

## Economic Commission for Europe

### Inland Transport Committee

#### Working Party on the Transport of Dangerous Goods

Joint Meeting of the RID Committee of Experts and the

Working Party on the Transport of Dangerous Goods

1 September 2022

Geneva, 12-16 September 2022

Item 5 (b) of the provisional agenda

**Proposals for amendments to RID/ADR/ADN:  
new proposals**

### Revised definition of Liquefied Petroleum Gas - Informal exchange of views

Transmitted by Liquid Gas Europe

#### Summary

<b>Executive summary:</b>	<p>Several years ago, the LPG industry introduced bioLPG i.e. LPG (C3/C4) of identical molecular composition, but of bio/renewable origin. However, the existing definition of LPG in ADR, described as a “petroleum” product, does not reflect any more either the renewable origin of bioLPG, or the conventional LPG of natural gas origin.</p> <p>In addition, other molecules, blended with LPG, like dimethyl ether (DME), particularly that of renewable origin (rDME), are already present in the US market and are expected in Europe very soon.</p> <p>A revised definition of LPG needs to be defined and agreed.</p>
<b>Action to be taken</b>	<p>Informal exchange of views on the revised definition for LPG, ready for the preparation of a formal detailed proposal for the Spring session.</p>
<b>Related documents:</b>	<p>n.a.</p>

### Background

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

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

(b) **Natural Gas (NG) processing** (often not covered by existing definitions that refer only to “petroleum”, although the industry had been applying the same regulations/standards as for “petroleum” origin products): currently meeting 60-70% of world demand.

2. Today, in the context of energy transition and aiming at defossilisation, decarbonisation and reduction of overall carbon footprints, the LPG industry is transforming by including within its product range, propane C<sup>3</sup>H<sup>8</sup> and butane C<sup>4</sup>H<sup>10</sup> products, of bio or

renewable origin. These are being introduced as the industry gradually moves away from petroleum refining and natural gas to non-fossil and renewable sources.

3. The RID/ADR/ADN regulate the safe carriage of these products and as such their origin, where historically referenced, is no longer relevant or correct.

4. Besides the sources of LPG in (a) and (b) above, a third possible origin of the product is missing from the definition and needs to be introduced i.e.:

**(c) from bio/renewable/recycled feedstocks (not covered by existing definition)**

The introduction of **(c)** is referring to the production of a fuel that is chemically identical from bio/renewable/recycled feedstocks (which has absolutely no impact on the properties of the fuel) and has no impact or effect on its safe transportation, storage and use.

5. In addition, the LPG industry, recently started including other products and blends of bio/renewable/recycled origin that are of a lower carbon footprint within its offerings. More specifically is the inclusion of DME (Dimethyl Ether), as a blend component with LPG. DME is a molecule with similar physical properties to LPG, that can originate from fossil, non-fossil and/or renewable or recycled sources. The renewable DME (rDME), is a complementary liquefied gas that can be produced from multiple renewable/recycled feedstocks. With no negative safety implications, rDME is a cost-effective and clean-burning fuel, providing 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 its blended form with LPG, rDME can help the de-fossilisation of the LPG industry in all types of applications. DME/LPG blends with a maximum DME content by mass of XX%\* are compatible with existing LPG infrastructure and equipment.

6. DME has the same classification code as LPG (2F), the same label (2.1) and an identical Hazard Identifications Number (HIN) 23.

7. A DME/LPG blend constitutes a revised product offering and requires a revised definition and specification.

8. In reality, already for a number of years, there have been a variety of offerings in the Global market, that do not correspond well to the current international regulatory and standards definitions, like the examples below, and there will additional future offerings that will fall into these categories:

(a) The bioLPG (renewable LPG from biological or recycled feedstock) available today in many European markets, is not of petroleum origin as the current LPG definition describes. This product exists as standalone bioLPG or as blend with fossil LPG;

(b) The LPG blends with DME (commercialised many years ago in some countries outside Europe (e.g. China, Indonesia etc.), do not have a specific name and associated definition in regulations and standards. Recently, a blend of propane with renewable DME (rDME) was made available in the US market. Such a blend will soon be available on the European market also.

9. The proposal below, includes an amendment of the existing definition of “LPG” (to continue to be primarily composed of C<sup>3</sup>/C<sup>4</sup>) to:

(a) allow products from renewable sources (i.e. delete all “petroleum” references) and also;

(b) allow the inclusion of DME (C<sup>2</sup>H<sup>6</sup>O) in small quantities up to a drop-in level XX%\* blend/composition i.e. the level at which the resulted LPG/DME(rDME) blend will be interchangeable with today’s conventional C<sup>3</sup>/C<sup>4</sup> LPG, without any reduction in safety or the need for any changes in supply chain infrastructure, equipment and appliances.

10. A formal paper (ST/SG/AC.10/C.3/2022/53) has been submitted to the UN TDG Sub-Committee for the November/December meeting, with the amendments of the definitions of:

- UN 1075 – “Petroleum gases, liquefied or Liquefied petroleum gas” to be amended to read “[Petroleum gases, liquefied or molecular identical gases from renewable sources, may also include up to XX%\\* by mass of DME](#)”

- UN 1965 – “Hydrocarbon gas mixtures, liquefied, N.O.S.” to be amended to read “Hydrocarbon gas mixtures, liquefied, N.O.S., may also include up to XX%\* by mass of DME”

The following related UN numbers do not require an amendment: UN 1011 – “Butane”, UN 1969 – “Isobutane”, UN 1978 – “Propane”.

## Proposal

11. Amend in the RID/ADR all existing names, definition and references of LPG (Liquefied Petroleum Gas) to exclude any references to “Petroleum” ie

- (a) Amend 1.1.3.2 Liquefied Petroleum Gas (LPG) to read only: “LPG”.
- (b) Amend in 1.2.1 the definition of LPG from “Liquefied Petroleum Gas (LPG) is.....” to read “LPG is a low-pressure liquefied gas, from either fossil, non-fossil and/or renewable or recycled sources, composed of propane and/or butane or mixtures of the two, which can also include DME (UN 1033) up to XX%\* by mass, as well as one or more other light hydrocarbons such as propene (propylene), isobutane, isobutylene, butene (butylene) which are assigned to UN Nos. 1011, 1012, 1055, 1075, 1965, 1969 or 1978 with traces of other hydrocarbon gases”.
- (c) P200 - All amendments will be detailed in a formal document to be submitted to the Spring 2023 session.
- (d) All other amendments will be detailed in a formal document to be submitted to the Spring 2023 session.

\* **Note:** The quantity XX% of DME, i.e. the drop-in level of DME in the LPG/DME blend, allowing full compatibility with existing LPG infrastructure equipment and appliances, without any impact to safety, is expected to be in the range of 10% to 20%. Ongoing research has already confirmed full compatibility at 10% by mass, and this figure is expected to increase with the completion of the research work. This will be firmly defined and formally submitted for the March 2023 session of the RID/ADR/ADN Joint Meeting and the July 2023 session of the UN TDG session for the amendment of the UN numbers.

## Annex

A preliminary copy of the formal document (ST/SG/AC.10/C.3/2022/53) that has been submitted to the UN TDG Sub-Sommittee for the November/December 2022 session is reproduced below.



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**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****Sixty-first session**

Geneva, 28 November-6 December 2022

Item 3 of the provisional agenda

**Listing, classification and packing****Present and future products in the LPG industry,  
amendment of UN Numbers, discussion points and proposals****Submitted by the World LPG Association and Liquid Gas Europe\****Summary*

**Executive summary:** The LPG industry introduced into the market a few years ago, bioLPG ie 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.

In addition, today, other molecules like renewable Dimethyl Ether (rDME), 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.

Some existing UN numbers need to be re-defined to reflect also the new products.

**Action to be taken** Informal exchange of views on the UN numbers for these new products, in preparation of a formal detailed proposal in the next session.

**Related documents:**

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\* A/75/6 (Sect.20), para. 20.51

## Background

1. Liquefied Petroleum Gas (LPG) has been a commercial fuel for just over a century. It consists of mostly propane and butane, supplied 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 the same UN number (UN 1075) as that for the “petroleum” originated products.
2. Today, in the context of energy transition and aiming at de-fossilisation, decarbonisation and reduction of the overall carbon footprints, the LPG industry is transforming, by including also in its product range, the same propane C<sup>3</sup>H<sup>8</sup> and butane C<sup>4</sup>H<sup>10</sup> products, but also those 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 non-fossil and bio/renewable supplies.
3. In addition, the LPG industry, started recently (in the US) to include in its offerings other products and blends of bio/renewable/recycled origin of lower carbon footprint. More specifically, such an example is the inclusion of renewable DME (Dimethyl Ether), 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 sources. The renewable DME (rDME), is a complementary liquid gas that can be produced from multiple renewable/recycled 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 pure and blended form, rDME can help the de-fossilization of the LPG industry in all types of applications. It is highly compatible with the existing LPG infrastructure and equipment.
4. DME (UN 1033) has the same classification code as LPG (2F), the same label (2.1) and identical hazards.
  - The vapour pressure of DME is approximately midway between that of butane and propane, almost the same as a 50/50 mix of butane and propane. That 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 when added at the maximum XX%\* mass set out in this proposal.
  - 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 flow capacity for DME/LPG blends (and unblended DME).
  - The thermal expansion ratio’s of DME and LPG are almost the same.
5. The above mentioned, 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.
6. For a number of years, there have been products transported, that did not completely correspond to the UN number used, like the example below, and there will be more coming in the future that will fall in these categories:
  - The bioLPG (renewable LPG from biological or recycled feedstock) available today in many European markets, is in some areas transported using the number UN 1075, however that is “Petroleum Gases, Liquefied” and although the bioLPG is identical to the fossil LPG, it is not a petroleum gas. BioLPG can exist as standalone product or as blend with fossil LPG.
  - LPG blends with DME (commercialised many years ago in some countries outside Europe (eg 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.

7. As DME has the same classification, labelling and hazards as LPG, permitting the addition up to XX%\* of rDME (by mass) to LPG assigned to UN Nos. UN 1075 or UN 1965 will have no effect on safety.

8. The emergency services instantly recognise UN 1075 and UN 1965 and know the dangers and required actions. However, if industry transports the rDME/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. There is also the problem with placarding and labelling on tanks, tankers and cylinders which could alternate between LPG and rDME/LPG blends, which is easier with tanks and tankers, but not as easy with cylinders.

## Currently

- UN 1075 is “Petroleum Gases, Liquefied”, that needs to be amended to include renewable sourced LPG and also the addition of a “drop-in” level quantity of DME/rDME.
- UN 1965 is “Hydrocarbon Gas Mixtures, Liquefied, NOS”, also needs the addition of a “drop-in” level quantity of DME/rDME

## Proposal

9. Amend the Dangerous Goods List in 3.2.2 as follows –

UN 1075	PETROLEUM GASES, LIQUEFIED <u>or molecular identical gases from renewable sources, may also include up to XX%* by mass of DME</u>
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10. Amend the Alphabetical Index of Substances and Articles in Appendix A as follows:

PETROLEUM GASES, LIQUEFIED or molecular identical gases from renewable sources, may also include up to XX%\* by mass of DME      2.1      1075

11. Amend the Dangerous Goods List in 3.2.2 as follows –

UN 1965	HYDROCARBON GAS MIXTURE, LIQUEFIED, N.O.S., <u>may also include up to XX%* by mass of DME</u>
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12. Amend the Alphabetical Index of Substances and Articles in Appendix A as follows:

HYDROCARBON GAS MIXTURE, LIQUEFIED, N.O.S. such as mixtures A, A01, A02, A0, A1, B1, B2, B or C, may also include up to XX%\* by mass of DME      2.1      1965

\* **Note:** The quantity XX% of DME, ie the drop-in level of DME in the LPG/DME blend, allowing full compatibility with existing LPG infrastructure equipment and appliances, without any impact to safety, is expected to be in the range of 10% to 20%. Ongoing research has already confirmed full compatibility at 10% by mass, and this figure is expected to increase with the completion of the research work. This will be firmly defined and formally submitted for the June/July 2023 meeting for final approval.

## Safety implications

13. 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.

## Annex I

### Pressure temperature curves for DME, butane, propane and butane/propane mixtures

