

SETTING NATIONAL FUEL QUALITY STANDARDS

Submission To Department Of The Environment And Heritage

Comments By Apace Research Limited On Issues Raised In Discussion Paper On Diesohol

1. Overview Comments

Oxygen Content and Density Of Diesohol

The *Fuel Quality Standards Regulations 2001* defines “diesohol” as a “blend primarily comprising diesel and an alcohol”. Within this definition the “alcohol” could be methanol, ethanol, or mixtures of methanol and ethanol. The “alcohol” could also be in combination with varying amounts of water.

Diesohol, within the definition, may also contain varying amounts of different additives for various purposes, e.g., blend stabilisation, ignition quality improvement, lubricity and viscosity modification, etc.

The variation possible in chemical composition and water content of the “alcohol” as well as the variation in chemical composition of different additives that may be present in diesohol create significant complexity in:

- using oxygen content as the parameter for regulating alcohol content in diesohol; and
- setting a minimum density for diesohol.

Accordingly, Apace submits that:

- alcohol content be determined by fractional distillation of diesohol and gas chromatography analysis of the distilled “alcohol” fraction; and
- minimum density of diesohol be left open.

Proposed Fuel Quality Standard For Diesohol

Apace submits that the parameters and their respective limits in any fuel quality standard for diesohol could directly correspond with the parameters and their respective limits in the fuel quality standard for diesel, necessarily except for the following parameters:

- density;
- distillation;

- colour; and
- flash point.

The above listed parameters (with the possible exception of colour) are significantly different as between alcohol and diesel and the differences are reflected in the parameters of diesohol. The colour of diesohol may or may not be different to diesel, being dependent on the blend stabilisation mechanism.

Water and Sediment

Apace submits that the diesel standard parameter of “water and sediment” would, in any standard for diesohol, mean “free” water and sediment determined by a centrifugation method.

Cetane Index and Cetane Number

Because of the significant effect of the alcohol content on the distillation characteristic of diesohol, the diesel standard parameter of “cetane index” is not applicable to diesohol.

Apace submits that the current minimum cetane index parameter in the diesel standard be supplemented by a minimum cetane number parameter, determined by the ignition delay measurement method.

Cetane number (i.e., ignition quality) is arguably the most critical parameter for diesohol. Apace submits that the minimum cetane number parameter in any fuel quality standard for diesohol directly correspond with the minimum cetane number parameter for diesel, if included in the fuel quality standard for diesel.

Alcohol Content Of Diesohol

With the exception of the parameters of density, distillation, colour and flash point identified above, it is possible for diesohol to meet all other parameters of the diesel standard. This applies equally to diesohol containing in excess of 15% by volume of alcohol.

Higher levels of alcohol in diesohol maximises the reductions in regulated exhaust emissions (HC, CO, NO_x, PM) and the reduction in net greenhouse gas emission achieved by use of diesohol.

The magnitude of reduction in engine maximum power output is the main issue associated with use of diesohol that meets the parameters of the diesel standard and contains in excess of 15% by volume of alcohol.

It is possible to restore engine maximum power output when operating on diesohol to that when operating on diesel, by increasing fuel delivery and adjusting injection timing. Such mechanical adjustments to the engine fuel injection system must be reversed if the engine is returned to operation on diesel for any extended period of time.

Under Australian Government and UNIDO funded research projects, Apace has experience with diesohol containing from 20% to 30% by volume of hydrated ethanol, where the diesohol is expressly formulated with cetane improver for use in diesel engines specifically adapted and dedicated to use diesohol exclusively.

Apace submits that informed users, such as owners/operators of centrally fuelled fleets, have the option of using diesohol containing from 15% to 25% by volume of alcohol, in order to maximise the exhaust emissions reduction benefit.

2. Specific Comments

The following extract from the Discussion Paper incorporates, *in blue italicised text*, specific comments submitted by Apace.

No specific comments are provided on the appropriateness of particular test methods for determining parameters of diesohol. The test methods cited in the Discussion Paper are for determining the parameters of diesel and certain of the methods may require modification/adaptation for determining the parameters of alcohol-in-oil emulsions (i.e., diesohol). Apace submits that such detailed expert technical review is beyond the scope of this response.

PART A – Options for regulating diesohol

1. Stakeholders are asked to provide comment on:
 - the issue of vehicle warranties and the use of diesohol; and
 - if applicable, those properties of diesohol that may lead to the voiding of warranties.

Apace agrees with the comments of Section 4.4 of the Discussion Paper.

2. Stakeholders are asked to provide comment on their preferred option for the regulation of diesohol:
 - a) no diesohol fuel quality standard (business as usual);
 - b) encourage a voluntary industry diesohol fuel quality standard;
 - c) encourage State and Territory diesohol fuel quality standards; and
 - d) introduce a diesohol fuel quality standard under the FQS Act.

Apace supports the introduction of a diesohol fuel quality standard under the FQS Act.

3. Stakeholders are asked to provide comment on the preliminary impact analysis of implementing a fuel quality standard for diesohol (presented in Section 5.4).

Apace agrees with the comments of Section 5.4 of the Discussion Paper.

PART B – Technical issues related to a fuel quality standard for diesohol

Critical parameters

4. Stakeholders are asked to comment on:

- the appropriateness of setting a maximum acid value (total) of 0.08 mg KOH/g; and

Apace considers the proposed maximum acid parameter necessary and the proposed value appropriate.

- the appropriateness of test methods ASTM D974 and ASTM D664 for determining total acid value.

5. Stakeholders are asked to comment on:

- the appropriateness of limiting alcohol to 15%;

See Overview Comments above. Higher levels of alcohol in diesohol maximises the reductions in regulated exhaust emissions (HC, CO, NOx, PM) and the reduction in net greenhouse gas emission achieved by the use of diesohol. Accordingly, Apace submits that informed users, such as owners/operators of centrally fuelled fleets have the option of using diesohol containing from 15% to 25% by volume of alcohol, where the diesohol is expressly formulated with cetane improver for use in diesel engines specifically adapted and dedicated to use diesohol exclusively.

- an appropriate parameter for regulating alcohol content;

Percentage by volume - see Overview Comments above.

- the appropriateness of using oxygen content as the parameter for regulating alcohol content;

Not appropriate - see Overview Comments above.

- an appropriate test method for determining alcohol content; and

Fractional distillation of diesohol and gas chromatography of the distilled alcohol fraction - see Overview Comments above.

- an appropriate parameter for indirectly ensuring the quality of alcohol used to blend diesohol.

6. Stakeholders are asked to comment on:

- an appropriate measure for cetane;

Apace considers cetane number to be an appropriate measure and IP 498 and ASTM D6890 to be appropriate test methods.

- an appropriate minimum limit for cetane number; and

Apace submits CN 47 as an appropriate minimum.

- the appropriateness of test methods EN ISO 5165 and ASTM D613 for determining cetane number.

Apace does not consider either test method to be appropriate for determining cetane number.

7. Stakeholders are asked to comment on:

- the appropriateness of setting a maximum density limit of 860 kg/m³, to be reduced to 850 kg/m³ on 1 January 2006;
- the appropriateness of leaving minimum density open; and

Apace considers it appropriate to leave the minimum density of diesohol open - see Overview Comments above.

- the appropriateness of test method ASTM D1298 for determining density.

8. Stakeholders are asked to comment on:

- the appropriateness of setting a standard for lubricity at a maximum wear of 0.460 mm at 60°C; and

Appropriate, since is the same as the diesel standard. Apace submits that the parameters and their respective limits in any fuel quality standard for diesohol could directly correspond with the parameters and their respective limits in the fuel quality standard for diesel – see Overview Comments above.

- the appropriateness of test method IP 450 for determining lubricity.

9. Stakeholders are asked to comment on:

- the appropriateness of setting a maximum limit for PAHs at 11% m/m to come into effect on 1 January 2006; and

Appropriate, since is the same as the diesel standard. Apace submits that the parameters and their respective limits in any fuel quality standard for diesohol could directly correspond with the parameters and their respective limits in the fuel quality standard for diesel – see Overview Comments above.

- an appropriate test method for determining the level of PAHs.

10. Stakeholders are asked to comment on:

- their experience of storage stability of different diesohol blends;
- an appropriate target time for storage stability (e.g. six months);

Apace considers six months an appropriate minimum target time for undisturbed storage stability at an ambient temperature of <30°C.

- an appropriate test method or methods for determining storage stability;
- the appropriateness of the following test method for determining storage stability, if modified as required for Alcohol-in-Oil Emulsions - ASTM D3707 Standard Test Method for Storage Stability of Water-in-Oil Emulsions by the Oven Test Method; and
- the appropriateness of the following test method for determining storage stability, if modified as required for Alcohol-in-Oil Emulsions - ASTM D3709 Standard Test Method for Storage Stability of Water-in-Oil Emulsions Under Low to Ambient Temperature Cycling Conditions.

ASTM D3707 specifies a maximum test temperature of 85°C which would result in distilling the alcohol content. Apace submits testing be conducted on sealed samples and that 60°C is an appropriate maximum test temperature.

Apace considers ASTM D3709 temperature limits (-18° to 21°C nominal) appropriate.

11. Stakeholders are asked to comment on:

- the appropriateness of setting a maximum limit for sulfur at 500 ppm, to be reduced to 50 ppm on 1 January 2006; and

Appropriate, since is the same as the diesel standard. Apace submits that the parameters and their respective limits in any fuel quality standard for diesohol could directly correspond with the parameters and their respective limits in the fuel quality standard for diesel – see Overview Comments above.

- the appropriateness of test method ASTM D5453 for determining the level of sulfur.

12. Stakeholders are asked to comment on:

- a) the appropriateness of regulating viscosity; and
- b) if necessary:
 - an appropriate viscosity standard; and

Appropriate. Use same limit as the diesel standard. Apace submits that the parameters and their respective limits in any fuel quality standard for diesohol could directly correspond with the parameters and their respective limits in the fuel quality standard for diesel – see Overview Comments above.

the appropriateness of test method ASTM D445 for determining viscosity.

13. Stakeholders are asked to comment on:

- the appropriateness of a water and sediment limit of 500 ppm; and

Appropriate. However, Apace submits that the diesel standard parameter of “water and sediment” would mean “free” water and sediment in any standard for diesohol. Use same limit as the diesel standard, i.e., 0.05 vol % (not 500 ppm). Apace submits that the parameters and their respective limits in any fuel quality standard for diesohol could directly correspond with the parameters and their respective limits in the fuel quality standard for diesel – see Overview Comments above.

- an appropriate test method for determining water and sediment.

Apace proposes that the test method for “free” water and sediment provide for an initial fixed equilibration time following agitation of the sample. Determine “free” water and sediment by a centrifugation method. Apace further proposes that “bound” water be determined by fractional distillation of diesohol and measurement of the water content of the distilled “alcohol” fraction. Apace submits that the water content of the alcohol be a maximum of 6% by volume.

Non-critical parameters

14. Stakeholders are asked to comment on:

- a) the appropriateness of regulating ash and suspended solids; and
- b) if necessary:

- establishing a 100 ppm maximum limit for ash and suspended solids; and

Appropriate, since is the same as the diesel standard. Apace submits that the parameters and their respective limits in any fuel quality standard for diesohol could directly correspond with the parameters and their respective limits in the fuel quality standard for diesel – see Overview Comments above.

- the appropriateness of test method ASTM D482 for determining the level of ash and suspended solids.

15. Stakeholders are asked to comment on:

- a) the appropriateness of regulating carbon residue; and
- b) if necessary:

- the appropriateness of establishing a maximum carbon residue (on 10% distillation residue) at 0.2 mass %; and

Appropriate, since is the same as the diesel standard. Apace submits that the parameters and their respective limits in any fuel quality standard for diesohol could directly correspond with the parameters and their respective limits in the fuel quality standard for diesel – see Overview Comments above.

- the appropriateness of test method ASTM D4530 for determining the level of carbon residue.

16. Stakeholders are asked to comment on:

- a) the appropriateness of regulating conductivity; and
- b) if necessary:
 - the appropriateness of setting a minimum conductivity at ambient temperature of 50 pS/m for all diesohol; and

Appropriate, since is the same as the diesel standard. Apace submits that the parameters and their respective limits in any fuel quality standard for diesohol could directly correspond with the parameters and their respective limits in the fuel quality standard for diesel – see Overview Comments above.

- the appropriateness of test method ASTM 2624 for determining the level of conductivity.

17. Stakeholders are asked to comment on:

- a) the appropriateness of regulating copper corrosion; and
- b) if necessary:
 - the appropriateness of setting a maximum copper corrosion limit of Class 1 (3 hours at 50°C); and

Appropriate, since is the same as the diesel standard. Apace submits that the parameters and their respective limits in any fuel quality standard for diesohol could directly correspond with the parameters and their respective limits in the fuel quality standard for diesel – see Overview Comments above.

- the appropriateness of test method ASTM D130 for determining the level of copper corrosion.

18. Stakeholders are asked to comment on:

- a) the appropriateness of regulating distillation; and
- b) if necessary:
 - an appropriate Australian specification for distillation; and
 - an appropriate test method for determining distillation.

Apace considers ASTM D86, Standard Test Method for Distillation of Petroleum Products, Group 3 (IBP<100°, EP>250°C) to be an appropriate test method.

19. Stakeholders are asked to comment on:

- a) the appropriateness of regulating filter blocking tendency; and
- b) if necessary the appropriateness of setting a maximum filter blocking tendency of 2.0 as measured by test method IP 387.

Appropriate, since is the same as the diesel standard. Apace submits that the parameters and their respective limits in any fuel quality standard for diesohol

could directly correspond with the parameters and their respective limits in the fuel quality standard for diesel – see Overview Comments above.

- Stakeholders are asked to comment on the appropriateness of not regulating flash point.

Apac agrees with the comments of Sections 4.3.3 and 7.9 of the Discussion Paper.