



14 July 2004

Clean Fuels and Vehicles Section
Department of the Environment and Heritage
GPO Box 787
CANBERRA ACT 2601

Dear Sir/Madam

National Fuel Quality Standards: Diesohol

The Australian Institute of Petroleum (AIP) is pleased to respond to the Discussion Paper No 7 on Diesohol, issued by the Department of Environment and Heritage in May 2004. This submission is made on behalf of the following refiner-marketer members of AIP:

BP Australia Pty Ltd
Caltex Australia Petroleum Pty Ltd
Mobil Oil Australia Pty Ltd
Shell Company of Australia Ltd

Overview

Diesohol may have potential as a fuel in certain markets. However it has significant quality differences to conventional diesel. These differences need to be fully understood, in regard to both their effects on the operability in, and material compatibility with, standard diesel engines, and on safe handling requirements through the supply chain.

A particular point of difference is the low flashpoint of diesohol. AIP agrees with the position taken in the Discussion Paper that the lower flashpoint of diesohol, and the consequent storage and handling requirements, present serious challenges to the use of diesohol in the general market. Due to its low flash point, diesohol is not readily interchangeable with conventional diesel, and it is important that there is no confusion in the market on this point. Some AIP members have such serious reservations about diesohol because of this that they will not advocate its general use at retail sites.

Given the significant differences in performance characteristics between diesohol and conventional diesel, and bearing in mind the wide range of diesel engines currently in use in Australia, it is essential that the views of the vehicle industry be sought to establish whether diesohol is suitable for vehicles currently used in Australia, as well as new vehicles. If the vehicle industry does advise that it is suitable, it is then necessary to ensure that the fuel is fit-for-purpose.

To help ensure that diesohol is fit-for-purpose, AIP believes strongly that any supply of diesohol must be regulated. As with petrol-ethanol blends, the regulation should cover the quality of the fuel, the maximum blend rates, and labeling (including safe handling procedures).

AIP notes the comments in the Discussion Paper regarding the environmental advantages and disadvantages of diesohol. AIP does not agree that diesohol will necessarily lead to lower emissions of particulates.

These points are further discussed in the attached paper. This also contains AIP's comments on technical specifications for diesohol.

Yours sincerely

John Tilley
Executive Director

THE NEED TO REGULATE DIESOHOL FUEL QUALITY

1 Fuel Standards

The Government has a clearly identified goal to harmonise Australian and international vehicle emission standards. Fuel quality standards are also being established, which will support the new vehicle emission standards. The Discussion Paper notes these standards are being progressively tightened to address advances in vehicle and fuel refining technology, increasing vehicle fleet size and continuing concerns on air pollution.

AIP and its member companies support these policies and have worked with Government and other industry stakeholders to establish a set of mandatory fuel standards that will complement the vehicle standards. AIP has urged that these standards should be:

- Pragmatic and realistic;
- Based on sound science;
- Fully encompassing – ie covering all suppliers of fuel into the market.

AIP believes that these criteria should apply equally to diesohol. There are three key reasons for this.

1. Diesohol is a potential competitor to diesel and biodiesel. Both of these either are or will be covered by mandatory fuel standards. To ensure a sound competitive outcome, all fuels serving the same market should be regulated in a similar manner, to ensure a level playing field.

It must be recognised that the assumption in the Discussion Paper that diesohol would only be used in dedicated fleets with their own refuelling centres is not sufficient grounds to obviate the need for a mandatory standard. The assumption may well be wrong, and it is unclear what measures would be in place to prevent use of diesohol outside these dedicated fleets. Indeed the lack of a mandatory fuel standard could encourage the wider use of diesohol – in part due to the potential for loopholes to the regulated standards (see 3 below)

2. The new vehicle technology requires fuels to be increasingly tightly specified to be fit-for-purpose. AIP strongly believes that only fuels that are proven to be fit-for-purpose should be offered to the market.

It is necessary first to establish that Australian diesel vehicles can in fact handle ethanol-blend diesels. This is important both in terms of material compatibility, as with petrol-ethanol blends, and in terms of the impact of the markedly lower flashpoint on storage and ignition. AIP believes that the vehicle industry – the Federal Chamber of Automotive Industries and the Truck Industry Council – should advise whether diesohol is fit-for-purpose as a fuel for the current and future Australian diesel fleet, and what, if any, additional specifications need to be included relative to the normal diesel standard.

If diesohol is confirmed as a potential fuel, the lack of a mandatory standard for diesohol could encourage some diesohol suppliers to offer fuel that is easier to make but not necessarily fit-for-purpose. This could cause problems for the consumers of the fuels, and could also damage the reputation of all diesohol. A standard would give consumers more confidence in the product, to assist its market penetration.

3. The lack of a standard would open up a major avenue for rorting diesel fuel quality standards in the general diesel market. In theory, the addition of any ethanol into diesel would take it outside the diesel standard, and allow departures from the diesel standard in any of the specifications. For example, an unscrupulous diesel supplier could add 30 per cent used lube oil and 0.5 per cent ethanol to a batch of diesel, resulting in a fuel that was grossly sub-quality but technically not in breach of the standard. This risk should not be taken lightly. Over the years, diesel has been the main risk area for fuel substitution, and a number of creative rorting practices have been discovered.

AIP therefore believes most strongly that, if it is confirmed by the Original Equipment Manufacturers (OEMs) that diesohol is suitable for the Australian diesel fleet, it must be covered by mandatory fuel standards, as are normal diesel, biodiesel and petrol-ethanol blends.

If however, the OEMs cannot confirm that diesel-ethanol blends are suitable for the diesel fleet, AIP recommends that the regulations (Part 1, sub-section 3 of the Fuel Quality Standards Regulations 2001) be amended to remove reference to diesohol as a fuel, until it can be established to the satisfaction of the OEMs that it is fit-for-purpose. This need not preclude the use of diesohol in defined niche markets, regulated through the waiver Approval process already in the legislation.

If diesohol is confirmed to be potentially fit-for-purpose, the regulation should address the same issues that were found to be relevant for the regulation of petrol-ethanol blends. In particular, the regulation should encompass:

- The diesohol fuel quality specifications;
- The maximum content of ethanol in diesel. This should be determined with reference to materials compatibility and engine operability. A minimum content could also be considered;
- The labeling of any bowsers dispensing diesohol for general (non-dedicated fleet) use.

Labeling will be important both to ensure that vehicle users are aware of the safety issues posed by the low flash point, can assess the compatibility of the product with their vehicles, and make an informed assessment of the value of the diesohol compared to normal diesel or biodiesel. This reflects the lower energy content of the ethanol compared to diesel, which will affect both consumption and power.

There is also a case to require some form of labeling for dedicated fleet usage for safety reasons, to remind users of the differences in flammability characteristics between diesohol and diesel. This could be effected by the printing of appropriate advice on the delivery docket or invoice.

2 Storage Standards

'Wet' and 'Dry' Systems

Current diesel storage standards are 'wet' systems. The storage of ethanol blend fuels such as diesohol, particularly anhydrous diesohol, will require dry systems. The management of this issue is covered in the AIP Guideline GL14 *The Storage, Transport, and Handling of Fuel Ethanol and Ethanol Blend Fuels*.

Classification as a Flammable Liquid

The Discussion Paper points out that the substantially reduced flashpoint of diesohol means that it must be treated as a Class 3 Dangerous Good flammable liquid, as compared to diesel which is a combustible liquid. These requirements will be covered under Dangerous Goods storage and handling regulations in each State and Territory.

This flammable liquid classification for diesohol will particularly impact on above-ground tanks installations. The separation distance requirements for flammable liquid tanks are significantly tighter than for combustible liquids. Sectors which will be especially affected will be industrial and farm above-ground tank installations which comply with combustible liquid requirements, but may not comply with those for flammable liquids.

However, underground tanks will also be impacted. For example, the requirements for venting are different between flammable and combustible liquids.

Other Storage Issues

A further point to note is that tank linings that are suitable for diesel may not be suitable fuels containing ethanol.

In general, it can be expected that the ethanol (and possibly the cosolvents/emulsifier systems) in the diesohol will have a scouring effect on the storage tank system with initial use. This will require filters to be installed on fuel lines and the following of special operational procedures. The AIP Guide GL14 on the *Storage, Transport and Handling of Fuel Ethanol and Ethanol Blend Fuels* provides guidance on these points.

ENVIRONMENTAL PERFORMANCE OF DIESOHOL

The Discussion Paper concludes that diesohol has little advantage or disadvantage on emissions over normal diesel, except in the emissions of particulates.

On particulates, the Discussion Paper drew attention to a Swedish study, based on diesel of the mid 1990s, which found that a 15% diesohol reduced particulates emissions by 35 – 50 per cent compared to normal diesel. On the basis of this, the Discussion Paper concluded that a reduction in particulate emissions would be one of the major benefits of the use of diesohol.

Great caution is needed on this conclusion. In particular, the Swedish study is based on relatively high sulfur diesel, compared to that which will be available in Australia in the last years of this decade.

The introduction of the 50 ppm sulfur diesel standard in 2006 was forecast (MVEC Review of Vehicle Emissions and Fuel Standards post 2006, by Coffey Geosciences October 2003) to reduce PM₁₀ vehicle emissions by approximately 50 per cent by 2010 and 80 per cent by 2020. The expected introduction of a 10 ppm sulfur diesel standard will reduce diesel vehicle particulate emissions even further.

The study '*A Comparison of Transport Fuels: Life Cycle Emissions Analysis of Alternative Fuels for Heavy Vehicles*' (carried out by CSIRO/RMIT for the Australian Greenhouse Office in 2001) found that diesohol had equivalent emissions performance to diesel on NO_x, toxics and Health, and only slightly better performance on greenhouse gases and particulates.

The CSIRO/RMIT study was based on emissions from a low sulfur Euro 3 type diesel fuel, but running on a 1995 diesel engine. As such, the performance comparison for the diesel was significantly understated. The matching of a Euro 3 engine to the fuel would lead to a reduction in the particulate emissions of the normal diesel. The introduction of 50 and 10 ppm sulfur diesel would reduce them even further. The net effect must be that the slight performance advantage that diesohol had in particulate emissions must have been eroded.

AIP believes that, on the basis of this evidence, it is wrong to conclude that diesohol has any significant advantage over normal diesel in particulate emission performance. Rather, the conclusion should be that the emission performance of the two fuels is likely to be broadly equivalent.

TECHNICAL ISSUES FOR A FUEL QUALITY STANDARD FOR DIESOHOL

General Policy

Any fuel standard should be set on the basis that the fuel can be supplied for general use, rather than restricted to defined supply patterns. Niche supply of an alternative product that is not fully interchangeable with diesel can be handled when appropriate under an Approval for variation from the Automotive Diesel Determination.

AIP is advocating that, if diesohol is allowed for general use, diesohol sold on forecourts should be clearly labeled to allow consumers to distinguish between supplies of diesel and diesohol. It is necessary to allow for the possibility that consumers may wish to interchange between diesel and diesohol from time to time.

Because of this interchangeability, AIP believes strongly that the fuel standards for diesohol should mirror those current for conventional diesel. The only exceptions should be where:

- the physical characteristics of diesohol make it technically impossible to meet the diesel fuel standard, and the difference from the diesel standard does not compromise the operational integrity of an engine tuned to run on normal diesel;
- additional specifications are required for properties that are unique to diesohol/fuel grade ethanol, to ensure the fuel is fit-for-purpose.

AIP also recommends that the impact/compatibility of any cosolvent/emulsifier be specifically considered. In particular, AIP believes that the use of methanol should not be allowed, as a cosolvent or otherwise, due to its toxicity and incompatibility with several materials commonly used in distribution systems and vehicle fuel systems.

Comment on Individual Specifications

Acidity

As per diesel

Alcohol quality and content

The maximum allowable level of alcohol should be set with reference to the advice from the vehicle industry as to what levels are suitable for the Australian fleet. Consideration could also be given to a minimum level of content, to differentiate true diesohol from diesel to which a small amount of ethanol has been added to avoid the need to meet other diesel specifications.

AIP is not aware of any test methods specific to the determination of the alcohol/oxygen content of diesel fuels. Further research is needed to assess the applicability or suitability of modifying ASTM D5622 or D4815. It should be noted that these test methods have been designed for

gasolines, and their apparatus/columns/temperatures may not be appropriate for diesel.

Cetane

Cetane is an important fuel specification for users of diesel. Normal diesel is assessed through a cetane index. This method will not be appropriate for diesohol. An alternative approach would be to use a cetane number specification, using the IQT test method (as suggested by AIP in its submission to the Department of May 2004). The cetane number should be no lower than the equivalent cetane index for normal diesel

Density

Density is an important specification for users, being related to power and fuel consumption. Labeling of diesohol should alert purchasers that the fuel is of lower density than normal diesel and will provide lower energy; this will allow correct assessment of the price of the product.

However, AIP believes that a lower limit must be set for this important specification, combined with the maximum density of normal diesel. The issue of lower density diesel is currently being researched by the Department, and AIP suggests that the lower density minimum for diesohol be assessed in consultation with all stakeholders once the findings of this research are known.

Lubricity

As per diesel

Polyaromatic Hydrocarbons

As per diesel

Storage Stability

There are two issues that need to be addressed – oxidative stability and emulsion/solution stability.

Oxidative stability should be as per diesel.

Emulsion/solution stability needs to encompass temperature stability (stability against phase separation in cold climate conditions), water stability (stability against phase separation in the presence of limited quantities of water), and ‘interchangeability’ stability (stability when switching between diesohol and conventional diesel).

With regard to test method ASTM D3707 for Oil-Water Emulsion Stability at high temperature, it should be noted

that this test method is not designed for flammable liquids. Its use with diesohol may pose significant safety concerns regarding the generation and ignition of an explosive atmosphere.

With regard to test method ASTM D3709 for Oil-Water Emulsion Stability at low temperature, this test method is not directly applicable to diesohol.

AIP believes that the test method ASTM D6422, while not being directly applicable due to its being designed for a gasoline-ethanol blend, provides a base methodology for more appropriate determination of phase separation characteristics.

Sulfur

As per diesel

Viscosity

As per diesel

Water and sediment

The current diesel test method ASTM D2709 identifies free water and sediment by centrifuging a portion of the sample. Given that free water is most unlikely to be present in diesohol, the test can still be used to obtain a suitable result for anhydrous diesohol.

However the impact of centrifugal force upon hydrous diesel emulsions and the ability to read a sediment result would need to be further evaluated to determine the suitability of this test method. The centrifugal force could possibly cause a separation of the emulsion and make sediment measurement difficult.

An alternative test method for sediment content evaluation may be ASTM D6217, with the specified level needing to be determined.

Ash and Suspended Solids

As per diesel

Carbon Residue

As per diesel

Colour

As per diesel. It should be noted that ASTM D1500 colour determination is applicable for anhydrous diesohol, but not for hydrous diesohol.

Conductivity

As per diesel

Copper Corrosion

As per diesel

Distillation

The distillation curve for diesohol will differ from that of diesel. However, the heavy end should not be affected. It is reasonable therefore for the diesel T95 specification to apply.

ASTM D86 does not adequately comprehend a blend structure such as that of diesohol. At this stage, it is considered that classification of diesohol under group 3 seems most appropriate. However further test work is needed to determine what distillation group is appropriate for both hydrous and anhydrous diesohol.

Filter Blocking Tendency

As per diesel. Filterability is becoming more important for all diesel type fuels, as OEMs continue to reduce fuel filter pore sizes.

It is possible that the hydrous formulation may experience some increase in the 'base' FBT level

Flashpoint

The flashpoint of diesohol will be substantially different to diesel. The main effect is on storage and handling, which is covered by other regulations. AIP therefore suggests that this specification can be deleted for diesohol, unless vehicle manufacturers require a minimum specification for engine operability purposes.