LPG AUSTRALIA

SUBMISSION TO THE DEPARTMENT OF THE ENVIRONMENT, WATER, HERITAGE AND THE ARTS DRAFT DISCUSSION PAPER

REVIEW OF LPG (AUTOGAS) FUEL QUALITY STANDARD

30 MARCH 2010

The purpose of this Submission is to record the responses of LPG Australia Fuel Quality Standards Technical Committee to the Discussion Paper presented by the Federal Government Department of Environment, Water, Heritage and the Arts (DEWHA) on the Review of LPG (Autogas) Fuel Quality Standard.

References

A. The Department of the Environment, Water, Heritage and the Arts Draft Discussion Paper – Review of LPG (Autogas) Fuel Quality Standard, January 2010.

B. LPG Australia Fuel Quality Standard Technical Committee – various Agenda and Meeting Minutes dated March 2010.

See Distribution.

Introduction

The purpose of this document is to present the combined views of the LPG Australia Fuel Quality Standards Technical Committee (Committee) which includes technical representatives from LPG importers, suppliers, manufacturers and blenders of domestic propane, butane and autogas mixes in Australia.

About LPG Australia

The Australian Liquefied Petroleum Gas Association, known as LPG Australia, was established in 1958 and its mission is to promote the development and growth of the LPG Industry in Australia for the benefit of members and the community.

LPG Australia member companies include producers, refiners and merchants of LPG and suppliers and installers of LPG equipment in both the traditional an automotive sectors.

LPG Australia is pleased to present this submission on behalf of the member LPG supply companies who have been represented on the LPG Australia Fuels Quality Standards Committee.

Committee membership:

a. BP Australia Pty Ltd

b. BHP Billiton Ltd

c. Caltex Australia Limited

d. ELGAS Energy

e. ExxonMobil Oil Australia Pty Ltd

f. Origin Energy Pty ltd

g. Santos Ltd

h. The Shell Company of Australia Limited

i. Wesfarmers Kleenheat Gas

j. Woodside Petroleum

Background Information

LPG Australia member companies import, export, produce and retail propane and butane for a wide variety of applications.

Propane and Butane are blended to produce autogas for the automotive market. The autogas and domestic gas distribution systems are shared, therefore autogas specifications need to take into account domestic gas requirements which are covered by state gas regulations. Propane and butane are sourced from natural gas fields, refining of crude oil to produce petrol and diesel and the chemicals industry so changes to LPG specifications need to take into account supply contracts, domestic gas regulations and end user requirements.

LPG Australia has contributed to the successful development of the Automotive LPG industry in Australia by developing specifications for Autogas before the introduction of National Fuels Quality Standards Act of 2001.

The starting premise for the development of all fuel standards in Australia under the Act is harmonisation with international standards. It is recognised however, that the development of CEN (European Committee for Standardisation) fuel specifications, while linked to the EC vehicle standards have also been designed to address issues that are specific to European Union countries. The Australian government has, therefore, applied a set of guiding principles for fuel standards development which include a general principle that fuel standards should address environmental or health issues based on Australian specific requirements. In such instances, harmonisation with particular elements of the European specifications may be neither necessary or desirable.

The Committee supports this premise and is pleased to have the opportunity to comment on the draft discussion about proposed changes to the Autogas Standard of 2004 that reflect changes recently included in the European Autogas Standard EN 589. The comments are summarised below and then expanded in the relevant sections.

Executive Summary

The Committee supports the alignment of the LPG (Autogas) Fuel Quality Standard with EN 589 to the extent that the Australian Standard and EN 589 use the same parameters to control product

quality including the use of Motor Octane (MON) and Vapour Pressure to control the composition (e.g. propane, butane and olefin content). However there are differences in the limits and some test methods which reflect the Australian conditions and markets. In some respects such as MON and "diene" content the Australian Standard is more restrictive than the 2008 update of EN 589.

The Committee's recommendations on the key issues raised in the discussion paper include:

a. **Sulphur**: Adopt 50 mg/kg maximum in 18 months time to allow suppliers time to modify equipment and procedures to enable the specification to be reliably met. This is particularly with stench dosing where gas regulators should be consulted to ensure that any tightening of stench controls is not going to increase safety risks in the domestic and autogas markets.

   Any further reduction cannot be considered until alternative non-sulphur based stench agents have been identified and adopted and required investment completed to reduce the sulphur content of the propane and butane used to produce autogas. However it is not currently known to the committee whether a reduction of sulphur content at chemical plants generating Autogas as a by product is achievable without significant investment in plant and equipment.

b. **Residue on evaporation**: Do not change the Australian Standard until the Australian Standard AS 1869 has been changed to incorporate a low extractable hose and hoses in the supply chain have been changed to low extractable material.

c. **Residue on Evaporation Test Method**: No change

d. **Test method for water**: specify test method used in EN 589 of 2004

e. **Vapour pressure**: Revise the Australian Standard to incorporate a summer and winter specification with a lower minimum vapour pressure in summer

f. **Sulphur Test method**: include one of the EN methods and install ASTM D6667 as the referee method in the Australian Standard.

g. **Compositional Requirements** – propane, butane , olefins require no change; the Australian Standard is already aligned with EN 589 and composition is controlled by MON and Vapour pressure. The Australian MON at 90.5 minimum is more restrictive than EN 589:2008 at 89.0

h. **Particulate controls** – A requirement for particulate control to protect direct injection fuel pumps is not seen to be necessary.

LPG and Sulphur

The amount of sulphur in Autogas is determined by the quantity of sulphur in the propane and butane components plus the sulphur contained in the ethyl mercaptan used to odorise the Autogas to meet state based safety regulations.

The natural sulphur content of the gas is determined by the source and the sulphur removing processes within the production facility. LPG from a sour gas field will contain higher sulphur levels as will LPG produced from high sulphur sour crude and the resulting LPG products will normally contain higher sulphur contents after treatment.

Because LPG is gas at ambient temperature and pressure the sulphur molecules associated with LPG will be gaseous and of lower molecular weight. Examples are hydrogen sulphide, carbonyl sulphides or Methyl or Ethyl Mercaptan. LPG produced from sweet low sulphur crude oil or

obtained from natural gas fields is naturally low in sulphur although some additional processing may be required to further reduce sulphur and remove hydrogen sulphide.

LPG is typically odourless and this poses safety issues with regard to leak detection and prevention of explosions so it is a requirement of gas regulations that the gas must be detectable at 1/5th of the lower explosive limit at the consumer. It is accepted that this can be achieved by the addition of a sulphur compound – Ethyl Mercaptan- at 25mg/kg at the supplier's facility.

Industry experience has shown that Ethyl Mercaptan is subject to fade in the distribution system due to reactions with iron scale and that typically about 33% of the active mercaptan can be lost during distribution. Suppliers will take this account when dosing the gas and the typical dose rate of Ethyl Mercaptan at the supplier can be higher than 35 mg/kg.

The requirement to have gas detectable at 20% the lower explosive limit (LEL) is stipulated in state gas regulations for safety reasons and one state stipulates that only Ethyl Mercaptan shall be used.

25 mg/kg of Ethyl Mercaptan is equivalent to adding 13 mg/kg of Sulphur to the LPG, a higher dose of odourant to allow for fade during distribution can increase the Sulphur contribution to 26 mg/kg or more.

The ability to meet lower sulphur limits in autogas is therefore governed by the amount of processing required to reduce the natural sulphur content, the source of the gas and what contract specifications govern the composition of the gas, the type of odorant used and the accuracy of the systems used to control the odorant injection facilities.

Detailed Response to Discussion Paper Items

1. Amendment to Sulphur Content

a. Reduction to 50 mg / kg maximum

The majority of Committee members agree that a reduction to a 50 mg/kg sulphur maximum limit including odorant is feasible but it requires a review by some suppliers of current commercial contracts in relation to supplies of chemical grade LPG and a review of odorant dosing facilities at some sites.

It is not currently known to the Committee whether a reduction of sulphur content at chemical plants producing Autogas LPG as a by product is achievable without significant investment in plant and equipment. This will mean that the proposed date of 1 June 2010 for the implementation of the standard is not achievable and it is felt that a more appropriate date would be 1 June 2011.

Currently the Committee is of the view that the reduction in sulphur will contribute no practical vehicles emission benefits for dual fuel vehicles but may be of relevance to dedicated gas versions in the future and may enable the development of specific dedicated LPG exhaust emission control technology. At such time the specification should be reviewed so that product is available in the market place when required.

It is recommended that any reduction in normal odorant levels should be done in consultation with State domestic gas regulators to allow for the fact that in some areas domestic LPG and Autogas can be the same product.

b. Reduction to 10 mg/kg maximum and alternative odorants

Reducing the sulphur level to less than 10 mg/kg including odorant requires the LPG producers to find and alternative non-sulphur odorant for use in both the domestic gas and automotive gas industries plus investment in facilities to reduce the natural sulphur content of the LPG components with a resultant increase in production costs.

Although alternative non-sulphur odorants have been identified overseas, a survey of these odorants identified health and safety issues greater than those encountered with Ethyl Mercaptan.

Additionally the potential for reactivity with fuel system components and stability has not been assessed, as a result Ethyl Mercaptan is still the most widely used odorant and the committee is not aware of any country that is proposing to replace Ethyl Mercaptan.

The introduction of a new non-sulphur odorant to the domestic and automotive LPG markets would require a significant amount of evaluation and trials in conjunction with a consumer education program and a change in gas regulations in at least one state. A non-sulphur odorant would help the process but meeting a 10 mg/kg sulphur limit would impose significant costs on the industry and these have been currently estimated at about US$ 50 Million per refinery operating In Australia.

2. Residue on Evaporation Limit

Residue in Autogas was identified as a significant quality issue when the Autogas standard was originally drafted but at that time there was little information on the source of the residue. Since that time work on LPG residue in vehicles has identified that the majority of residue deposits originate from rubber hoses in contact with the fuel.

The current LPGA specification for autogas includes a maximum residue of 20 mg/kg at the initial supply point which is comfortably within the current EN 589 specification of 60 mg/kg. However a limit of 60 mg/kg cannot be guaranteed to consumers at a retail level until a standard for low extractable dispenser hose has been implemented.

The interaction between fuel hose extractables and autogas has been extensively covered in a report by the Department of Consumer and Employment Protection (DOCEP) in Western Australia and this report includes a test for determining the extractable level called the Appendix N test which includes limits for vehicle fuel hoses and identifies which are low extractable hoses.

A copy of the Prohibition Notice as published in the *Government Gazette* and the Energy*Safety* Report including the Appendix N test may be viewed and downloaded from the Energy*Safety* website at www.energysafety.wa.gov.au

The website contains a list of equipment / vehicle hoses that meet the specification in the Appendix N test. It is felt that this process could be applied to retail dispenser hoses and that hoses that meet an acceptable pass by this test could be listed on the site.

a. Summer 1 November to 31 March inclusive:

1. Maximum Vapour Pressure is 1530 kPa at 40 deg C
2. Minimum Vapour Pressure is 700 kPa at 40 deg C

b. Winter 1 April to 31 October inclusive:

1. Maximum Vapour Pressure is 1530 kPa at 40 deg C
2. Minimum Vapour Pressure is 800 kPa at 40 deg C

The minimum vapour pressure in winter will ensure adequate vaporisation during the colder months and in the colder areas.

The lower vapour pressure in summer will enable the blending of more butane into Autogas which would provide an outlet for a fuel which is currently flared or exported and will benefit the local economy.

Any move to widen the vapour pressure range of fuel in the market will be made with consideration to the possible impact on vehicle operability.

6. Compositional Constraints

The discussion paper raises the question as to whether compositional limits such as propane, butane and olefin limits need to be included in the Australian Standard. The issues cited in the paper include:

a. future LPG technologies that enable the use of higher compression ratios to be used and controlling composition e.g. olefins, dienes is required so that RON and MON are not lowered to the point where destructive knock could occur

b. lower olefin is required to avoid injector clogging.

The current standard , as does EN 589:2008 , controls composition via the VP and MON specifications with the Australian MON of 90.5 minimum being more stringent than EN 589.

In addition both standards include a specification limit on dienes for occupational health and safety reasons. The Australian standard of 0.3 mg/kg is more stringent than the EN 589 which is 0.5 mg/kg.

Addressing specific issues raised above:

a. octane number – if the constraint is octane then this should be specified rather than include compositional constraints;

b. injector clogging - the reported connection between olefin levels and combustion chamber deposits and injector clogging was established with work on petrol engines where there is a link with high olefin contents in petrol.

   The mechanism for such deposit formation in petrol is the formation of peroxides due to the reaction between di-olefins, the peroxides then polymerise to form high molecular weight gums causing deposit formation. Autogas systems are sealed so the fuel is not exposed to air so the polymerisation reactions required to produce deposits do not proceed.

   It is suggested that the potential for injector clogging in LPG direct injection systems or valve deposits in port LPG injection systems will be determined by the residue test and is a function of fuel system elastomer compatibility.

The LPG Fuels Quality Standards Committee supports the current position of not specifying olefin levels in the Autogas Standard in alignment with EN 589.

7. Other Test Methods - Sulphur

The current standard cites ASTM D2784 as the referee test method. This method requires the laboratory to burn LPG in a hydrogen and oxygen atmosphere with its associated safety issues. Most laboratories use ASTM D6667 which is the EN 589 referee method or ASTM D 3246.

The Committee recommends that ASTM D6667 be made the referee method.

8. Particulates

A recent survey of retail autogas indicated that autogas particulate levels are similar to petrol and that typical particulate sizes were in the range 1 to 5 micron. It is more appropriate to control this issue through the fuel dispenser.

The Committee does not consider that a particulate specification is required.

LPG Australia wishes to thank DEWHA for the opportunity to review and make comment on the LPG (Autogas) Fuel Quality Standard.

Garry Whitfield

Chairman – LPG Australia Fuel Quality Standards Technical Committee

31 March 2010

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