Shell Company of Australia Ltd
8 Redfern Road
Hawthorn, Melbourne
GPO 872K
MLB VIC 3123
Tel +64 4 4980205 X8205
Other Tel 027 4434 823
Email david.jacobson@shell.com
Internet www.shell.com.au

Daniel Sheedy
Clean Fuels and Vehicles Section
Environment Australia
GPO Box 787
CANBERRA, ACT 2601
AUSTRALIA

27 May 2003

Dear Sir,

Shell Comments on National Standard for Biodiesel Discussion Paper.

Introduction:

Our overall view is that we agree with the paper in seeing the need for a suitable Biodiesel Standard in Australia as essential to the constant supply of the high quality esters needed for trouble free use. A Shell research programme, conducted in Europe last year, indicated that FAME quality can vary significantly from producer to producer and quality can often be poor. Also the use of poor quality FAMEs in AGO can have profound effects on vehicle performance as well as serious safety implications. Hence a suitable FAME specification is critical for market development and consumer and OEM acceptance.

Shell fully supports the submission to you on this subject by the Australian Institute of Petroleum.

We believe that Standards need to be prepared for:

1. B100 methyl ester
2. B100 ethyl ester
3. B20 methyl ester
4. B20 ethyl ester

All ester used for blending B5 or lower concentration blends must contain certified ester meeting the appropriate B100 specification. In addition B5 diesel blends must conform to the ruling Australian Diesel Standard (National Fuel Quality Standards Act 2000 – Fuel Standard (Automotive Diesel) Determination 2001). The Australian Diesel Standard should be amended accordingly, to specifically allow up to 5% ester concentration in the diesel, providing that the ester meets the well defined B100 specification.

The use of fatty oil glycerides should be specifically excluded from the B100 specification and the diesel specification at any blending concentration.

The ester specification should be as close as possible to the European one for commercial flexibility and OEMs support. It should avoid mentioning feedstock and processing to maintain full flexibility for future products and processes. Engines are sensitive to molecules not to process or to original feedstock. The objective should be to provide an opportunity for Australians to be flexible towards the use of local crops as well as waste oils, animal or plant derived, as the feedstock source for biodiesel. However, it should be noted that different types of FAMEs do have different properties. While the use of up to 5% FAME in AGO is accepted, by Shell, this acceptance is based purely on the use of RME-5 in France.

When Biodiesel is launched onto the market we strongly support the "seamless approach" of B5.

B20 and B100 are more suited to niche markets for customers who understand the usage requirements and seek to contract a supply of one or other of these grades. In this respect they will have equipment with known suitability and OEM approval for the fuel.

While tax support seems to be a common factor in countries where biodiesel is marketed it would be a useful incentive in Australia to encourage recovery of fatty materials that may be going to waste or lower value uses. There needs to be stability in the arrangement with a commitment from government to a subsidy support period with review and renewal provisions.

Below are answers to the specific questions raised in the discussion document.

Page 11 *What is your view on harmonisation of any Australian Biodiesel Standard with European and/or US biodiesel specifications?*

It can be seen from Table 6.1 that the EU standard is more demanding than the US standard. This probably reflects the differences in their respective diesel standards, with EN 590 being more demanding than ASTM D975. Bearing in mind the large number of European vehicles in the light-duty and heavy-duty sectors in Australia, and that Asian and Japanese vehicle makers tend to take their lead from Europe, we feel that it is appropriate for Australia to emulate the European standards in order to avoid side effects and protect engines. Thi is supported when we look at the direction of the Australian Diesel standards. These standards are based on the European diesel standard EN590.

A significant amount of work has gone into developing the EU biodiesel standard, prEN14214. The majority of European OEMs will tolerate the use of FAMEs at up to 5% in AGO, providing that the neat FAME meets this standard prior to blending with AGO. As such, we see no reason to steer away from the European standard.

The customer who buys B5 wants to be assured that the fuel is fit for purpose and that use of it will not except him from normal OEM warranties. In this respect the properties of the diesel fuel should be strongly associated to and preferably compliant with EN 590 and ASTM D975.

Where other ester concentrations are contemplated the opportunity should be taken to define the grade structure and mandate the ester concentration that applies to each grade (or of the single grade).

Recommend: Adopt prEN 14214 for the methyl ester and adapt/include it to an ethyl ester standard to provide for a fully biosourced project.

Page 13 *Do you consider that an Australian Standard for Biodiesel should prescribe feedstock or production technologies, or should the standard only address characteristics and composition of biodiesel?*

The proposed EU FAME specification does not prescribe feedstock or production technologies (although this standard was drawn up largely based on the properties of RME).

With the decline in use of tallow for soap manufacture and the possible availability of other indigenous low cost fatty material by-products such as cotton seed oil, fish oil and tall oil there is plenty of scope to research and manufacture alternatively sourced esters that complement and enhance the value of existing primary production activities. Likewise the sourcing of biodiesel from oil seed production has the potential to create a very large seed cake by-product with potential for protein and carbohydrate extraction and animal feed manufacture. In the end these may be the high value products. The oil seed chosen should be the one that maximises the total return – and may not necessarily be rapeseed.

Engines only respond to molecules, not to the process, or the feedstock used to generate the molecules. Provided the ester meets a well-specified B100 standard for example prEN14214, and the B5 blend conforms to the Australian Diesel standard, then we should not need to restrict the biodiesel to be sourced from certain feedstocks or produced by certain processes.

Page 14-21. *Do you wish to comment on any aspects of the impacts of biodiesel use raised in this chapter?*

4.3 Lubricity

While Stanadyne Automotive showed that the addition of 2% biodiesel to ULSD gave the AGO acceptable lubricity properties, testing by Shell confirmed the efficacy of RME but did not show satisfactory lubricity for blends containing CME and SME, even at 5%. Hence feedstock source is extremely influential in the degree of lubricity performance the FAME offers. Again the B5 blend would need to conform to the Australian Diesel standard.

Page 23. *What are your views on biodiesel blends ?*

Shell's views are the same as the OEMs: up to 5% FAME is acceptable providing the neat FAME meets the prEN 14214 specification prior to blending with AGO, although again note that this OEM acceptance is based purely on the use of RME-5 in France. Other FAMEs have not been as extensively trialled or tested. Using FAME/AGO blends containing greater then 5% FAME is only acceptable in engines that have been specifically modified for this purpose. Once modifications, such as installing compatible elastomers, are made then there is a good track record for successful use of biodiesel in captive fleets, B30 in France and B20 in the USA. Fleet managers have control over many of the factors which can overcome implementation and quality control challenges associated with the use of >5% FAMEs. Use of B100 is not so widespread and some OEMs (particularly Bosch) remain sceptical about its use.

The taxation status of B100 and biodiesel blends certainly needs to be addressed in a consistent manner so that the noble intentions of this project are not subverted. Either the B100 and ester component of biodiesel blends are not taxed or they are taxed. In some respects it may be administratively simpler to apply an excise tax to everything and provide producer subsidies separately at the point of manufacture to achieve the desired input cost structure. The subsidies can then be reviewed regularly independently of the taxation system.

The philosophy in France is to allow up to 5% ester in the standard Diesel, provided that the ester meets the pr EN 14214 specification and that the bio-diesel blend meets the standard EN-590 spec. The bio-diesel is hence completely seamless all along the value and distribution chain. This has been working smoothly since 1995.

Similarly for B5 blends in Australia it is essential that the customer is supplied with fuel that complies with the Australian Standard for Diesel (based on EN590 etc). To achieve this the blender will have to be aware of the quality data applying to both the B100 and diesel components. The blend would be nominally 5% but the actual concentration would be adjusted so that the Australian Standard's limits are complied with. For example the B100 may have been sourced from tallow and have a cloud point that restricts its use to 3% in winter or the density of the diesel component may be such that only 2% of B100 can be incorporated in the blend without exceeding the density limit.

Page 24-60. *Stakeholders are specifically requested to provide comment on appropriate specifications and test methods.*

It would be difficult to improve on the work that went into developing prEN14214 and this should be used in total for methyl esters and as the default guide for ethyl ester specification development. However a few specific comments are as follows:

Water

The presence of water in a fuel can lead to the growth of microbes and cause corrosion of fuel injector system components. The EU FAME specification for water is 500ppmw. However, in France where FAMEs have been used successfully since 1991, the national specification is 200ppmw (same as conventional EN590 diesel). This is deemed to be a more appropriate limit for problem free operation.

Iodine number

Iodine number reflects the content of unsaturated acids in FAMEs and a high iodine number is correlated with poor stability and a high tendency for sludge formation. Studies by Shell Global Solutions have confirmed this relationship. The EU and US Specification limits for iodine number are 120max and 125max respectively. However problem free experience with FAMEs to date has been with iodine numbers <115. Our laboratory work has also indicated that whilst the stability of FAMEs is generally good below an iodine number of 100, this stability deteriorates rapidly once the iodine number increases above 100.

Some studies have suggested that iodine number alone is insufficient to characterise the higher reactivity and polymer-forming tendencies of poly-unsaturated oils such as linoleic acid (2 double

bonds) and linolenic acid (3 double bonds). For this reason, the European specification includes a separate limit for linolenic acid content.

Thermal Stability

This is covered by the carbon residue test.

Cloud Point

Adopt CFPP.

Distillation Temperature

Not required for B100. B5 limits are covered by the diesel standard. B20 limits need investigation.

Calorific Value

Not required.

Page 61 *Stakeholders are requested to comment on the issue of alcohol feedstock for the production of biodiesel and impacts on vehicle emissions and engine operability.* This is not something that Shell has looked at in detail so far. Our feeling is that the cost of ethanol (non-subsidized) will be the deciding factor - the same reason why there is little ETBE sold. Conventional economics would indicate the use of methanol – especially so if a methanol plant based on NW Shelf gas is built in Australia. However Kyoto signatories may develop a different model based on carbon tax credits, which may make ethanol an attractive option. More work may need to be conducted to validate the use of ethyl esters in B5 diesel fuel blends.

Pages 67, 70 and 76.

We defer to OEM requirements.

Page 77 *Stakeholders are requested to comment on issues relating to the suitability of current infrastructure, or any requirements for specialised infrastructure for the use of biodiesel.*

Experience of using RME in France suggests that providing the potential problems with using FAMEs are understood (e.g. hygroscopicity, oxidative stability etc) and good housekeeping standards are maintained, 5% FAME-AGO blends can be handled and distributed in much the same way as conventional AGO. For neat FAMEs or FAME blends, some small infrastructure changes in the distribution and handling system may be required. For example storage tanks, facilities and fittings made out of copper, copper-containing alloys, lead, zinc and tin are not suitable for storing neat FAMEs or >5% FAME blends and must be replaced by materials such as stainless steel, fluorinated polyethylene and fluorinated polypropylene, aluminium and Teflon. Problems may occur with unsuitable elastomers in depot and tank farm equipment, for example nitrile, flurosilicon, polyurethane and polypropylene. Acceptable materials are fluroelastomers (for example Viton VT70).

One of the few points missing in the paper is the ability of the ester containing Diesel to be pushed through multi-product pipelines. This is required to allow a maximum supply / exchange flexibility. Information on this matter can be accessed from Shell.

Depending on the available volume and constancy of supply of methyl ester the blending points may have to be at selected terminals and the product available to customers at designated sites. More infrastructure like storage tanks and blenders would be necessary. Quality monitoring would present some challenges.

Page 77 *Stakeholders are invited to comment on the case for labelling of biodiesel/biodiesel blends and what information would be relevant to the end user.*

For 5% FAME blends we see no reason for labelling the ester content of the biodiesel blend unless for specific marketing purpose (for example a reduced CO_2 emissions differentiated fuel) as there is little perceived difference in performance to the end customer and it is accepted that the fuel can be used in existing engine technologies without modification. However, for >5% FAME blends, our view would be that the biodiesel content should be labelled because:

1. It can only be used in engines modified for this purpose
2. There are various performance issues that would be very noticeable to the customer, e.g. increased fuel consumption and reduced power, exhaust smell, poor cold flow performance.

Summary:

- Shell strongly supports the introduction of a B5 blend. This allows for seamless introduction of the ester.
- The neat ester needs to meet a well defined ester specification, preferably based on prEN14214.
- The B5 blend needs to meet the current Australian Diesel fuel specification. B5 blends do not require specific labelling, as up to 5% blends are accepted by OEMs.
- The tax system used to encourage the introduction of esters should be simple and consistent with other biofuels.
- Use of straight vegetable or animal oils as fuel blending components is not supported by Shell

We hope that these comments will aid the successful introduction of the biodiesel option into Australia.

Yours faithfully

David Jacobson

Fuels Technical Manager - Oceania

More comments on the report from our reviewers :

- Page 13 : There is a reference to Appendix C . The Apendix C title is missing.
- Page 16 : There are a series of very recent well-to-wheel studies on esters that should also be quoted and referenced (GM-LBST study, ADEME study, EU Concawe 2002 review and Shell A.Groves study on RME)-. The US NBB data are considered to be a bit optimistic (78.5% less CO2) especially by recognised US experts such as Mark Delucci of UTC. 40-50% CO2 savings is a more recognised figure.
- Page 16 : On the emission side, there should also be some European studies quoted such as the AVL-WTC reports (www.MTc.se) , AVL Austria or from the French Institute of Petroleum particularly relevant of Euro-1 and Euro 2 technologies.
- Page 17 : 3rd paragraph, I think the author meant "teratology" (SOED spelling).
- Page 18 : A more appropriate comment on the effects on rubbers could be that, at low concentration in Diesel fuels esters are relatively neutral against seals and would not compensate for a reduction of seal swell observed with Diesel fuels containing less aromatics.
- Page 20 : Quote the same studies as Page 16 for the energy balance.
- Page 20 : The 27th reference is missing in the list of references.
- Page 62 Section 7.6 Viscosity. Ethyl esters stated as being up to 7 times more viscous than methyl esters. Elsewhere in the paper the number 7% higher is quoted.
- Page 66 : 2nd paragraph, the aromatic content of diesel is generally considered to lie in the range 10-40%. 98% seems unlikely. The logic of the remainder of the para then seems remote.

Appendix B : The German total production capacity seem a bit too high -see
http://www.mvo.nl/biobrandstoffen/download/145784397.pdf