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National Fuel Quality Standards Discussion paper
Measuring the Cetane Number: Options for diesel and alternative diesel fuels

Ethyl Asia Pacific Company are pleased to make a submission in response to this discussion paper. We believe that technical and policy decisions relating to Australian fuel specifications should be based on robust and transparent technical assessment.

Ethyl Corporation is one of the major global suppliers of cetane number improver additives. We agree that cetane number is an important fuel quality parameter as described in the discussion paper. We believe that cetane number, as determined by the engine test method, should be seen the best measure of the combustion performance of a fuel in practice.

Analytical and correlation methods can provide an acceptable working methodology for classifying the properties of different fuels – "natural", additised, and those containing exotic blends or alcohol, biodiesel, or water emulsion – however ultimately performance in an engine is the desired outcome.

Ethyl have several main comments in relation to the cetane specification, and testing issues raised in the discussion paper:

1. ***We believe that the Australian Standard for diesel fuel (and similarly the other related standards, such as for biodiesel) should be modified to allow certification of diesel fuel against a cetane number specification*** (using the ASTM D613 engine test method). This would allow diesel suppliers to certify to either cetane index or cetane number, as their circumstances dictate. The initial specification would be set at minimum 46 cetane number for automotive diesel fuel, consistent with the current minimum 46 cetane index specified in the regulations; along with 51 cetane number/index in September 2004 as planned for biodiesel. This change would allow and encourage flexibility for suppliers to provide suitable fuels to the market.

2. ***It would be to Australia's advantage for government to support (financially if needed) and encourage the establishment of a local cetane engine test resource.*** This would allow the local certification of all types of diesel fuel to cetane number specification.

3. ***The Australian fuel regulations should recognise the global use of methods such as IQT/IR*** which, in the absence of equipment to test to ASTM D613, can be used to certify additised or alternative diesel fuels.

4. ***In the specific case of cetane number improver additives,*** the engine benefits seen by increased cetane when additives are used, are indistinguishable from increased cetane resulting from different refining/blending options. With pressure on refiners resulting from other scheduled specification changes (eg 50ppm S diesel etc), ***use of cetane number improver additives can add a significant level of flexibility and cost effectiveness to the refinery operating equation.*** Cetane number improver additives can be especially useful to refiners in upgrading the quality of diesel blends which use cat-cracked steams that are not otherwise used in petrol blends (such as light cycle oil). Cat cracking is a common denominator of all current refineries in Australia for petrol production.

We are attaching a number of additional specific comments on the issues raised in the discussion paper, and would look forward to an opportunity to review these matters in person with the DEH team should that be possible.

Ethyl Asia Pacific Company hope that this input will be of use to DEH in your considerations on diesel cetane issues, and please don't hesitate to contact me should you require any clarification or further information.

Yours Sincerely

Wayne Morris

Manager
Australia & New Zealand

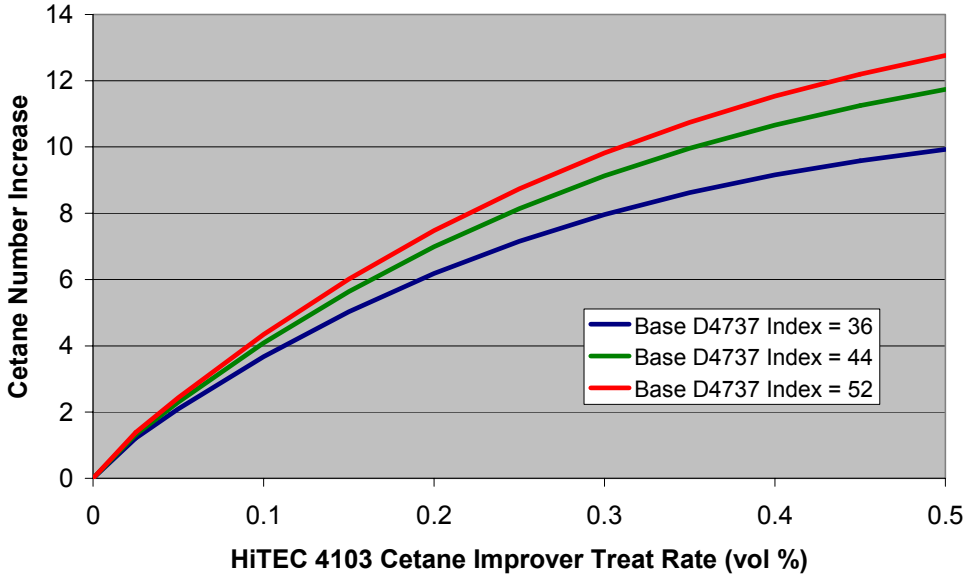
Ethyl Asia Pacific Company Comments on the Discussion Paper:

Measuring Cetane Number:
Options for diesel and alternative diesel fuels

- We would like to point out one additional reference published by the U.S. EPA on the environmental benefits of higher cetane number diesel fuel: **The Effect of Cetane Number Increase Due to Additives on NOx Emissions from Heavy-Duty Highway Engines** (EPAA420-R-03-002, February 2003; www.epa.gov/otaq/models/analysis.htm).

- We would clarify the statement in parenthesis in section 2.4 about the cost of the cetane improver additive ("Generally large quantities of additive are not added for economic reasons, as the additive is expensive."). Large *quantities* of cetane improver *are* today consumed globally to increase the cetane quality of the diesel pool. This holds true for most world areas. There is however, a dosage/response curve relationship for a given base fuel:- the response to additive plateaus, such that the benefits from the first 1,000 ppm of additive are much greater than for the second 1,000 ppm. Minimal incremental benefit results in most fuels for incremental additive amounts in excess of 5,000 ppm. We are attaching a typical response curve for cetane number improver in a 500ppm sulphur diesel for reference.

Cetane Response of HiTEC® 4103 (2-EHN)
Cetane Improver in Low Sulfur Diesel Fuels



- The predominant cetane number improver additive chemistry used in diesel fuel is 2-ethylhexyl nitrate (2-EHN). There is an ASTM method (D 4046-91) for determining the amount of any alkyl nitrate in diesel fuel. It is a spectophotometric method and the detection range is 0.03 - 0.30 volume percent (300 – 3,000 ppm) of alkyl nitrate in the diesel fuel. There are also some IR instruments such as the Petrospec Cetane 2000 Diesel analyzer (www.paclp.com) which can measure 2-ethylhexyl nitrate in diesel fuel to +/- 200 ppm.

- During the 50 plus years in which Ethyl has been supplying cetane number improver additives, we have evaluated many different methods for measuring the cetane number of diesel fuel. While the cetane engine (ASTM D613) remains the industry standard, several attractive alternatives have been developed. The most promising approach is use of constant volume combustion apparatus technology. Several commercial products based on this technology are currently in use around the world. Once such device, the Ignition Quality Tester (IQT^{TM}) from Advanced Engine Technologies Ltd. has been standardized as ASTM D6890-03 and IP 498/03. Since this a combustion-based analytical instrument, it provides an actual determination of the ignition quality of all types of diesel fuels. The IQT is certainly less expensive and easier to use than a cetane engine and can be applicable to alternative as well as standard diesel fuels.

- There are also a number of promising infra-red (IR) based analytical instruments currently in use. One such instrument - with which Ethyl has extensive experience - is the PetroSpec Cetane 2000 Diesel Analyzer currently marketed by PAC. These instruments are less expensive and easier to use than combustion-based instruments. Their major drawback is that they rely on a correlation to a base cetane number (ASTM D613) data set. Alternative diesel fuels will likely require generation of new data sets. Ethyl have for example developed IR Correlations on a matrix of approximately 1,000 US base fuels. For Australia, developing the correlations would require some considerable initial effort and expense, in addition to regular monitoring to ensure that the correlations remain valid.

- Ethyl are aware of the existence in Sydney of a test engine capable of testing to ASTM D613. This is at the laboratory of Caltex International Technical Centre (CITC) at Kurnell. We understand that, although maintained, the equipment is not currently used by CITC for certification.