

Committee of Experts on the Transport of Dangerous Goods and on the Globally Harmonized System of Classification and Labelling of Chemicals

Sub-Committee of Experts on the Transport of Dangerous Goods

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Item 3 of the provisional agenda

Listing, classification and packing

Present and future products in the LPG industry - Addition of a new special provision to UN numbers UN 1075 and UN 1965

Submitted by the World LPG Association (WLPGA)

Executive summary:	<p>The LPG industry introduced into the market a few years ago, bio-LPG i.e. LPG (C3/C4) of identical molecular composition with conventional LPG, but of bio/renewable origin. However, the existing definitions and UN numbers of LPG, described as a “petroleum” product, do not reflect any more either the renewable origin of bioLPG, or the conventional LPG extracted from Natural Gas.</p> <p>In addition, today, other molecules with similar physical properties like renewable Dimethyl Ether (DME), blended with LPG (and also as stand-alone product), are already present in the US market and expected to be also in Europe and other markets very soon.</p> <p>Document ST/SG/AC.10/C.3/2022/53 and informal document INF.23 were discussed during the sixty-first session and the preferred option was for a new a new special provision (SP) to be added to UN 1075 and UN 1965.</p> <p>This proposal is separate from and not linked to the proposal to create a new UN number for hydrocarbon and DME blends.</p>
Action to be taken	<p>Informal exchange of views on a new SP in Chapter 3.3.1 and referencing that SP against the entries for UN 1075 and UN 1965 in the Dangerous Goods List in Chapter 3.2.</p>
Related documents:	<p>ST/SG/AC.10/C.3/2022/53, UN/SCETDG/61/INF.23, UN/SCETDG/63/INF.19 – with details of the supporting research and testing that has been undertaken by the WLPGA</p>

I. Background

1. Liquefied Petroleum Gas (LPG) has been a commercial fuel for just over a century. It consists of mostly propane and butane, produced until a few years ago through only:

(a) Petroleum refining (covered by existing definitions and UN numbers), currently meeting 30-40% of world demand and decreasing.

(b) Natural Gas (NG) processing (not covered by one existing UN number, which refers only to “petroleum”), currently meeting 60-70% of world demand. However, the LPG

industry has been applying for both cases, the same UN number (UN 1075) as that for the “petroleum” originated products.

Today, in the context of energy transition and aiming at decarbonisation and de-fossilisation, and reduction of the overall carbon footprints, the LPG industry is transforming itself, by including also in its product range, the same propane C³H⁸ and butane C⁴H¹⁰ products, but of bio/renewable/recycled origin and gradually moving away from product originating from both, petroleum refining and extraction from natural gas. These two current sources are being replaced by bio/renewable/recycled and non-fossil supplies.

In addition, the LPG industry, started recently (in the USA) to include in its offerings other products and blends of molecules of bio/renewable/recycled origin of lower carbon footprint. More specifically, such an example is the inclusion of renewable or recycled carbon Dimethyl Ether (DME), as a blend component, or as a standalone fuel. DME is a molecule with similar physical properties to LPG, that can originate from fossil, non-fossil and/or renewable or recycled carbon sources. The renewable or recycled carbon DME, is a complementary liquid gas that can be produced from multiple renewable/recycled carbon feedstocks. Being a safe and clean-burning fuel, it is a viable sustainable addition to the energy mix. With its low greenhouse gas (GHG) footprint, it can reduce emissions by up to 85% compared to fossil fuel alternatives. In both its pure and blended form, it can help the decarbonisation and de-fossilisation of the LPG industry in all types of applications as it can be highly compatible with the existing LPG infrastructure and equipment, either with no modifications or only minor modifications.

- DME (UN 1033) has the same classification code as LPG (2F), the same label (2.1) and identical hazards.
- Its vapour pressure is approximately midway between that of butane and propane, almost the same as a 50/50 mix of butane and propane. Blending will have the effect of reducing the vapour pressure of propane rich mixtures and increasing the vapour pressure of butane rich mixtures, but only by small amounts, even when added at the maximum percentage mass set out in this proposal.
- As DME has a higher liquid density than both butane and propane, there will not be any negative effect on filling ratios.
- Calculations have been undertaken on the required flow capacity for safety valves (pressure relief valves) and those calculations show that if the safety valves are sized for LPG, they will have also the correct (conservative) flow capacity for DME/LPG blends (and unblended DME).
- The thermal expansion ratios of DME and LPG are almost the same.

The above-mentioned blends, constitute new product offerings, and like any other new commercial fuel in general, they need to be assigned to a UN number that reflects them correctly.

2. For several years, there have been products transported, that did not completely correspond to the UN number used, like the two examples below, and there will be more coming in the future that will fall in these categories:

- The bio-LPG (renewable LPG from biological or recycled carbon feedstock) available today in many European markets, is in some areas transported under UN 1075, however that is “Petroleum Gases, liquefied” and although the bio-LPG is identical to the fossil LPG, it is not a petroleum gas. Bio-LPG can exist as standalone product or as blend with fossil LPG.
- LPG blends with DME (commercialised many years ago in some countries outside Europe (e.g. China, Indonesia etc.), do not have a specific UN number and therefore should be assigned to UN 3161 (Flammable Gases, Liquefied, NOS), however that is a general UN number.

3. The emergency services instantly recognise UN 1075 and UN 1965 and know the dangers and required actions. However, if industry transports DME/LPG blend as UN 3161 Flammable Liquefied Gas, NOS, for some period of time, there may be a delay whilst the

required emergency actions for UN 3161 are confirmed at the time of an incident. There is also the problem with placarding and labelling on tanks, tankers and cylinders which could alternate between LPG and renewable/recycled carbon DME/LPG blends, which is easier with tanks and tankers, but not as easy with cylinders.

4. Permitting the addition of up to 12% of renewable/recycled DME (by mass) to LPG assigned to UN Nos. UN 1075 or UN 1965 will have no effect on safety in the transport chain. WLPGA have undertaken a large degree of testing on non-metallic and certain metallic materials that are used in the LPG industry, but not listed as being suitable for use with both LPG and DME in either standards ISO 11114-1 or ISO 11114-2. Informal document UN/SCETDG/63/INF.19 provides further information on the testing undertaken by the WLPGA.

5. All of the testing undertaken by the WLPGA and other test facilities in India, Japan, USA, etc. shows that blends of 20% DME (by mass) with LPG has no negative effects on the materials used in the transport and storage chain – this allows our proposed maximum percentage to be used with at least a 50% safety factor. In many countries/regions (Australia, Europe, Japan, North America) consumer equipment is also suitable; however, it has been identified that in some country's elastomers have been used for domestic consumer equipment that are only suitable lower ratio blends. Existing controls, such as those preventing the use of butane in propane devices, shall enable markets which use unsuitable elastomeric materials in consumer equipment to ensure that the DME content is appropriately managed.

6. However, in the same way as different grades of LPG can cause danger (for example if propane is used in a butane appliance), this can be controlled on a local basis in the same way that motor spirit or gasoline or petrol with up to 10% ethanol can still be assigned to UN 1203, but it is not suitable for all spark ignition engines.

Also, it should be noted, that even today and current definitions, mixtures of gases that are completely unsuitable for use as LPG can still be assigned to UN 1075 or UN 1965, for example with high percentage of ethane or propylene.

7. The Sub-Committee in its 61st session welcomed the initiative of the LPG industry to offer, in the context of circular economy and the sustainable use of natural resources, a solution to reduce the overall carbon footprint and it was agreed that more research and data was needed on the percentage of dimethyl ether (DME) blended with LPG, including the results on the compatibility of DME with material used for tanks, cylinders and their sealings. The Sub-Committee agreed to resume consideration of this subject at its next session, based on new documents by World LPG Association and Liquid Gas Europe, including the outcome of their research work, if possible. This research and collection of more data on the percentage of dimethyl ether (DME) blended with LPG has now been done.

II. Proposal

8. Amend the Dangerous Goods List in 3.2.2 as follows:

UN No.	Name and description	Class or division	Subsidiary hazard	UN packing group	Special provision
(1)	(2)	(3)	(4)	(5)	(6)
1075	PETROLEUM GASES, LIQUEFIED	2.1			392, XXX
1965	HYDROCARBON GAS MIXTURE, LIQUEFIED, N.O.S.	2.1			274, 392, XXX

9. Add a new special provision 'XXX' in 3.3.1 as follows:

XXX This substance may contain hydrocarbon gases from non-petroleum sources and may also contain up to 12% by mass of UN 1033 DIMETHYL ETHER. When UN 1033 DIMETHYL ETHER is present in the substance its percentage by mass shall be included with the technical name.

III. Safety implications

10. No safety implications are foreseen from the proposal. The LPG industry has the opinion that safety in the transport of the proposed LPG/DME blend will not be affected or changed compared to conventional LPG. See Annex (below) for the pressure temperature curves for DME, butane, propane and butane/propane mixtures.

Annex

Pressure Temperature Curves for DME, Butane, Propane and Butane/Propane Mixtures

