lend themselves to a definite or standardized procedure without loss of effectiveness.
Test method	Product and process testing that complies with recognised national or international standards issued by organisations such as BSI or CEN.
Transesterification	The process of exchanging the alkoxy group of an ester compound by another alcohol. These reactions are often catalyzed by the addition of an acid or base. The process is a chemical activity that is regulated under the Environmental Permitting (England and Wales) Regulations 2007.
User(s)	The individuals or organisations that obtain biodiesel from a producer or third party with the intention of using that biodiesel.
Waste Carriers Licence	The Waste Framework Directive requires that establishments and undertakings who collect or transport waste on a professional basis to be *registered waste carriers*. This is implemented in England and Wales by the Control of Pollution (Amendment) Act 1989 and in Northern Ireland through Article 5(9) of the Waste and Contaminated Land (Northern Ireland) Order 1997. Persons who carry waste as part of their business are required to be registered with the Environment Agency in England and Wales and with NIEA in Northern Ireland.
Waste cooking oil	Waste cooking oils are purified fats of plant or animal origin, which are liquid at room temperature. Like all fats, cooking oils are esters of glycerol and a varying blend of fatty acids, are biodegradable, insoluble in water, but soluble in organic solvent. Cooking oils are generally processed and used in production of products fit for human consumption and do not contain toxic substances.
Waste management controls	Controls under legislation that govern the treatment, handling, containment and storage of waste. For example, in compliance with Article 11 of the Waste Framework Directive the user might need to apply to the Environment Agency for a permit (or to NIEA for a waste management licence if in Northern Ireland).
Waste Management Licence or Exemption (Northern Ireland)	An authorisation issued in Northern Ireland under the Waste Management Licensing Regulations (Northern Ireland) 2003 for the storage, treatment or disposal of waste.
WRAP	WRAP's vision is a world without waste, where resources are used sustainably. It 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 Typical production process and quality controls

Table B.1: Production steps

Process stage	Description
1. Physical processing	Input materials are screened and filtered to remove solid particles prior to further processing. The amount of water and free fatty acids (FFA) in incoming oil is monitored to prevent too high levels of either leading to soap formation and the separation of glycerol residue downstream. Following determination of FFA level compensation may need to be made.
2. Catalyst mixing	Catalyst is typically sodium hydroxide or potassium hydroxide. Catalyst is dissolved in methanol. Excess methanol is used to ensure total conversion of oil to its esters in the subsequent reaction stage.
3. Reaction	Closed reaction vessel is charged with methanol/catalyst mix and oil added. Throughout the rest of the process the system is kept totally closed to atmosphere to prevent loss of methanol. Reaction mix is kept just below the boiling point of methanol to avoid losses unless the vessel is pressurised. Reaction time must be specified.
4. Separation	Once reaction is complete, the reaction mixture remains highly alkaline until after separation to prevent biodiesel reverting to its original ester. The glycerol phase is much denser than biodiesel phase, allowing the two to be gravity separated. Centrifugation may be used to separate the two materials faster. Glycerol is drawn off from the bottom of the settling vessel.
5. Methanol removal	Once the glycerol and biodiesel phases have been separated, excess methanol in each phase is removed using a flash evaporation process or by distillation. Methanol is removed and the mixture neutralised before glycerol and esters are separated. Methanol is recovered for reuse by distillation. It is important to ensure that no water accumulates in the recovered methanol stream.
6. Glycerol neutralisation	Glycerol containing catalyst and soaps is neutralised with acid and sent for storage as crude glycerol. Salt formed during this phase may be recovered and used for agricultural purposes. Water and methanol are removed to give 70–88 per cent pure glycerol (sold as crude glycerol) or glycerol is distilled to produce ≥99 per cent pure glycerol (sold to cosmetic and pharmaceutical markets).
7. Methyl ester wash	Once separated from glycerol, the biodiesel is purified by washing with warm water to remove residual catalyst or soaps. Biodiesel is dried and sent for storage.
8. Product quality	The final biodiesel is analysed to ensure it meets any required specifications.

Figure B.1: Simplified process flow diagram

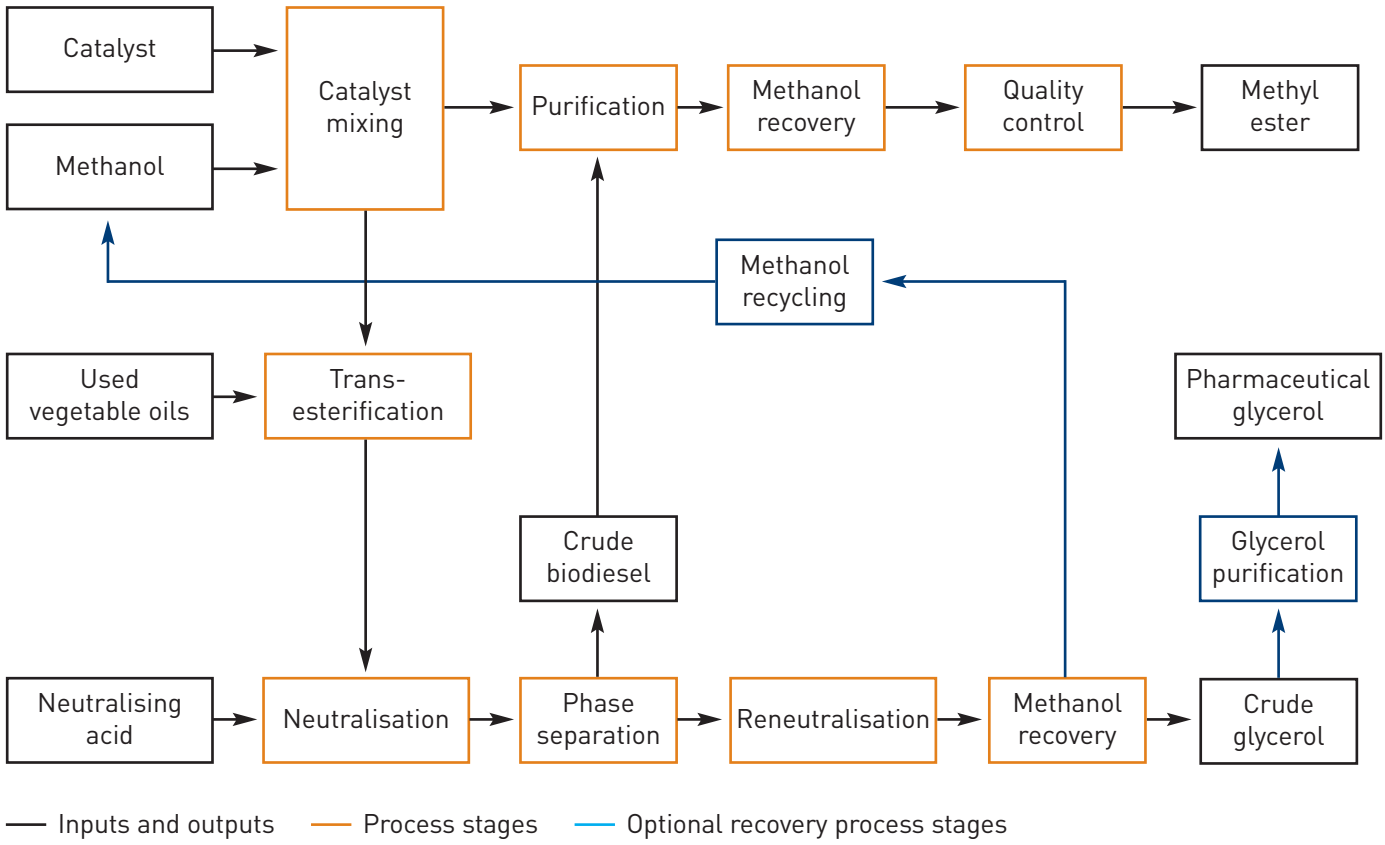


Table B.2: Quality controls

Key element	Summary description
Raw material supply	Keep contracts of supply for auditing purposes.
Raw material storage[1]	Provision must be made for product storage, including storage location and conditions.
Process control	A process control system supported by accurate record-keeping and document control procedures must be in operation throughout the biodiesel manufacturing process. This must include details of heating control, pump control, level control, wash control and safe shut-down. Biodiesel producers must have a clearly defined quality policy. Biodiesel producers must undertake a risk assessment. Biodiesel producers must have clearly defined Standard Operating Procedures (SOPs) covering quality management aspects of the biodiesel manufacturing process. All staff must be appropriately trained and supervised. The process control system must be reviewed on an ongoing basis whenever any changes to the process have taken place and updated as appropriate.
Biodiesel sampling and analysis	Sampling and analysis procedures must be defined. Product quality testing results must be reported annually. Detailed records of sampling must be kept.
Final product storage[2]	Provision must be made for final product storage, including storage location and conditions.
Final product sale	Keep contracts of sale for auditing purposes.

1 Details and guidance documents can be found at: www http://www.environment-agency.gov.uk/business/topics/oil or for Northern Ireland at: http://www.doeni.gov.uk/index/protect_the_environment/water/oil_storage.htm

2 Further best practice guidance for the storage of biodiesel on any premises for onwards distribution of oil is available in the *Institute of Petroleum – Environmental Guidelines for Petroleum Distribution Installations*. ISBN 085 293 41662.

Appendix C: Standards for determining the quality of quality biodiesel

1. *BS EN 14214:2003. Automotive fuels. Fatty acid methyl esters (FAME) for diesel engines. Requirements and test methods*. British Standards Institution (BSI), 2003.
2. *BS EN 14213:2003. Heating fuels Fatty acid methyl esters (FAME). Requirements and test methods*. British Standards Institution (BSI), 2003.

Any changes to BS EN 14214 or BS EN 14213 (and the standards within them) should take immediate and automatic effect.

Appendix D Further information and good practice

Table D.1: Further information and good practice

Hazardous event and potential pathway	Good practice guide[1]
Noise	Follow Local Authority Planning permission controls.
Odour	Waste acceptance procedures – exclusion of odour producing wastes. Monitoring of aerial emissions for odour; and action plan requiring control of odorous aerial emissions.
Spillage	Spill kit/absorbent material to be available for use. Spill procedures to be followed.
Contaminated run-off/release of contaminated site drainage to the environment	Activity will be secure. Drums to be contained within a contained impermeable pavement or similar with controlled/sealed drainage. Control and remediation of spillages of waste.
Wind borne litter	Waste input controls. Litter control measures and remedial action to retrieve fugitive.
Airborne dust, fibres, powders or particulates	Waste acceptance procedures – exclusion of dusts and powders.
Vermin	Routine monitoring and control.
Combustion potential of biodiesel	Flash point of biodiesel compliant with BS EN 14214 is at least 120°C. Store in areas with impermeable pavement and sealed drainage. Follow oil treatment standards. Fire prohibition and measures to prevent run-off occurring.
Biodiesel storage	Ensure compliance with applicable Oil Storage Regulations. Retain records of sale to demonstrate end use of material.
Methanol storage	Ensure compliance with ATEX Directives on explosive atmospheres.
Methanol evaporation	Following applicable H&S Regulations. Ensure compliance with ATEX Directives on explosive atmospheres[2].
Methanol disposal	Transfer to suitably licensed facility. Full/partial recovery and transfer for reuse where feasible.
Glycerol disposal	Transfer to suitably licensed facility. Full/partial recovery and transfer for reuse where feasible.

1 Producers must ensure that where a waste authorisation is in place conditions are complied with and that these take precedence over the good practice referred to.

2 Directive 94/9/EC (ATEX 100a) "on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres" and Directive 99/92/EC (ATEX 118a or ATEX 137) "minimum requirements for improving the safety and health protection of workers potentially at risk from explosive atmospheres" implemented by Statutory Instrument 2002 No. 2776 *The Dangerous Substances and Explosive Atmospheres Regulations 2002*.

Appendix E Useful information sources

The following is a list of useful information sources and websites. It is not exhaustive and the author cannot take responsibility for the content and availability of the websites.

1. *Biofuels and other fuel substitutes*. HM Revenue and Customs Notice 179E, October 2005. Available from: www.hmrc.gov.uk [Go to: Excise & Other > Information & Guides > Oils > Biodiesel & Bioblend; Accessed 2 January 2007]
2. Defra guidance on the Pollution Prevention and Control (PPC) Regulations. Available from: www.defra.gov.uk/Environment/ppc/policy.htm [Accessed 2 January 2007].
3. *Environmental Protection Act 1990 Section 34. Waste Management. The Duty of Care. A Code of Practice*, HMSO, March 1996. Available from: www.defra.gov.uk/environment/waste/legislation/duty.htm [Accessed 2 January 2007].
4. *Criteria for Determining Whether an Installation can be Classified as 'Low Impact'*, Environment Agency IPPC Regulatory Guidance Series No. 7 (Version 3, June 2006). Available from: www.environment-agency.gov.uk/business/444217/444663/298441/572322/ [Accessed 2 January 2007].
5. *Environment Agency Guidance on Low Risk Waste Activities* (Version 15), October 2006. Available from: www.environment-agency.gov.uk/commondata/acrobat/app_a_v15_1098102.pdf [Accessed 2 January 2007].
6. *Biodiesel Production and Quality*, National Biodiesel Board, March 2002. Available from: www.biodiesel.org/pdf_files/fuelfactsheets/prod_quality.pdf [Accessed 2 January 2007].
7. Customs and Excise. Biodiesel and Bioblend Regulations 2002, SI 2002 No. 1928. Available from: www.opsi.gov.uk/SI/si2002/20021928.htm [Accessed 2 January 2007].
8. Northern Ireland Environment Agency(NIEA) website: http://www.ni-environment.gov.uk/waste-home.htm
9. Department of the Environment (Northern Ireland) Guidance on Oil Storage http://www.doeni.gov.uk/index/protect_the_environment/water/oil_storage.htm

Waste & Resources Action Programme

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