

Waste Protocols Project

Waste Vegetable Oil

A technical report on the manufacture
of products from waste vegetable oil.

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Executive summary

Background

The aim of the Business Resource Efficiency and Waste (BREW) Waste Protocols Project is to provide guidance to business on various waste streams that will:

- define the point of full recovery from a waste back into a product or material that can be reused by the business or industry, or sold into other markets; or
- define when wastes are recovered to a state where the Environment Agency considers their use is acceptable in accordance with its low risk regulatory principles; or
- confirm what legal obligations remain to control the reuse of the treated waste material.

Waste food oil is one of the waste streams addressed by the BREW Waste Protocols Project. A Technical Advisory Group (TAG) was set up to bring together representatives from the Environment Agency, the Waste & Resources Action Programme (WRAP) and industry. Due to time constraints and the scale of the project, the TAG decided to limit its study initially to waste vegetable oil (WVO).

The TAG's role is to produce a technical report, which will assist in achieving one of the aims of the Waste Protocols Project mentioned above.

Methodology

The TAG set out to:

- identify the major markets and therefore appropriate end uses for WVO;
- identify the current legislative framework;
- obtain and review analytical data on the quality of material produced to market specifications;
- propose revisions to terminology so that it is consistent across markets;
- identify and subjectively quantify the relative risk to human health and the environment from the use of WVO in the markets identified; and
- suggest the way forward for each of the major markets so that certain end uses may be regarded as fully recovered when strictly defined conditions are met.

Findings

The TAG focused on the production of biodiesel from WVO. Its findings are summarised below.

- Although there are physical methods of blending vegetable oil with fuel, they do not provide confidence in the quality of the product. Therefore, the assessment of WVO looked mainly at the production of biodiesel through chemical modification.
- There are different definitions of 'biodiesel'. The TAG considered those within HM Revenue and Customs (HMRC) Notice 179E and the quality specification, BS EN 14214, to establish whether the chemical modification of WVO to create biodiesel could be shown to meet a quality standard.
- HMRC Notice 179E gives a definition of biodiesel eligible for reduced fuel duty. But this involved only two key criteria and was not considered further.
- BS EN 14214 specifies detailed quality parameters that must be achieved and specifies associated test methods that must be used. Although all the parameters laid down by BS EN 14214 can be met, the methyl ester content parameter can only be met when measured using a different test method than the one specified. The methyl ester content can be met if the test method described in another standard, BS EN 14078, is used. In addition, there may be difficulties in achieving the cold filter plugging point (CFPP) specification. However, this issue can be overcome through the use of additives or by using the biodiesel in a blend with regular diesel.
- The environmental risk associated with biodiesel produced from WVO to BS EN 14214 is no greater than that from biodiesel produced from virgin oil. The risks of the hazards identified by the TAG are considered low if appropriate mitigation measures are adopted.

Recommendations

The TAG recommends the production of a Quality Protocol for the production and use of biodiesel from WVO, which specifies that:

- the biodiesel produced should meet the criteria specified in BS EN 14214;
- testing should be carried out in accordance with the methods specified in BS EN 14214, with the exception of methyl ester content, which should be tested using BS EN 14078;
- the producer informs the customer of the CFPP;
- testing frequency should be at least annually;
- records of test results should be held on site; and
- the quality controls and mitigation measures outlined in this technical report should be adopted.

This Quality Protocol should be reviewed if there are any changes to processing technology or material use. Otherwise the TAG recommends that the Quality Protocol be reviewed every two years.

In addition, the TAG recommends that industry and the Environment Agency evaluate the residues from biodiesel production (i.e. glycerol and methanol) with a view to establishing how they can be processed to a level such that they are no longer subject to waste regulatory controls. The results of this further work could be incorporated into the Quality Protocol at a later date.

1. Introduction

- 1.1 The Waste Protocols Project is a joint Environment Agency and Waste & Resources Action Programme (WRAP) initiative, funded by the Department for Environment Food and Rural Affairs (Defra) Business Resource Efficiency and Waste (BREW) Programme.
- 1.2 Uncertainty over the point at which 'waste' is fully recovered and ceases to be waste has meant that some materials have continued to be controlled under the EU Waste Framework Directive and, in some cases, disposed of to landfill. To provide more certainty, to stop materials being landfilled unnecessarily and to increase the use of waste as a resource, we have set up the Waste Protocols Project.
- 1.3 Depending on the circumstances of the sector concerned, the project seeks to achieve one or more of the following outcomes:
- to produce a Quality Protocol defining the point at which waste may become a non-waste product or material that can be either reused by business or industry, or supplied into other markets, enabling recovered products to be used without the need for waste regulation controls;
 - to produce a statement, in accordance with the Environment Agency's low risk regulatory policy¹, indicating that the use of the waste is considered to be such low risk that it would not normally be in the public interest to take enforcement action for failure to obtain a waste management licence (WML);
 - to produce a statement that confirms to the business community what legal obligations they must comply with to use the treated waste material.
- 1.4 Waste food oil is one of the waste streams addressed by the BREW Waste Protocols Project. A Technical Advisory Group (TAG) was set up to bring together representatives from the Environment Agency, WRAP and industry (see Appendix A for members' details). Due to time constraints and the scale of the project, the TAG decided to limit its study initially to waste vegetable oil (WVO).
- 1.5 This technical report looks mainly at the production of biodiesel from WVO via chemical modification. It does not cover physical processing of WVO. This involves filtration and screening prior to further processing, as well as blending of vegetable oil with mineral oil. The TAG considers that physical processing for the production of 'biofuel'² cannot meet a recognised standard and its quality cannot be assured.
- 1.6 The TAG did not consider the standards adopted by HM Revenue & Customs (HMRC) for the regulation of biodiesel from a fuel duty point of view. The purpose of this report is to decide whether, and at which point, the waste regulation controls can fall away. The HMRC standard was not considered to be suitable for this purpose.
- 1.7 In light of case law, the Environment Agency is obliged to consider that waste-derived biodiesel has not ceased to be waste until it has been burnt in an engine for energy recovery. However, the Environment Agency has set out a low risk position; it does not require environmental authorisations for the storage and use of waste-derived biodiesel in an engine as it does not believe this to be in the public interest. The purpose of this technical report is to review this position by:
- taking into account the criteria outlined in paragraph 1.5; and
 - evaluating the associated risks.
- 1.8 The objectives of this report are to:
- describe the progress of the TAG on this topic;
 - set out its findings; and
 - provide recommendations to the Project Board and the Environment Agency on the next steps.

1 See <http://www.environment-agency.gov.uk/subjects/waste/1416460/1334460/1098094/>

2 Appendix F contains definitions of terms such as biofuel.

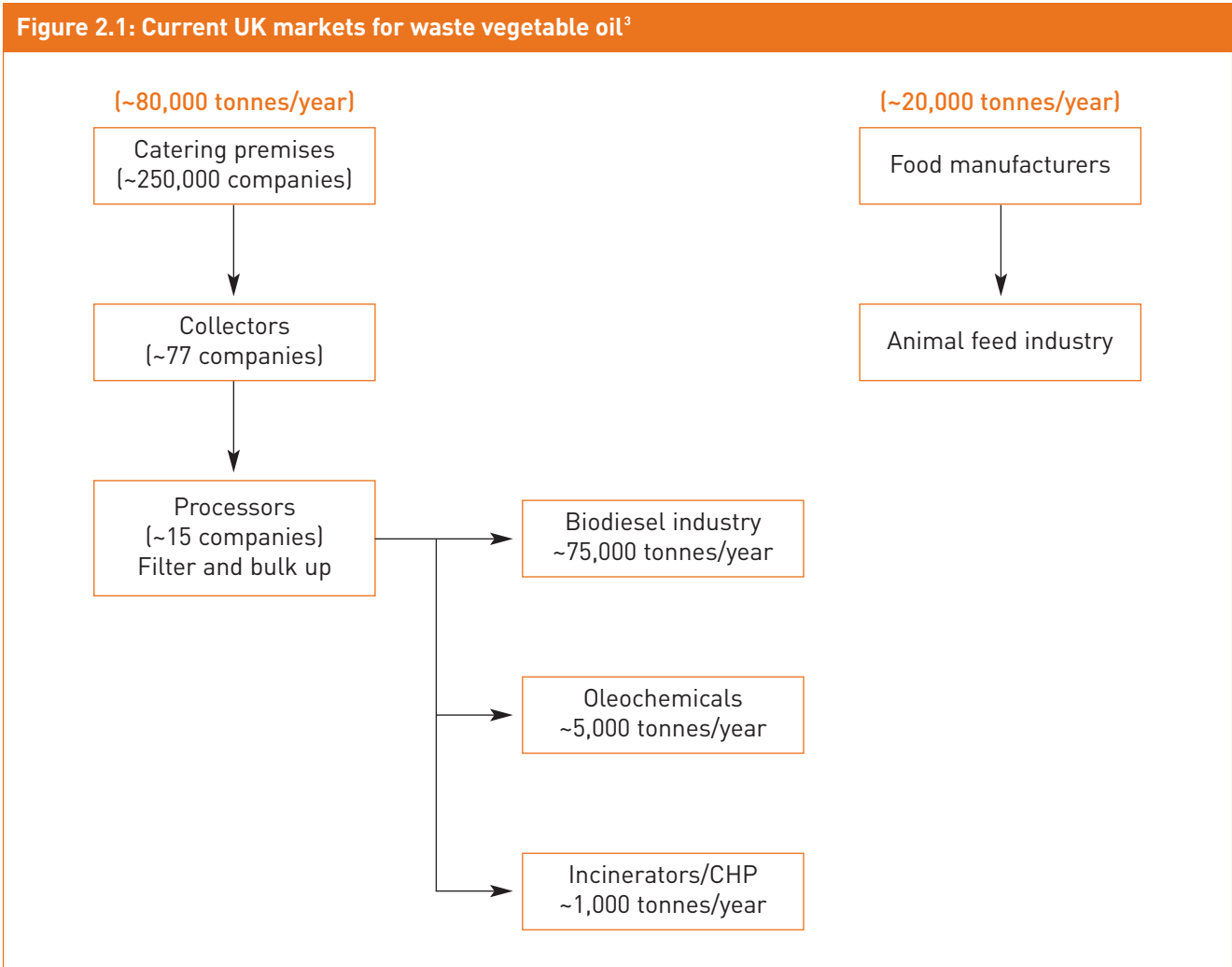
- 1.9 The TAG set out to:
- identify the major markets and therefore appropriate end uses for waste vegetable oil;
 - identify the current legislative framework;
 - obtain and review analytical data on the quality of material produced to market specifications;
 - propose revisions to terminology so that it is consistent across markets;
 - identify and subjectively quantify the relative risk to human health and the environment from the use of WVO in the markets identified; and
 - suggest the way forward for each of the major markets so that certain end uses may be regarded as fully recovered when strictly defined conditions are met.
- 1.10 The terms of reference for the TAG are given in Appendix B.
- 1.11 Appendix G contains details of other useful information and websites.

2. Key markets for waste vegetable oil

2.1 The main markets for WVO were identified as:

- animal feed; and
- biodiesel production.

2.2 Figure 2.1 sets out the estimated annual quantities of WVO going into the different end markets. See Appendix C for a detailed market analysis.



3 Source: TAG and Defra case study (<http://www.defra.gov.uk/farm/policy/sustain/procurement/casestudies/recyclingoil.htm>)
 Some raw WVO is exported to the Netherlands.
 Some collectors also process waste oil.
 CHP = combined heat and power

3. Legislative position

3.1 Collection and storage of waste vegetable oil

3.1.1 Apart from the producers of WVO, only a registered waste carrier⁴ should collect WVO.

3.1.2 The storage of WVOs is regulated under:

- Environmental Protection Act 1990;
- relevant Oil Storage Regulations for different parts of the UK;⁵ and
- Waste Management Licensing Regulations.⁶

3.1.3 In England and Wales, the Environment Agency considers the secure storage of up to 5,000 litres of WVO, which is destined for recovery, as a low risk activity.⁷ This means that the holder of the oil is not expected to obtain a WML.

3.2 Animal feed

3.2.1 A derogation under the Animal By-Product Regulations (ABPR) permits WVO from manufacturing sources to be used in animal feed. The industry applies stringent quality controls to the use of WVO in this market. Therefore the TAG agreed there was no merit in considering this market further in this report.

3.3 Biodiesel production

3.3.1 Table 3.1 summarises the environmental legislation relating to WVO and biodiesel production from waste. Differences between England, Scotland, Wales and Northern Ireland are noted.

3.3.2 Sites processing WVOs to produce biodiesel need a WML unless they treat less than 250 litres of WVO at any time (considered a low risk activity by the Environment Agency).

3.3.3 The Environment Agency considers the secure storage of up to 5,000 litres of waste-derived biodiesel as a low risk activity. This means that the holder of the oil is not expected to obtain a WML.

3.3.4 The production of biodiesel for commercial purposes by trans-esterification is a chemical activity regulated under the Pollution Prevention and Control (PPC) Regulations and requires a PPC permit.⁸ However, sites producing very low quantities of biodiesel (i.e. less than 5,000 litres per year) are considered small-scale commercial producers and are exempt from PPC requirements.⁹

3.3.5 Small to medium-scale operators requiring a PPC permit may qualify for 'low impact' status.¹⁰ The reduced fees and charges associated with this status reflect the fact that the environmental impact of such installations is low.

3.3.6 Sites operating under a PPC permit do not require a WML, as all aspects of waste storage and management are already regulated through the PPC permit.

3.3.7 Where a PPC permit is not required but biodiesel production involves the treatment of waste, statutory waste management controls will still apply.

3.3.8 In larger facilities where a PPC permit is held, regulatory controls may apply to other aspects of the manufacturing process. These controls may not be directly related to the waste material accepted at the facility, but may be required as a result of the processing activity (e.g. controls on releases to air).

⁴ See <http://www.netregs.gov.uk/netregs/275207/276315>

⁵ See <http://www.netregs.gov.uk/netregs/275207/275441/>

⁶ See <http://www.environment-agency.gov.uk/subjects/waste/1416460/>

⁷ See http://www.environment-agency.gov.uk/commondata/acrobat/appendixa_june07_1762944.pdf

⁸ See <http://www.environment-agency.gov.uk/business/1745440/1745496/298441>

⁹ See <http://www.environment-agency.gov.uk/yourenv/857406/1173616/>

¹⁰ *Criteria for Determining Whether an Installation can be Classified as 'Low Impact'*, IPPC Regulatory Guidance Series No. 7, Version 3, Environment Agency, June 2006.

3.3.9 In addition to environmental regulations, there are legal requirements placed upon producers of biodiesel in relation to tax. HMRC requires producers of more than 2,500 litres of biodiesel to:

- register their premises within a prescribed time limit in respect of their first chargeable use of biodiesel on those premises;
- issue delivery notes containing specified information in respect of certain consignments of biodiesel sent out from their premises;
- pay biodiesel duty and furnish monthly returns to the Commissioners within a prescribed time limit; and
- maintain a biodiesel record at their premises.

Table 3.1 Summary of legislative controls on waste vegetable oil in relation to biodiesel production¹¹

Use	Current legislative control	Current regulatory approach
All sites (unless otherwise specified below)	<p>WVO delivered for processing is considered to be waste, so the Duty of Care Regulations¹² apply.</p> <p>Storage of oil in containers with a capacity >200 litres are subject to the Control of Pollution (Oil Storage Regulations) 2001¹³ in England and the Water Environment (Oil Storage Regulations) 2006¹⁴ in Scotland. No similar regulations apply in Northern Ireland or Wales.</p> <p>Sites processing WVOs to produce biodiesel will need a WML.</p>	<p>Sites treating <250 litres of WVO at any time are considered a low risk activity by the Environment Agency¹⁵ and do not require a WML. Otherwise normal regulatory controls apply.</p> <p>No such low risk position applies in Scotland or Northern Ireland, where normal regulatory controls apply.</p>
Small-scale (<5,000 litres of WVO stored on-site at any one time)	<p>WVO delivered for processing is considered to be waste, so the Duty of Care Regulations¹² apply.</p> <p>Storage of oil in containers with a capacity >200 litres are subject to the Control of Pollution (Oil Storage Regulations) 2001¹³ in England and the Water Environment (Oil Storage Regulations) 2006¹⁴ in Scotland. No similar regulations apply in Northern Ireland or Wales.</p> <p>Sites processing WVOs to produce biodiesel will need a WML.</p>	<p>The site receiving the material is covered by the Environment Agency's low risk position statement, i.e. the holders of the oil do not need to register an exemption, but must comply with the requirements of the Waste Management Licensing Regulations.</p> <p>No such low risk position applies in Scotland or Northern Ireland.</p>

continued overleaf

¹¹ As of 1 January 2007.

¹² See <http://www.defra.gov.uk/environment/waste/legislation/duty.htm>

¹³ SI 2001 No. 2954; <http://www.opsi.gov.uk/SI/si2001/20012954.htm>

¹⁴ Scottish SI 2006 No. 133; <http://www.opsi.gov.uk/legislation/scotland/ssi2006/20060133.htm>

¹⁵ Appendix A of *Environment Agency Guidance on Low Risk Waste Activities* (http://www.environment-agency.gov.uk/commondata/acrobat/app_a_v15_1098102.pdf) states: Reference LRW 3:

- The secure storage of up to 5,000 litres of waste cooking oil (purified fat of plant or animal origin) destined for recovery.
- The secure storage of waste derived biodiesel (a fuel derived from the treatment of waste cooking oil or animal fat).
- The recovery of waste derived biodiesel as a fuel in motor vehicles.
- The treatment of up to 250 litres at anytime of waste cooking oil to produce biodiesel.

Table 3.1 Summary of legislative controls on waste vegetable oil in relation to biodiesel production¹¹ cont.

Use	Current legislative control	Current regulatory approach
Large-scale (>5,000 litres of WVO stored on-site at any one time)	Sites processing WVOs to produce biodiesel need a WML unless they already hold a PPC permit.	Normal regulatory controls apply.
Non-PPC regulated sites (<5,000 litres annual production in England and Wales; no threshold defined in Scotland)	Legislative controls depend on the quantity of WVO stored on-site at any one time (see above).	Normal regulatory controls apply.
PPC regulated sites (>5,000 litres annual production in England and Wales; no threshold defined in Scotland) PPC Regulations apply.	No additional requirements for a WML.	Normal regulatory controls apply.

4. Material composition and quality standards

- 4.1 The scale of the operations and the type of equipment used may affect the standards and specifications that can be met through processing.
- 4.2 The European Standards Organisation, CEN, finalised BS EN 14214 – the standard for biodiesel – in 2003. This standard was derived from the characteristics of biodiesel produced exclusively from virgin rape oil and came into force in the UK as BS EN 14214:2003¹⁶. The detailed specification for BS EN 14214 is given in Appendix D.
- 4.3 Most of the parameters specified in BS EN 14214 can be achieved through the chemical modification of WVO. However, difficulties may be experienced in two areas. These are:
- demonstrating that the processed vegetable oil meets the methyl ester content specified in BS EN 14214 when tested using the method specified in the standard; and
 - achieving the cold filter plugging point (CFPP). This provides an indication of the low temperature operability of fuels with/without flow improver additives when cooled below the cloud point (CP) temperature. Not meeting the CFPP causes engine problems when the biodiesel is used at ambient air temperatures below -20°C.
- 4.4 The TAG advised that the methyl ester content for biodiesel produced from waste cooking oil could be met if the test method detailed in BS EN 14078:2003¹⁷ is used instead of the one specified in BS EN 14214. The German Biofuels Association (Verband der Deutschen Biokraftstoffindustrie; VDB) has recognised this as a problem across Europe and CEN is understood to be looking into modifying BS EN 14214 to make it applicable to biodiesel manufactured from WVO.
- 4.5 The TAG advised that not meeting the CFPP specified in BS EN 14214 will not normally cause a problem in the UK due to the relatively mild average winter temperatures.
- 4.6 If the CFPP standard specified in BS EN 14214 cannot be achieved, the producer should advise customers of the actual CFPP, thus enabling them to make an informed decision about how to use the fuel (e.g. as a blend with regular diesel). The TAG did not consider that this issue would affect certainty of use of the biofuel produced from WVO.
- 4.7 By meeting BS EN 14214, the biodiesel produced meets both the sulphur and methyl ester content specified by HMRC Notice 179E¹⁸ and is recognised as qualifying for reduced fuel duty. The TAG believes that this gives confidence in the quality of material making it acceptable to the market and thereby assuring certainty of use.
- 4.8 Section 5 provides a basic process description that should ensure that the biodiesel produced from WVO meets the requirements of BS EN 14214.

16 BS EN 14214:2003. *Automotive fuels. Fatty acid methyl esters (FAME) for diesel engines. Requirements and test methods.*

17 BS EN 14078:2003. *Liquid petroleum products. Determination of fatty acid methyl esters (FAME) in middle distillates. Infrared spectroscopy method.*

18 *Biofuels and other fuel substitutes.* HM Revenue and Customs Notice 179E, October 2005.

5. Process description

- 5.1 Chemical production of biodiesel from WVO involves substitution of glycerol present in the oil by methanol using a lye catalyst such as sodium or potassium hydroxide.
- 5.2 Almost all biodiesel is produced using base-catalysed trans-esterification. This is the most economical process requiring only low temperatures and pressures, and achieving a conversion yield of 98 per cent.
- 5.3 The WVO is heated and filtered before methanol is added, together with a small amount of lye catalyst (e.g. sodium hydroxide). The mixture separates in a settling tank and the glycerol residue is removed. The product that remains is a methyl ester.
- 5.4 Glycerol and methanol residues are an unavoidable part of the process. The TAG felt that these could be fully recovered and reused. However, the TAG recommended that further work is needed to establish how they can be processed to a point such that they are no longer subject to waste regulatory controls.
- 5.5 Appendix E contains:
- a summary table of the main production steps;
 - an example of a simplified process flow diagram; and
 - a summary table of quality controls that allow the production of a biodiesel of BS EN 14214 quality.

6. Risk assessment

- 6.1 Table 6.1 presents the findings of a detailed risk assessment of the production and use of biodiesel from WVO undertaken by the TAG.
- 6.2 Based on this risk assessment the TAG considers that, provided appropriate mitigation is taken, the risks of the identified hazards are low.
- 6.3 As appropriate, pollution prevention guidance notes¹⁹ should be followed.

Table 6.1 Detailed risk assessment of the production and use of biodiesel from waste vegetable oil

Hazardous event and potential pathway	Receptor(s)	Risk before mitigation			Mitigation measures required	Risk before mitigation		
		High	Medium	Low		High	Medium	Low
Noise	People		✓		Follow local authority planning permission controls.			✓
Odour	People		✓		Waste acceptance procedures – exclude odour-producing wastes. Monitor aerial emissions for odour. Follow action plan requiring control of odorous aerial emissions.			✓
Spillage	Human Environment		✓		Make spill kit/absorbent material available. Develop and follow spill procedures.			✓
Contaminated run-off/release of contaminated site drainage to the environment	Properties Ecosystems Surface water Groundwater		✓		Activity must be secure. Ensure drums are within a contained impermeable pavement or similar with controlled/sealed drainage. Control and clean-up spillages of waste.			✓
Wind-borne litter	People Properties Ecosystems			✓	Implement waste input controls. Put in place litter control measures and take action to retrieve any lost materials.			✓
Air-borne dust, fibres, powders or particulates	People Properties Ecosystems			✓	Waste acceptance procedures – exclude dusts and powders.			✓
Vermin	People Properties Ecosystems			✓	Undertake routine monitoring and control.			✓

continued overleaf

Table 6.1 Detailed risk assessment of the production and use of biodiesel from waste vegetable oil cont.

Hazardous event and potential pathway	Receptor(s)	Risk before mitigation			Mitigation measures required	Risk before mitigation		
		High	Medium	Low		High	Medium	Low
Combustion potential of biodiesel	People Properties Ecosystems Atmosphere Surface water Groundwater		✓		Flash point of biodiesel is around 101°C. Store in areas with impermeable pavement and sealed drainage. Follow oil treatment standards. Adopt fire prohibition and measures to prevent run-off.			✓
Biodiesel storage	People Properties Ecosystems		✓		Ensure compliance with applicable Oil Storage Regulations. Retain records of sale to demonstrate end use of material.			✓
Methanol storage	People Properties Ecosystems	✓			Ensure compliance with ATEX Directives on explosive atmospheres. ²⁰			✓
Methanol evaporation	People Properties Ecosystems	✓			Follow applicable health and safety regulations. Ensure compliance with ATEX Directives on explosive atmospheres. ²⁰			✓
Methanol disposal	People Properties Ecosystems		✓		Transfer to suitably licensed facility. Undertake full/partial recovery and transfer for reuse where feasible			✓
Glycerol disposal	People Properties Ecosystems		✓		Transfer to suitably licensed facility. Undertake full/partial recovery and transfer for reuse where feasible. ²¹			✓

20 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. 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. See <http://ec.europa.eu/enterprise/atex/indexinfor.htm>

21 Glycerol produced in the trans-esterification process is currently classified as a waste product. It should be sent to another operator for recovery or, where this is not possible, be consigned as waste to an appropriately licensed or permitted waste facility. Current uses of glycerol include various applications in the pharmaceutical industry and as ingredient in food products. But because this market is oversupplied, alternative uses are being explored (e.g. use in an anaerobic digester for the production of biogas). Glycerol is highly stable under typical storage conditions. It is thought to biodegrade rapidly and not to bioaccumulate or adsorb to sediment or suspended particles. It is compatible with many other chemical materials, virtually non-toxic and non-irritating in its varied uses, and has no known negative environmental effects. Currently available ecotoxicity data suggest a very low toxicity to the range of species tested. However, these properties may not be applicable to glycerol that has not undergone full distillation to remove methanol and remaining fatty acid esters.

7. Findings and recommendations

- 7.1 The TAG limited its assessment of WVO to the production of biodiesel using chemical modification. A derogation under the ABPR permits WVO from manufacturing sources to be used in animal feed. In addition stringent quality control measures are put in place during the production of animal feed. Accordingly, the TAG concluded that there was no merit in considering this market further.
- 7.2 Although there are physical methods of blending WVO with fuel, they do not provide confidence in the quality of the product. Therefore, efforts were concentrated on the production of biodiesel using chemical modification.
- 7.3 There are different definitions of 'biodiesel'. The TAG considered those within HMRC Notice 179E and BS EN 14214 to establish whether the chemical modification of WVO to create biodiesel could be shown to meet a quality standard.
- 7.4 HMRC Notice 179E defines a biodiesel that is eligible for reduced fuel duty. It states that biodiesel must meet two specific quality parameters but does not specify testing methods or other parameters that may affect the quality of the fuel and therefore its certainty of use. This definition was not considered further.
- 7.5 Biodiesel manufactured from WVO via chemical modification can meet the quality specifications of BS EN 14214. However, it is necessary to use an alternative testing method for measuring methyl ester content (contained in BS EN 14078).
- 7.6 It was also found that there may be difficulties in achieving the CFPP specification. However, this problem can be overcome through the use of additives or by using the biodiesel in a blend with regular diesel.
- 7.7 A chemical modification process and recommended quality controls associated with the production of biodiesel from WVO are outlined in Section 5 and Appendix E. This should ensure the biodiesel meets the requirements of BS EN 14214.
- 7.8 The environmental risk associated with biodiesel produced from WVO to BS EN 14214 is no greater than that from biodiesel produced from virgin oil. If appropriate mitigation is taken (as detailed in Table 6.1), the risks of the identified hazards are considered to be low.
- 7.9 The TAG recommends the production of a Quality Protocol for the production and use of biodiesel from WVO which specifies that:
- the biodiesel produced should meet the criteria specified in BS EN 14214;
 - testing should be carried out in accordance with the methods specified in BS EN 14214, with the exception of methyl ester content, which should be tested using BS EN 14078;
 - the producer informs the customer of the CFPP;
 - testing frequency should be at least annually;
 - test records should be held on-site; and
 - the quality controls and mitigation measures outlined in Appendix E and Section 6 respectively should be adopted.
- 7.10 This Quality Protocol should be reviewed if there are any changes to processing technology or material use. Otherwise the TAG recommends that the Quality Protocol is reviewed every two years.
- 7.11 In addition, the TAG recommends that industry and the Environment Agency evaluate the residues from biodiesel production (i.e. glycerol and methanol) with a view to establishing how they can be processed to a level such that they are no longer subject to waste regulatory controls. The results of this further work could be incorporated into the Quality Protocol at a later date.

Appendix A Technical Advisory Group membership

Organisation	Representative	Type of member
BIP Oldbury Ltd	Ian Whyley	Attending
Entec UK	Mike Soldner	Attending
Environment Agency	Suzanne Laidlaw	Attending
	Michelle Steer	Attending
	Dominic O'Neill	Attending
	Amanda Barratt	Attending
	Clare McCallan	Corresponding
	Jonathan Hofton	Corresponding
	John Kirkham	Corresponding
Kathryn Harriss	Corresponding	
Environment Agency Wales	Rebecca Favager	Corresponding
Green Fuels Ltd	Colin Hygate	Attending
National Industrial Symbiosis Programme	Dr Adrian Murphy	Attending
PDM Group	Philip Simpson	Attending
	Joe Platt	Attending
Scottish Environment Protection Agency	Julie McKinney	Attending
Waste & Resources Action Programme	Sarah Clayton	Attending
Veolia Environmental Services	Raquel Carrasco	Attending

Appendix B TAG terms of reference

1. Mission statement

To produce a Quality Protocol, recognised by (and produced with the support of) industry, that defines when WVO has been reprocessed to such a level that it is considered to be fully recovered and no longer subject to the requirements of the regulatory waste regime.

If this is not achievable, the Quality Protocol will provide guidance to business that:

- defines when WVO is recovered to a state where the Environment Agency considers that its use is acceptable in accordance with its low risk regulatory principles; or
- confirms to the business community what legal obligations remain to control the reuse of the treated waste material.

2. Desired outcomes/outputs

The Technical Advisory Group (TAG) will produce a technical report that identifies and establishes:

- which end products the Quality Protocol should address;
- whether there are existing standards and specifications for each end product;
- whether the material can be collected and reprocessed to meet existing standards and specifications;
- where existing standards and specifications do not exist, to identify alternatives and/or to scope out a project for producing a new standard or specification;
- potential human health and environmental impacts, and mitigation methods;
- costs and benefits of the different end uses (with the aid of project economist); and
- a standard terminology.

3. Limitations

- In relation to the output of this TAG, the Environment Agency must be satisfied with the TAG's determination of the point at which WVO has been fully recovered.
- If the point of full recovery of WVO cannot be defined or agreed, the TAG will refer this matter to the Environment Agency for it to produce guidance on when waste regulatory controls apply.
- Where specifications and standards do not exist and are required, financial or time implications may delay the preparation of the technical report.

Appendix C Markets for waste vegetable oil

1. Markets for waste vegetable oil and waste vegetable oil biodiesel

The limited availability of WVO is the main constraint on the amount of WVO recycled, and the amount included in the production of biodiesel. Barriers that limit demand for biodiesel derived from WVO are not the main constraint.

WVO has been collected and processed for several end uses (including biodiesel production) for many decades.

Approximately 100,000 tonnes/year of WVO are currently collected in the UK (80,000 tonnes/year from catering and 20,000 tonnes/year from food factories/food production²²; Figure C.1). Total WVO arisings could be as much as 200,000 tonnes/year.²³ Much of this could be poured down the drain,²⁴ landfilled or utilised for very small-scale own use biodiesel production.

There is likely to be little increase in WVO arisings in the near future because:²⁵

- moves to better handling of cooking oils at retail premises will increase the 'service life' of oil and therefore reduce the amount disposed of;
- food factories are managing their oils better and moving to lower oil usage; and
- the move to higher quality and higher cost oils has created an economic driver for the food factories to minimise their oil consumption.

Currently a charge is made for the disposal of WVO. Previously it has been possible to sell this product. There is no evidence that the introduction of a charge for collection of WVO has resulted in a fall in volumes collected.

Domestic households are another source of WVO. This could potentially be collected by local authority kerbside collections. There are some initiatives to collect WVO from households, but they are relatively small scale.²⁶ Private companies are unlikely to take the initiative and collect from households as this would involve high transport costs with small amounts per collection.²⁷ There may be an incentive for local authorities to collect in the future in order to meet ever-demanding recycling targets. However, WVO from households is more likely to be contaminated and of relatively poor quality. Therefore, it may require considerable cleaning before it is suitable for converting into biodiesel.²⁸

There is little opportunity to divert WVO for biodiesel production from other end uses such as the oleochemical industry (it currently receives only small amounts). The premium on waste oil from food production to animal feed is likely to limit diversion from this route.

22 TAG

23 Domestic WVO annual arisings have been estimated at 3 kg per household (see <http://www.environmentcentre.org.uk/Projects/abstracts/vegeoilcollection.htm>). According to the Office for National Statistics, there were 24.2 million households in the UK in 2005. This gives a total of 72,600 tonnes/year of WVO from households.

24 Pouring used vegetable oil down the drain causes blockages and costs water companies millions of pounds in repairs each year.

25 TAG

26 Examples: Used cooking oil can be taken to a number of household waste recycling sites (managed by Veolia Environmental Services) in East Sussex and Brighton & Hove (source: News Release, 16 February 2006). In Scotland, seven out of 32 local authorities collect used cooking oil from civic amenity sites (source: National Best Practice Project Phase 1 UCO, September 2005; http://www.sepa.org.uk/pdf/nws/business/UCO_Phase1.pdf. A+B Oil Ltd thought the amount from households would be very low.

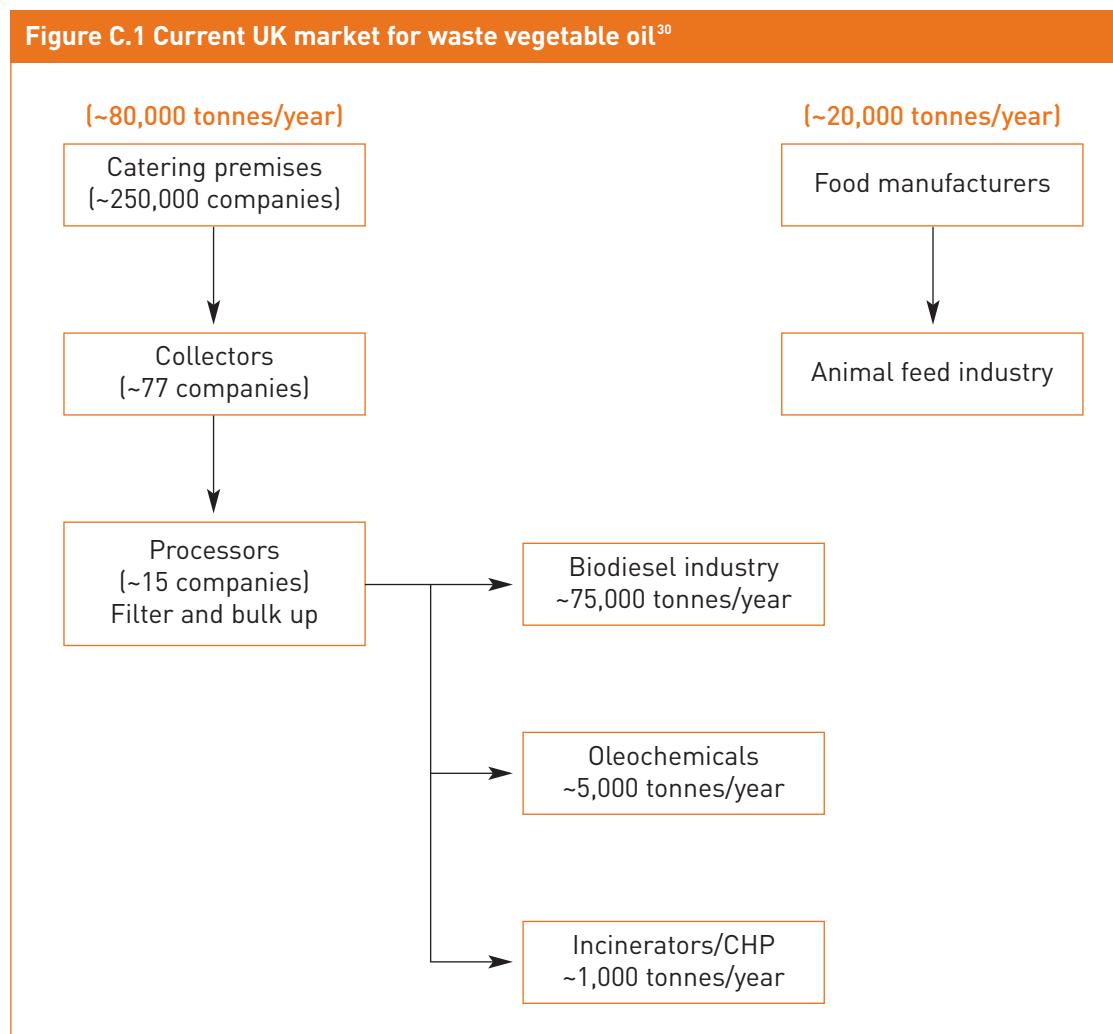
27 'The average quantity of used cooking oil potentially available for collection from domestic premises in Scotland is insufficient to justify separate household collection facilities provided by the local authority'. (source: National Best Practice Project Phase 1 UCO, September 2005; http://www.sepa.org.uk/pdf/nws/business/UCO_Phase1.pdf)

28 One possible option to increase supply is for biodiesel producers to blend low-quality WVO (mainly from households) with high-quality virgin oil. If blended biodiesel can be produced to an acceptable standard, then it may be worth collecting the lower quality waste oil.

Not all TAG members agreed that the amount of WVO collected would increase only by a small amount, if at all, in the future.²⁹

According to HMRC, 44,000 tonnes of biodiesel production, including biodiesel derived from virgin oil, was declared in the 12 months to August 2006. Given that around 80,000 tonnes/year of WVO is collected from catering sources for biodiesel production, these HMRC figures seem too low. A large proportion being exported could account for part of this discrepancy (20,000 tonnes/year was an estimate from a TAG member). Some of the discrepancy could be accounted for if some companies are underreporting the amount of biodiesel they are producing.

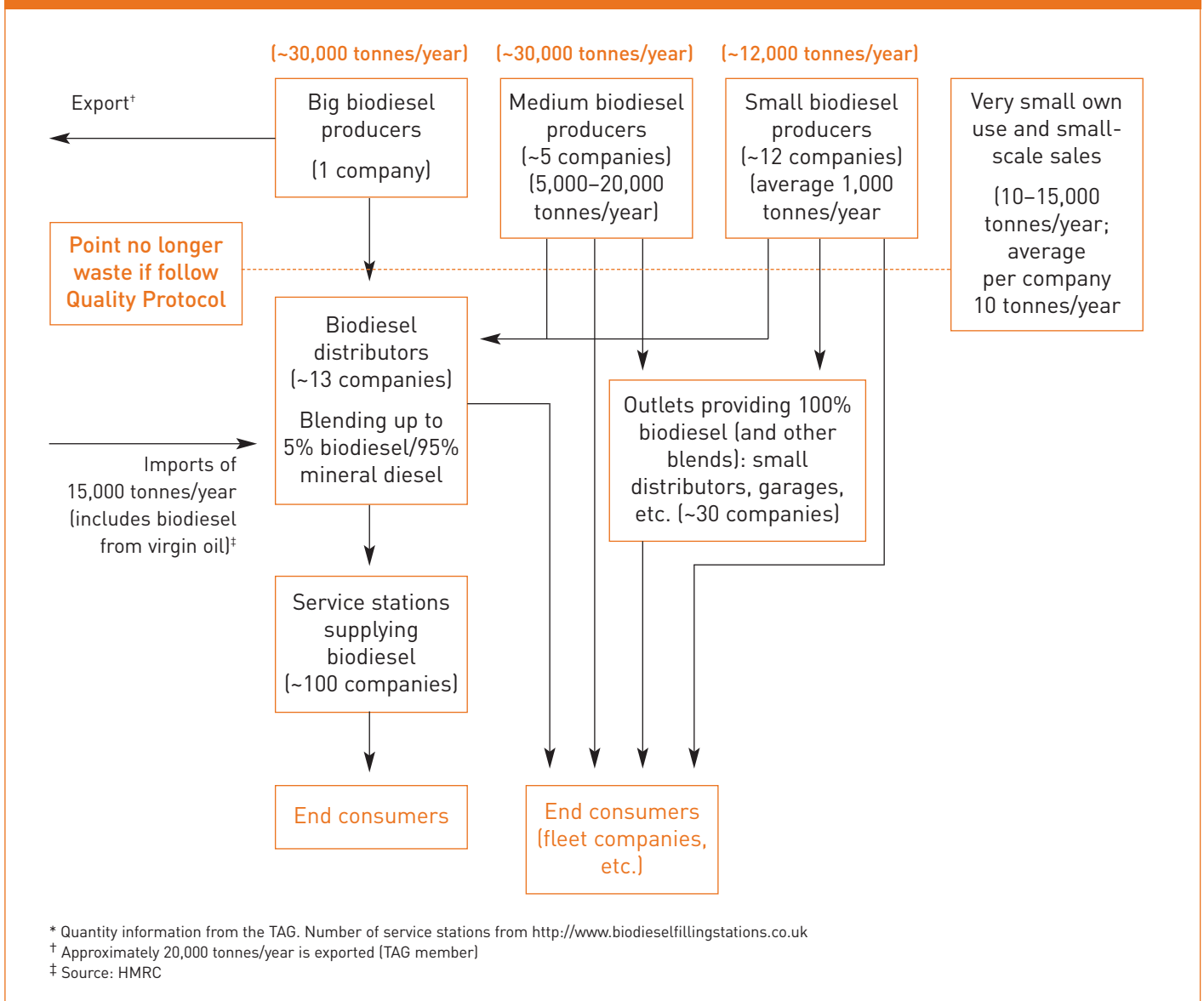
Figure C.1 Current UK market for waste vegetable oil³⁰



²⁹ One company represented on the TAG thought that volumes collected will increase. More and more of its big customers are requesting a waste cooking oil collection service with the aim of producing biodiesel. These customers plan to offset their carbon emissions by using the biodiesel in their distribution fleets. Another TAG member thought that the recovery of waste oil could eventually grow significantly (around 250,000 tonnes/year was suggested).

³⁰ Source: TAG and Defra case study (<http://www.defra.gov.uk/farm/policy/sustain/procurement/casestudies/recyclingoil.htm>)
Some raw WVO is exported to the Netherlands.
Some collectors also process waste oil.
CHP = combined heat and power

Figure C.2 Waste vegetable oil biodiesel production and distribution in UK*



Some biodiesel producers in the UK are also distributors. The majority of biodiesel from commercial biodiesel producers goes to fuel distributors. Figure C.2 shows the routes for WVO biodiesel production and distribution in the UK.

The majority of WVO biodiesel is blended. Either biodiesel producers or distributors blend the WVO biodiesel with mineral diesel³¹ (up to 5 per cent biodiesel/95 per cent mineral diesel), although distributors carry out most blending.

Blended biodiesel is at the specification laid down by BS EN 14214.³² This specification provides some guarantee of quality.

31 It is not economically viable to set up a business just to blend.

32 The EU introduced BS EN 14214 as the standard for biodiesel in Member States to ensure consistency in feedstock and standards. BS EN 14214:2003 *Automotive fuels. Fatty acid methyl esters (FAME) for diesel engines. Requirements and test methods.*

Although all the parameters laid down by BS EN 14214 can be met by WVO biodiesel, the methyl ester content can only be achieved using a different test method than the one specified. The methyl ester content can be met if the test method described in another standard, BS EN 14078³³, is used. In addition, there may be difficulties in achieving the CFPP specification. However, this issue can be overcome through the use of additives or by using the WVO biodiesel in a blend with regular diesel.³⁴

If BS EN 14214 biodiesel is used in a 5 per cent blend or below, then the resulting blend will achieve the standard for diesel, EN 590.³⁵ Biodiesel is used in higher blends and 100 per cent WVO biodiesel is available, though its use would currently invalidate many vehicle warranties. Despite the majority of diesel vehicles on the road running satisfactorily on 100 per cent biodiesel, only a handful of companies officially approve their vehicles for 100 per cent use.³⁶ The main rationale for blending is that the fuel can be used immediately in any diesel engine. A number of fleet companies buy neat biodiesel and blend themselves.

About 100 service stations in the UK offer 5 per cent biodiesel/95 per cent mineral diesel blends;³⁷ 100 per cent biodiesel is available at around 30 sources in the UK³⁸ (often the biodiesel is collected direct from the producer or from service stations).

Distributors supply either service stations or directly to wholesale end users such as fleet operators. The three big distributors handle at least 75 per cent of the market.³⁹ There are a number of smaller distributors.⁴⁰

The price of WVO biodiesel meeting BS EN 14214 is tracked to the price of both mineral diesel and virgin biodiesel. The competitive market means that producers of BS EN 14214 WVO biodiesel have little room to raise their prices to cover any increases in their costs.⁴¹

Not all biodiesel is produced to BS EN 14214. Smaller companies tend to produce to lower standards⁴² and some may even provide straight (i.e. 100 per cent) cooking oil. Such producers normally charge lower prices. All WVO biodiesel produced to BS EN 14214 sells at the same or very similar prices, but there is a big variation in the price of lower quality biodiesel, with the actual price depending on its quality.⁴³

There is a lack of awareness by some consumers of the existence of fuel standards, the quality of the biodiesel they are buying and the consequences of using lower quality biodiesel. Biodiesel that fails to reach BS EN 14214 can damage engines; fuel injector heads get blocked, reducing the life of the engine.⁴⁴

A significant recent development is the entry of numerous, often very small-scale, producers to the market. Many either collect WVO directly from restaurants or obtain it from collectors. They can buy kits or build their own using instructions on the internet. Production is normally for their own use and small-scale sales. Production may be up to 900 tonnes/year.⁴⁵

33 BS EN 14078:2003. *Liquid petroleum products. Determination of fatty acid methyl esters (FAME) in middle distillates. Infrared spectroscopy method.* British Standards Institution (BSI), 2003.

34 Technical Report for the Production and use of waste vegetable oil derived biodiesel (WVO biodiesel).

35 EN 590 describes the physical properties that all diesel fuel must meet if it is to be sold in the EU, Iceland, Norway or Switzerland. It allows the blending of up to 5 per cent biodiesel with mineral diesel.

36 <http://www.biodieselfillingstations.co.uk>

37 Department of Transport website (<http://www.dft.gov.uk/pgr/roads/environment/rtfo/notesbiodiesel>)

38 http://greenfuels.co.uk/dealers_uk.htm

39 The major oil companies do not currently distribute biodiesel.

40 Estimated 13 biodiesel distributors supply biodiesel derived from waste vegetable oil (source: TAG and <http://www.rixbiodiesel.co.uk>.)

41 TAG

42 The TAG had mixed views on this, with one member arguing that small producers are in close control of their production and have an incentive to produce to a high standard because they often use the biodiesel in their own cars.

43 Consultation with TAG members

44 TAG member

45 TAG member

A consequence is that it is becoming more difficult to obtain high quality WVO.⁴⁶ The price of WVO has risen sharply recently. The upper limit is currently 50 pence per litre.⁴⁷

Some of the new entrants may be producing to lower than BS EN 14214 and be unaware of how to achieve the standard.

The wide availability of sub-standard biodiesel (with its impact on engines) increases the risk of incidents producing bad publicity for the biodiesel market.⁴⁸

2. The Renewable Transport Fuel Obligations (RTFO)

The Renewable Transport Fuels Obligation (RTFO) could have a significant influence on the biodiesel market in general. The Government has agreed that:

- by 2008/09, at least 2.5 per cent of fuel consumed in the UK must be biofuels;
- by 2010/11, the figure must be at least 5 per cent.

If the RTFO has bite then this will result in a major expansion of the UK biodiesel market. However, the use of WVO for biodiesel is unlikely to increase significantly over the next decade in response to the RTFO due to the limited amount of WVO available. Most of the expansion would be satisfied by biodiesel derived from virgin oil.⁴⁹ Some virgin oil biodiesel producers have already invested heavily to achieve huge capacity in anticipation of the impact of the RTFO.⁵⁰

⁴⁶ A major oil collection company reported a fall in its share of the market because very small producers were capturing supplies of high-quality waste oil.

⁴⁷ Anonymous biodiesel producer.

⁴⁸ TAG

⁴⁹ TAG

⁵⁰ Contact with virgin oil biodiesel producers.

Appendix D Specification BS EN 14214:2003 for the production of biodiesel from virgin rape oil

Table D.1: Specification BS EN 14214:2003

Property	Unit	Limits		Test method
		Min	Max	
Ester content	% (m/m)	96.5	°	prEN 14103 ²
Density at 15°C	kg/m ³	860	900	EN ISO 3675EN/ISO 12185
Viscosity at 40°C ¹	mm ² /s	3.5	5.0	EN ISO 3104
Flash point	°C	above 101	–	ISO/CD 3679 ³
Sulphur content ⁹	mg/kg	–	10	°
Carbon residue (on 10% distillation residue) ⁵	% (m/m)	°	0.3	EN ISO 10370
Cetane number	°	51.0	°	EN ISO 5165
Sulphated ash content	% (m/m)	–	0.02	ISO 3987
Water content	mg/kg	–	500	EN ISO 12937
Total contamination ¹¹	mg/kg	°	24	EN 12662
Copper strip corrosion (3 h at 50°C)	Rating	Class 1	Class 1	EN ISO 2160
Thermal stability ⁷	°	°	°	°
Oxidation stability, 110°C	Hours	6	°	pr EN 14112 ⁸
Acid value	mg KOH/g	°	0.5	pr EN 14104
Iodine value	°	°	120	Pr EN 14111
Linolenic acid methyl ester	% (m/m)	°	12	pr EN 14103 ²
Polyunsaturated (≥ four double bonds) methyl esters ¹³	% (m/m)	°	1	°
Methanol content	% (m/m)	°	0.2	pr EN 14110 ⁹
Monoglyceride content	% (m/m)	°	0.8	pr EN 14105 ¹⁰
Diglyceride content	% (m/m)	°	0.2	pr EN 14105 ¹⁰
Triglyceride content	% (m/m)	°	0.2	pr EN 14105 ¹⁰
Free glycerol	% (m/m)	°	0.02	pr EN 14105 ¹⁰ /pr EN 14106
Total glycerol	% (m/m)	°	0.25	pr EN 14105 ¹⁰
Alkaline metals (Na + K) ¹¹	mg/kg	°	5	pr EN 14108/pr EN 14109
Phosphorus content	mg/kg	°	10	pr EN14107 ¹²

Notes

- 1 If CFPP is -20°C or lower, the viscosity measured at -20°C shall not exceed 48 mm²/second. In this case, EN ISO 3104 is applicable without the precision data.
- 2 CEN/TC 307 publication of NF T 60-703: 1997.
- 3 Apparatus equipped with a thermal detection device shall be used.
- 4 Suitable test methods to be proposed by CEN/TC 19.
- 5 ASTM D 1160 shall be used to obtain the 10 per cent distillation residue.
- 6 Pending development of a suitable method by CEN/TC 19, EN 12662 shall be used. The precision of EN 12662 is, however, poor for FAME products.
- 7 Suitable test method and limit to be proposed by CEN/TC 19.
- 8 CEN/TC 307 publication of ISO 6886 modified.
- 9 CEN/TC 307 publication of NF T 60-701 (procedure A) and DIN 51608 (procedure B).
- 10 CEN/TC 307 publication of NF T 60-704: 1997.
- 11 Extension of this to cover additional elements (e.g. Ca and Mg) to be considered.
- 12 CEN/TC 307 publication of NF T 60-705: 1997.
- 13 Suitable test method to be developed.

Appendix E Production process and quality control measures required for the production of biodiesel from waste vegetable oil

Table E.1: Production steps

Process stage	Description
1. Physical processing	WVO is screened and filtered to remove solid particles prior to further processing.
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	<p>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.</p> <p>Reaction mix is kept just above the boiling point of methanol to speed up the reaction. Reaction time must be specified.</p> <p>Amount of water and free fatty acids in incoming oil is monitored to prevent too high levels of either leading to soap formation and the separation of glycerol residue downstream.</p>
4. Separation	<p>Once reaction is complete, the reaction mixture is neutralised if necessary.</p> <p>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.</p> <p>Glycerol is drawn off from the bottom of the settling vessel.</p>
5. Methanol removal	<p>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.</p> <p>Methanol is recovered for reuse by distillation. It is important to ensure that no water accumulates in the recovered methanol stream.</p>
6. Glycerol neutralisation	<p>Glycerol containing catalyst and soaps is neutralised with acid and sent for storage as crude glycerol.</p> <p>Salt formed during this phase may be recovered and used for agricultural purposes.</p> <p>Water and methanol are removed to give 80–88 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).</p>
7. Methyl ester wash	<p>Once separated from glycerol, the biodiesel is purified by washing with warm water to remove residual catalyst or soaps.</p> <p>Biodiesel is dried and sent for storage.</p>
8. Product quality	The final biodiesel is analysed to ensure it meets any required specifications.

Figure E.1: Simplified process flow diagram

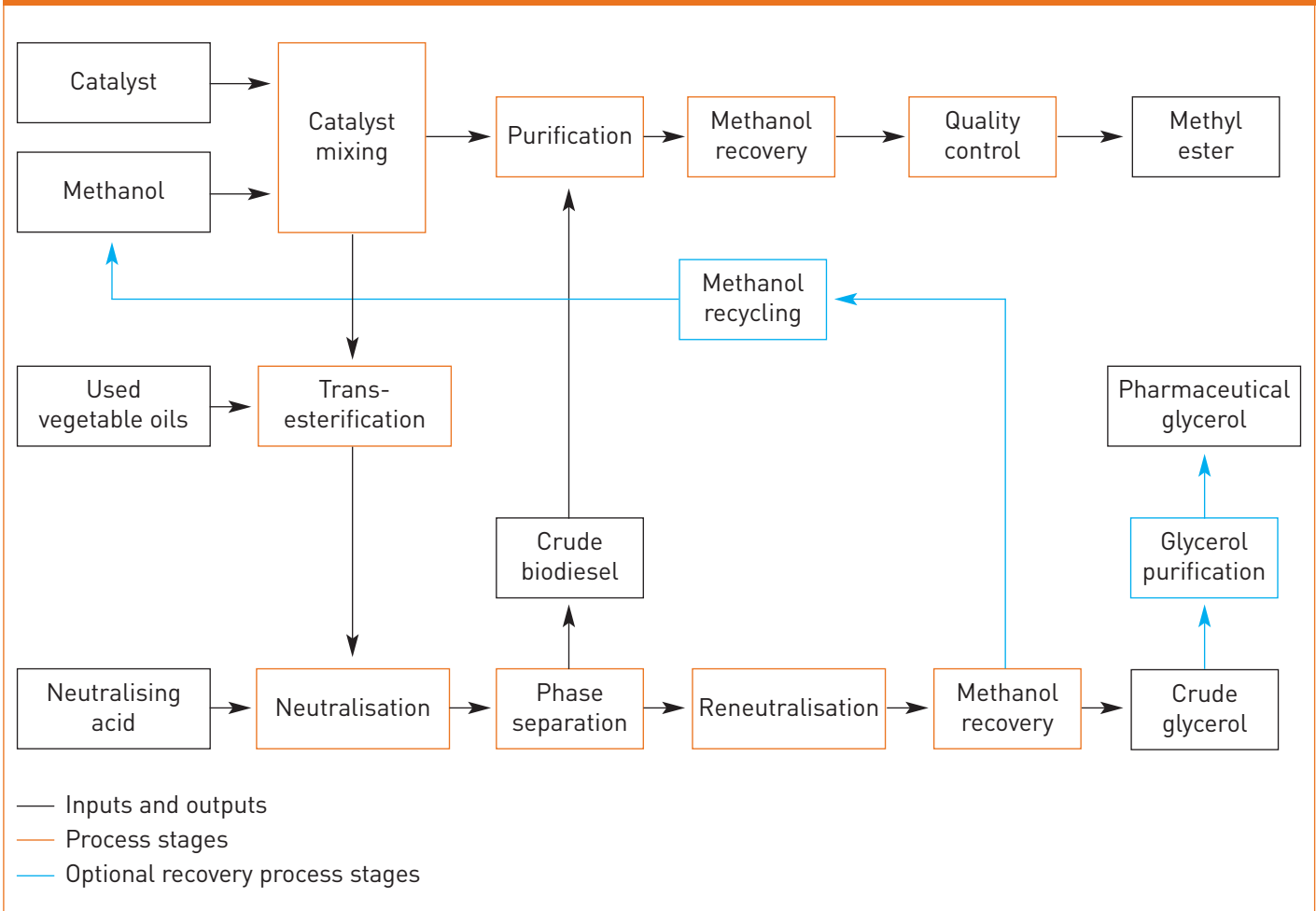


Table E.2: Quality controls

Key element	Summary description
Raw material supply	Keep contracts of supply for auditing purposes.
Raw material storage	Ensure compliance with Control of Pollution (Oil Storage) (England) Regulations 2001.*
Process control	<p>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.</p> <p>Biodiesel producers must have a clearly defined quality policy.</p> <p>Biodiesel producers must undertake Hazard and Operability (HAZOP) analysis.</p> <p>Biodiesel producers must have clearly defined Standard Operating Procedures (SOPs) covering quality management aspects of the biodiesel manufacturing process.</p> <p>All staff must be appropriately trained and supervised.</p> <p>The process control system must be reviewed on an ongoing basis whenever any changes to the process have taken place and updated as appropriate.</p>
Biodiesel sampling and analysis	<p>Sampling and analysis procedures must be defined.</p> <p>Product quality testing results must be reported annually.</p> <p>Detailed records of sampling must be kept.</p>
Final product storage	<p>Provision must be made for final product storage, including storage location and conditions.</p> <p>Ensure compliance with Control of Pollution (Oil Storage) (England) Regulations 2001.</p> <p>Ensure compliance with the Water Environment (Oil Storage Regulations) 2006 in Scotland.</p>
Final product sale	Keep contracts of sale for auditing purposes.

* Details and guidance documents can be found at: <http://www.environment-agency.gov.uk/business/444217/590750/590821/174658/>

Appendix F Definitions

Term	Description
Animal feed	Any foodstuff that is used specifically to feed livestock (e.g. cattle, sheep, chickens and pigs).
Automotive engine	A vehicle that converts energy into mechanical force or motion by use of a fuel.
Bioblend	Any mixture that is made by mixing (a) biodiesel and (b) heavy oil not charged with the excise duty on hydrocarbon oil (duty-suspended heavy oil).
Biodiesel	A diesel quality liquid fuel derived from biomass or waste cooking oils, the ester content of which is not less than 96.5 per cent by weight, and the sulphur content of which does not exceed 0.005 per cent by weight or is nil. Defined by HMRC as 'an ester of vegetable oil fatty acid'.
Biofuel	A fuel that derives from biomass. These plant-based fuels (e.g. ethanol made from sugarcane or grains) can be added to petrol, diesel and biodiesel (e.g. from oilseeds or palm oil).
Chemical modification	Refers to WVO having undergone trans-esterification process.
Controlled waste	Controlled waste is household, commercial and industrial waste. Controlled waste is defined in section 30 of the Control of Pollution Act 1974, section 75 of the 1990 Act and the Controlled Waste Regulations 1992 (as amended). Paragraphs 9(2) and 10(3) to Schedule 4 of the Waste Management Licensing Regulations 1994 provide that any reference to 'waste' in Part I of the 1974 Act or Part II of the 1990 Act includes a reference to Directive waste.
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.
Duty of Care	<p>The Duty of Care is set out in section 34 of the Environmental Protection Act 1990 and associated regulations. It applies to anyone who is the holder of controlled waste.</p> <p>Persons concerned with controlled waste must ensure that the waste:</p> <ul style="list-style-type: none"> ■ is managed properly; ■ recovered or disposed of safely; ■ does not cause harm to human health or pollution of the environment; ■ is only transferred to someone who is authorised to receive it. <p>The duty applies to any person who produces, imports, carries, keeps, treats or disposes of controlled waste or, as a broker, has control of such waste.</p>
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.
Fatty acid methyl ester (FAME)	Substance created by an alkali-catalysed reaction between fats or fatty acids and methanol. The molecules in biodiesel are primarily FAMES.

[continues on next page](#)

Term	Description
Glycerol	Also known as glycerin and glycerine. A sweet syrupy trihydroxy alcohol obtained by saponification of fats and oils. Glycerol is a liquid by-product of biodiesel production.
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.
Lye	A strong solution of sodium or potassium hydroxide.
Mineral oils	Hydrocarbons that are liquid below 15°C. The terms 'hydrocarbon oils' and 'mineral oils' have the same meaning.
Mitigation	Measures put in place to reduce all potentially significant effects.
Physical blending	The blending of different substances such that they do not undergo chemical change.
Rebate	A reduction in excise duty allowed on oils put to industrial and off-road uses. The oils are marked to show they have been rebated. It is illegal to use rebated fuels in road vehicles.
Registered waste carrier	A waste carrier must be registered with a Waste Regulation Authority under the Control of Pollution (Amendment) Act 1989.
Small producers	Includes those who produce mainly or entirely for own use rather than as a significant business with a high volume of output per year.
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 standardised procedure without loss of effectiveness.
Trans-esterification	The process of exchanging the alkoxy group of an ester compound with another alcohol. These reactions are often catalysed by the addition of an acid or base. The process is a chemical activity regulated under the Pollution Prevention and Control (PPC) Regulations 2000.
Waste vegetable oil (WVO)	WVOs are purified fat of plant origin, which are liquid at room temperature. Common plant-derived cooking oils (vegetable oils) are derived from nuts, seeds, grains and beans. Like all fats, cooking oils are esters of glycerol and a varying blend of fatty acids. They are biodegradable and insoluble in water, but soluble in organic solvent. Cooking oils are generally processed and used in the production of products fit for human consumption and do not contain toxic substances. Used cooking oils (UCOs) contain food contamination and after frequent use turn dark and more viscous, and develop a rancid or 'off' smell.
WRAP	WRAP (Waste & Resources Action Programme) works in partnership to encourage and enable businesses and consumers to be more efficient in their use of materials and recycle more things more often. This helps to minimise landfill, reduce carbon emissions and improve our environment.

Appendix G Useful information sources

1. *Biofuels and other fuel substitutes*. HM Revenue and Customs Notice 179E, October 2005. Available from: <http://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: <http://www.defra.gov.uk/environment/ppc/regs/index.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: <http://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: http://www.environment-agency.gov.uk/commondata/acrobat/ippc_rgs7_v3_0606_509888.pdf [Accessed 2 January 2007].
5. *Environment Agency Guidance on Low Risk Waste Activities* (Version 15), October 2006. Available from: http://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: http://www.biodiesel.org/pdf_files/fuelfactsheets/prod_quality.pdf [Accessed 2 January 2007].

Standards

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 14078:2003. Liquid petroleum products. Determination of fatty acid methyl esters (FAME) in middle distillates. Infrared spectroscopy method*. British Standards Institution (BSI), 2003.

Legislation

1. Environment Act 1990. Available from: http://www.opsi.gov.uk/acts/acts1990/Ukpga_19900043_en_1.htm [Accessed 2 January 2007].
2. Customs and Excise. Biodiesel and Bioblend Regulations 2002, SI 2002 No. 1928. Available from: <http://www.opsi.gov.uk/SI/si2002/20021928.htm> [Accessed 2 January 2007].
3. The Animal By-Products (Scotland) Regulations 2003, Scottish SI 2003 No. 411. Available from: <http://www.opsi.gov.uk/legislation/scotland/ssi2003/20030411.htm> [Accessed 2 January 2007].
4. The Animal By-Products Regulations 2005, SI 2005 No. 2347. Available from: <http://www.opsi.gov.uk/si/si2005/20052347.htm> [Accessed 2 January 2007].
5. Commission Decision of 12 May 2003 on transitional measures under Regulation (EC) No 1774/2002 of the European Parliament and of the Council as regards the use in feed of used cooking oil. *Official Journal of the European Union*, L117, 23-29.
6. Directive 2006/12/EC of the European Parliament and of the Council of 5 April 2006 on waste. [Waste Framework Directive; Codified version of Council Directive 75/442/EEC as amended by Directives 91/156/EEC and 91/692/EEC]. Available from: http://eur-lex.europa.eu/LexUriServ/site/en/oj/2006/l_114/l_11420060427en00090021.pdf [Accessed 2 January 2007].

Useful websites

Source	URL*
ACORN – waste cooking oil collectors	http://www.cdoil.co.uk/acorn_map.htm
ARROW Oils UK – waste cooking oil collectors	http://www.arrowoils.co.uk
Biodiesel outlets in the UK	http://www.biodieselfillingstations.co.uk/outlets.htm
British Association for Biofuels and Oils (BABFO)	http://www.biodiesel.co.uk
Business Resource Efficiency & Waste Programme (BREW)	http://www.defra.gov.uk/ENVIRONMENT/WASTE/brew/
Defra – guidance on the Duty of Care	http://www.defra.gov.uk/environment/waste/legislation/duty.htm
Directive 94/9/EC Equipment intended for use in Potentially Explosive Atmospheres (ATEX)	http://ec.europa.eu/enterprise/atex/direct/newapproach.htm
Environment Agency – Biodiesel Regulations	http://www.environment-agency.gov.uk/yourenv/857406/1173616/
Environment Agency – Oil Storage Regulations	http://www.environment-agency.gov.uk/business/444217/590750/590821/174658/
Environment Agency – Waste Protocols Project	http://www.environment-agency.gov.uk/subjects/waste/1019330/1334884
European Court of Justice (ECJ) judgments: the definition of waste	http://www.defra.gov.uk/environment/waste/topics/pdf/ecj-definition.pdf
European Court of Justice (ECJ): list of leading cases and judgements on the environment	http://ec.europa.eu/environment/law/cases_judgements.htm
Health and Safety Executive (HSE) – Domestic Production of Biodiesel: Health and Safety Warning	http://www.hse.gov.uk/pubns/biodiesel.htm
PDM Group – waste cooking oil collectors	http://www.pdm-group.co.uk
Petrotec – German manufacturer of biodiesel from WVO	http://www.petrotec.de
Pollution Prevention Guidance notes (PPGs)	http://www.environment-agency.gov.uk/business/444251/444731/ppg/
Rix BioDiesel Ltd – biodiesel distributors	http://www.rixbiodiesel.co.uk
SEPA – Interim Position Statement on Biodiesel	http://www.sepa.org.uk/pdf/guidance/waste/position_statement_biodiesel.pdf
Verband der Deutschen Biokraftstoffindustrie (VDB) – German Biofuels Association	http://www.biokraftstoffverband.de/vdb/
Waste & Resources Action Programme (WRAP)	http://www.wrap.org.uk

* Accessed 2 January 2007.

**Waste & Resources
Action Programme**

October 2007

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