United Nations ST/SG/AC.10/C.3/2022/26

Secretariat

Distr.: General
13 April 2022

Original: English

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

Sixtieth session
Geneva, 27 June-6 July 2022
Item 5 (b) of the provisional agenda
Transport of gases: limited quantities for division 2.2

Increase of the limited quantity volume for Division 2.2 compressed gases

Submitted by the Council on Safe Transportation of Hazardous Articles (COSTHA)*

Introduction

1. In this document COSTHA proposes to increase the limited quantity volume for Division 2.2 gases, without subsidiary risks consistent with the current provisions in special provision (SP) 653 of the annexes to the Agreement concerning the International Carriage of Dangerous Goods by Road (ADR).

2. There have been numerous informal and official documents related to this proposal, including:

(a) ST/SG/AC.10/C.3/2018/16

(b) ST/SG/AC.10/C.3/2018/17

(c) ST/SG/AC.10/C.3/2019/61

(d) ST/SG/AC.10/C.3/2020/54

(e) ST/SG/AC.10/C.3/2021/26

3. As previously stated, the Model Regulations authorize the transport of Division 2.2 gases without subsidiary hazards to be transported in quantities not exceeding 120 ml per inner packaging and 30 kg per outer packaging. According to the Guiding Principles, the rationale behind limited quantity provisions is that selected dangerous goods packed in small quantities and in strong, robust packaging pose a lesser risk in transport than do the same goods packed in larger volumes, and on this basis some relief from specific requirements such as danger labels is acceptable.

4. The above-referenced proposals and supporting documentation were initially focused on the safe transport of UN 1013, Carbon Dioxide. However, comments provided during

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

discussions asked to expand the scope of the proposal to any appropriate Division 2.2 gas without a subsidiary risk. Currently, ADR SP 653, states:

> *"653 The carriage of this gas in cylinders having a test pressure capacity product of maximum 15.2 MPa.litre (152 bar.litre) is not subject to the other provisions of ADR if the following conditions are met:*
>
> - *The provisions for construction and testing of cylinders are observed;*
> - *The cylinders are contained in outer packagings which at least meet the requirements of Part 4 for combination packagings. The general provisions of packing of 4.1.1.1, 4.1.1.2 and 4.1.1.5 to 4.1.1.7 shall be observed;*
> - *The cylinders are not packed together with other dangerous goods;*
> - *The total gross mass of a package does not exceed 30 kg; and*
> - *Each package is clearly and durably marked with "UN 1006" for argon compressed, "UN 1013" for carbon dioxide, "UN 1046" for helium compressed or "UN 1066" for nitrogen compressed. This mark is displayed within a diamond-shaped area surrounded by a line that measures at least 100 mm by 100 mm."*

5. During the previous discussions several experts indicated that they were supportive of addressing provisions for limited quantities for Division 2.2 gases. Much of the remaining concern from the participants was related to ensuring that any limited quantity exceptions included pressure limits, as with compressed gasses, potential energy was the main concern. Some experts expressed concern that the increased limited quantity provisions should not apply for air transport. However, any changes to the air transport regulations in the International Civil Aviation Organisation (ICAO) Technical Instructions are subject to review and agreement by the ICAO Dangerous Goods Panel (DGP) and Air Navigation Commission (ANC).

6. Non-toxic, non-flammable compressed gases, such as Carbon Dioxide (UN 1013), Argon (UN 1006) and other compressed gases with no subsidiary risks are required to be packaged in accordance with packing instruction P200, which is an established packaging regime with a proven transport history. Shipments of compressed gases according to ADR SP 653 has provided a history of safe shipments of these 2.2 compressed gases, with volumes greater than the existing limited quantity limitations (120 ml). The increase in the limited quantity volume for these commodities is supported by the inclusion of SP 653 in the ADR, and the issuance of similar authorizations by the United States Department of Transport (US DOT-SP 20796 and DOT-SP 20936) and Transport Canada (TU0715) through their regulatory approval processes. Currently, SP 653 requires a mark that consists of a 100 mm by 100 mm diamond mark, with the appropriate UN number inside. COSTHA has received comments in particular from Transport Canada and specific carriers that this mark is awkward and confusing since it only applies for four gases, is consistent with the predecessor of the current limited quantity (LQ) mark and is unique to this special provision. This proposal is in line with ADR SP 653, but requires the LQ marking which we believe would provide greater safety conditions and result in less confusion and complications for training dangerous goods employees including drivers of transport vehicles.

7. The limited quantity limits for aerosols and gas receptacles other than those that contain toxic gases are 1000 ml / 30 kg in accordance with SP 277. Consistent with a previous comment from Canada, aerosols and gas receptacles containing a Division 2.1, 2.1(8), and 2.2(8) all have a limited quantity limit of 1000 ml. Cylinders do contain a higher pressure, but cylinders are significantly more robust than aerosol cans. We are aware of one company safely shipping millions of CO_2 cylinders across Europe under SP 653 and under similar authorization through approvals in Canada and the United States of America (USA).

8. COSTHA believes that the addition of a special provision for these gases, that would allow the LQ exception for cylinders up to 152 bar litre test pressure as allowed in ADR SP 653, would be appropriate. In addition, it is not proposed to amend the limited quantity values for the Division 2.2 articles because exceptions for these are addressed through specific special provisions.

9. During the past discussions some members of the Sub-Committee have expressed reservations on this proposal. Our position is that this topic represents an area where the existing regulations are overly burdensome. The Model Regulations are quite mature and represent the baseline for the safe transport of dangerous goods. However, there are areas of the regulations that have commonly been granted relief from, and those areas should regularly be reviewed to determine whether they are too conservative and hindering the flow of commodities. It is the position of COSTHA that this is a representative example of where the existing regulations are burdensome and an area where data can be compiled and precedent set to review other related commodities for appropriate safety conditions. The fact that (i) the ADR has a special provision which reduces the regulatory burden for this activity and (ii) Canada and the USA have similar exemptions provides evidence that these commodities are possibly over-regulated and an amendment to the existing regulatory language is appropriate. This is further supported by millions of shipments of UN 1013 Carbon Dioxide shipped under SP 653 and the associated Canadian and US exemptions, without any significant incidents.

Proposal

10. COSTHA proposes to add in 3.3 the following special provision (XXX) to be authorized for the gases listed in Annex I of this document:

In 3.2 Dangerous Goods List, increase the limited quantity limit (column 7A) for Division 2.2 compressed gases, with no subsidiary hazards, from 120 ml to 1,000 ml.

"XXX The carriage of this gas in cylinders having a test pressure capacity product of maximum 152 bar may be transported as LQ in accordance with Chapter 3.4, if the following conditions are met:

(a) The provisions for construction and testing of cylinders are observed;

(b) The cylinders are contained in outer packagings, which at least meet the requirements of Part 4 for combination packagings. The general provisions of packing of 4.1.1.1, 4.1.1.2 and 4.1.1.5 to 4.1.1.7 shall be observed;

(c) The cylinders are not packed together with other dangerous goods; and

(d) The total gross mass of a package does not exceed 30 kg;

(e) The gas within the cylinder is a Division 2.2 with no subsidiary risks. Liquified or refrigerated gases are not authorized under this special provision."

11. As an alternative COSTHA is open to limiting the proposal to only the four gases addressed in SP 653 of ADR if most experts favour doing so. In Annex I, the four gases are highlighted.

Annex I

List of Division 2.2, compressed gases under consideration for 1000 ml Limited Quantity limit

1002 AIR, COMPRESSED

*1006 ARGON, COMPRESSED **

*1013 CARBON DIOXIDE **

*1046 HELIUM COMPRESSED **

*1066 NITROGEN COMPRESSED **

1056 KRYPTON, COMPRESSED

1065 NEON, COMPRESSED

1066 NITROGEN, COMPRESSED

1080 SULPHUR HEXAFLUORIDE

1952 ETHYLENE OXIDE AND CARBON DIOXIDE MIXTURE with not more than 9% ethylene oxide

1956 COMPRESSED GAS, N.O.S.

1968 INSECTICIDE GAS, N.O.S.

1973 CHLORODIFLUOROMETHANE AND CHLOROPENTAFLUORO-ETHANE MIXTURE with fixed boiling point, with approximately 49% chlorodifluoromethane (REFRIGERANT GAS R 502)

2036 XENON

2455 METHYL NITRITE

3070 ETHYLENE OXIDE AND DICHLORODIFLUORO-METHANE MIXTURE with not more than 12.5% ethylene oxide

3297 ETHYLENE OXIDE AND CHLOROTETRAFLUORO-ETHANE MIXTURE with not more than 8.8% ethylene oxide 2

3298 ETHYLENE OXIDE AND PENTAFLUOROETHANE MIXTURE with not more than 7.9% ethylene oxide

3299 ETHYLENE OXIDE AND TETRAFLUOROETHANE MIXTURE with not more than 5.6% ethylene oxide

**** These are the gases authorized according to SP 653 in ADR***

Annex II

History of RID/ADR/ADN special provision 653

Introduction

1. In 2001, the Government of Austria initiated a multilateral agreement M114 intended to allow the carriage of carbon dioxide in conditions less stringent than those of ADR to simplify the carriage of small cylinders with a capacity up to 0.5 litre for the preparation of soda water, and to allow carriage in packagings suitable for delivery services to private persons and organizers of small events. For the conditions for derogation, see the text of M114 or the text reproduced under section A below since the same text was introduced in ADR in 2007.

2. The agreement was signed by Austria, Czech Republic, Germany and Norway, with a date of expiration of 1 January 2006. A corresponding agreement was concluded for rail transport (RID 2002/3).

3. For inland waterways, ADN, concluded in 2000 but entered into force in 2009 only, so no special agreement could be legally envisaged at that time for this mode of transport.

4. As M114 was due to expire on 1 January 2006, Germany prepared a proposal submitted to the RID/ADR/ADN Joint Meeting in 2005 to get this derogation embodied in ADR and RID, see below for the following events.

A. 2007 version

5. The first version of special provision (SP) 653 was introduced in RID/ADR 2007 and read as follows:

> "653 The carriage of this gas in cylinders **with a maximum capacity of 0.5 litres**, is not subject to the other provisions of ADR if the following conditions are met:
>
> - The provisions for construction and testing of cylinders are observed;
> - The cylinders are contained in outer packagings which at least meet the requirements of Part 4 for combination packagings. The general provisions of packing of 4.1.1.1, 4.1.1.2 and 4.1.1.5 to 4.1.1.7 shall be observed;
> - The cylinders are not packed together with other dangerous goods;
> - The total gross mass of a package does not exceed 30 kg; and
> - Each package is clearly and durably marked with "UN 1013". This marking is displayed within a diamond-shaped area surrounded by a line that measures at least 100 mm by 100 mm."

6. The proposal was made by Germany in document TRANS/WP.15/AC.1/2005/53 to reflect the derogations that had been proposed in multilateral agreement M114, initiated by Austria.

7. The justification provided was that, according to 1.1.3.2 of ADR (corresponding to 2.2.2.3 of the UN Model Regulations, except that at that time the reference temperature - now aligned with the Model Regulations - was 15 °C instead of 20 °C), carbon dioxide carried at a pressure less than 200 kPa at 20 °C, and which not liquefied or refrigerated liquefied gas (i.e. completely gaseous), is not subject to the Model Regulations whatever the size of the receptacle or tank is.

8. In such a case, e.g. carbon dioxide contained in gaseous form only at a pressure of less than 2 bar in a 50 litre water capacity cylinder, exempted from the Model Regulations by 1.1.3.2 (UN 2.2.2.3), it could not be excluded that 100 litres of carbon dioxide be released if the valve was not airtight or was improperly closed and consequently could spread rapidly throughout the cargo space of the wagon/vehicle.

9. If such an event was considered as not likely to endanger the health of the participants in the transport operation, i.e. as a risk sufficiently acceptable from the safety point of view to justify the exemption, Germany considered that the effective risk presented by small cylinders of CO_2 should also be assessed by comparison. Germany stated that small cylinders of carbon dioxide of 0.5 litres contained 200 litres of gas at 15 °C each, and that it had been estimated whether, if the gas were released in the cargo space of any wagon/vehicle, there would be any reason to fear that the health of the participants would be endangered. It had been concluded that, even under adverse conditions, no concentrations of carbon dioxide would be produced in the cargo spaces of wagons/vehicles that could endanger the health of the driver or the participants in the transport operation.

10. Moreover, in the opinion of the *Bundesanstalt für Materialforschung und Prüfung* (BAM) (Federal Institute for Materials Research and Testing), it could be assumed, depending on the type of valves tested for these carbon dioxide cylinders, that there was an infinitely small probability of a valve ceasing to be airtight during carriage. If the valve of a small carbon dioxide cylinder were not airtight, this would become apparent directly after filling at the filling facility - the filled cylinder would already be empty at the start of carriage - or the airtightness deficiency would be so slight that the quantities of carbon dioxide released over time into the wagon/vehicle would not cause an appreciable increase in the atmospheric concentration of carbon dioxide.

11. Following these explanations, the German proposal was adopted at the autumn 2005 session of the RID/ADR/ADN Joint Meeting, as reflected in paragraph 89 of the session report ECE/TRANS/WP.15/AC.1/100 as reproduced below:

> "Carriage of UN No. 1013 in cylinders up to 0.5 litre
>
> *Document*: TRANS/WP.15/AC.1/2005/53 (Germany)
>
> 89. The proposal to transfer the provisions of the special multilateral agreement M114 and RID 3/2002 to the text of RID/ADR was adopted. The provisions adopted, however, were not included in 1.1.3.2 (g), nor in section 3.4.6 as proposed orally by certain delegations, but in a special 6xx provision in Chapter 3.3 (see annex 2)."

B. 2011 version

12. The text (RID, ADR and ADN) of SP 653 was amended in 2011:

> "653 The carriage of this gas in cylinders **having a test pressure capacity product of maximum 15 MPa.litre (150 bar.litre)** is not subject to the other provisions of ADR if the following conditions are met:
>
> - The provisions for construction and testing of cylinders are observed;
> - The cylinders are contained in outer packagings which at least meet the requirements of Part 4 for combination packagings. The general provisions of packing of 4.1.1.1, 4.1.1.2 and 4.1.1.5 to 4.1.1.7 shall be observed;
> - The cylinders are not packed together with other dangerous goods;
> - The total gross mass of a package does not exceed 30 kg; and
> - Each package is clearly and durably marked with "UN 1013" for carbon dioxide or "UN 1066" for nitrogen, compressed. This marking is displayed within a diamond-shaped area surrounded by a line that measures at least 100 mm by 100 mm"

13. The proposal was submitted by the European Industrial Gases Association (EIGA) and was intended to extend the concept of derogation to small cylinders of compressed nitrogen used in the context of preventive activation of avalanches. The proposal was submitted as document ECE/TRANS/WP.15/AC.1/2007/40 to the Autumn 2007 session of the Joint Meeting but was not discussed at that session. The arguments put forward by EIGA were that, if the small CO2 cylinders were mainly used for carbonating of tap water in private households, for avalanche-airbags small nitrogen cylinders of 0.22 litres, 300 bars were used.

14. According to EIGA, both these gases, CO_2 and nitrogen, were listed as gases of Class 2 under code 1A (asphyxiant compressed gases), in table A of Chapter 3.2 of RID/ADR/ADN (i.e. UN Division 2.2, asphyxiant compressed gas, no subsidiary hazard). (In fact, only nitrogen, compressed is listed as 1A, as CO_2 is listed as 2A, i.e. liquefied, asphyxiant.)

15. EIGA noted that cylinders above 0.5 litre for CO_2 were commonly used. As the size of the small cylinders could vary, it was proposed to exempt small cylinders for gases of Class 2, code 1A, based on the **product of size and test pressure** of the cylinders rather than on the basis of the **capacity** only.

16. The maximum product-litre volume would be 250 bar-litres. For CO_2, this would mean a size of cylinders of up to 1 litre (250 bar-litre for a 250 bar test pressure). For nitrogen it would mean a size of the cylinders up to 0.55 litre (300 bar-litre for a 450 bar test pressure). [The document indicates 300 bar-litre, but 450 X 0.55 results in 247.5, which would be in line with the proposed 250.]

17. In the same document, EIGA proposed also that the maximum mass of each delivery should not exceed 300 kg.

18. The proposal was discussed at the March 2008 session of the Joint Meeting, but EIGA came up with a new proposal in informal document INF.34, abandoning the principle of maximum product of size and test pressure and proposing to keep SP 653 as it was (i.e. only receptacle size limit of 0.5 litre but application of the special provision to compressed nitrogen). The reason is not explained in the report, but as the informal document was issued during the session, it is likely that there was no agreement on the proposed product of 250 litres.bar and that EIGA could live with the 0.5 litre size limit for nitrogen, which was not far from 0.55.

19. The conclusion in paragraph 50 of the report ECE/TRANS/WP.15/AC.1/110 reads as follows:

> "Amendment of special provision 653
>
> Document: ECE/TRANS/WP.15/AC.1/2007/40 (EIGA)
>
> Informal document: INF.34 (EIGA)
>
> 50. The Joint Meeting adopted the amendments to special provision 653 to extend its scope to include small nitrogen cylinders for avalanche airbags (see annex II)."

20. In fact the text adopted was not as proposed in any of the two EIGA proposals, since the Joint Meeting at the end agreed to use the concept of the product of size and test pressure, for both CO_2 and nitrogen, but to allow only a product of 150 bar.litre instead of 250. This seems to be closer to a product of size.test pressure of 0.5 X 250 and may be this is the reason. No condition on the maximum mass of the delivery was included.

***NOTE**: Since this text was adopted in March 2008 but could not become applicable before 1 January 2011 because of the legal procedures of amendments to RID, ADR and ADN, this text was made applicable on the territories of Germany, France and Czech Republic in the interim period through multilateral agreement M195 (ADR).*

C. 2013 version

21. The text (RID, ADR and ADN) was amended once again in 2013 to read:

> "653 The carriage of this gas in cylinders having a test pressure capacity product of **maximum 15.2 MPa.litre (152 bar.litre)** is not subject to the other provisions of ADR if the following conditions are met:
>
> - The provisions for construction and testing of cylinders are observed;
> - The cylinders are contained in outer packagings which at least meet the requirements of Part 4 for combination packagings. The general provisions of packing of 4.1.1.1, 4.1.1.2 and 4.1.1.5 to 4.1.1.7 shall be observed;

- The cylinders are not packed together with other dangerous goods;
- The total gross mass of a package does not exceed 30 kg; and
- Each package is clearly and durably marked with "**UN 1006" for argon** compressed, "UN 1013" for carbon dioxide, "UN 1046" for helium compressed or "UN 1066" for nitrogen compressed. This marking is displayed within a diamond-shaped area surrounded by a line that measures at least 100 mm by 100 mm."

22. This minor change was proposed by Sweden in 2011 (based on document ECE/TRANS/WP.15/AC.1/2011/12).

23. The reason was that the water capacity indicated on many CO_2 small cylinders used in Europe was (according to Chapter 6.2) 0.605 litre (water capacity measured without the safety valve). For these cylinders, the product of the test pressure and the capacity (250 X 0.605) is 151.25 bar.litre, i.e. a little more than the required value of 150 bar.litre. Nevertheless, in practice, once the safety valve is fitted, the water capacity is only 0.595 litre, which leads to a product of 250 X 0.595=148.75 bar.litre, i.e. below the 150 bar.litre limit.

24. This was discussed at the March 2011 session of the Joint Meeting. There was no objection to this proposal. However EIGA had proposed in parallel in informal document INF.15; (i) to extend the scope of special provision 653 to argon and other compressed gases, and (ii) to raise the 150 bar.litre limit to 187.5 to allow a more practicable larger capacity of 0.75 litres. Therefore, Sweden and EIGA were invited to consult themselves and to come back with a new proposal at the next session. This was recorded in paragraph 50 of the report ECE/TRANS/WP.15/AC.1/122, as follows:

"Modification of special provision 653

Document: ECE/TRANS/WP.15/AC.1/2011/12 (Sweden)

Informal document: INF.15 (EIGA)

50. In principle there was no objection to the proposal to increase the test pressure capacity product to 15.2 MPa.litre (from 15 MPa.litre) so as to exempt certain cylinders containing carbon dioxide or nitrogen. However, as EIGA proposed extending the exemption to compressed argon, and as other inert gases could eventually be concerned, the authors of the proposal were invited to hold consultations to prepare a more complete proposal for the next session."

25. Subsequently, at the Autumn 2011 session of the Joint Meeting, EIGA submitted a new proposal ECE/TRANS/WP.15/AC.1/2011/34. It dropped the proposal to increase the limit to 187.5 bar but carried forward the Swedish proposal to raise it to 152 bar for the reasons explained by Sweden, and proposed to extend the scope of SP 653 to argon, compressed and helium, compressed, noting in particular that both gases are inert. This proposal was adopted, as reflected in paragraph 68 of the session report ECE/TRANS/WP.15/AC.1/124, as follows:

"Special provision 653

Document: ECE/TRANS/WP.15/AC.1/2011/34 (EIGA)

68. The proposals by EIGA to apply special provision 653 also to ARGON, COMPRESSED and HELIUM, COMPRESSED and to increase the test pressure capacity product were adopted (see annex 1). The view was expressed, however, that EIGA might usefully consider dealing with such issues in a more systematic and comprehensive manner in order to avoid having to deal with specific cases on the basis of commercial requirements."

***NOTE**: Since the new text for SP 653 text was adopted in September 2011 but could not become applicable before 1 January 2013 because of the legal procedures of amendments to RID, ADR and ADN, this text was made applicable, for CO_2 and nitrogen only, on the territories of Austria, Denmark, Germany, Finland, France, Netherlands, Norway, Sweden, Switzerland and the United Kingdom in the interim period through multilateral agreement M244 (ADR).*

26. So far, no new proposal for addressing the issue in a more systematic way has been submitted and the current text of SP 653 remains as adopted for the 2013 versions of RID/ADR/ADN.

Summary

27. The derogations contained in SP 653 of ADR, RID and ADN were originally intended to apply to small cylinders of CO_2 with a capacity of not more than 0.5 litre used for the preparation of soda water by individuals in a private context or during events such as receptions. The main justification for the derogation was that the receptacles used were small and had to meet the construction and testing requirements applicable to pressure receptacles containing CO_2 and therefore the probability for bursting was very low. The probability for leakage was considered also very low and in any case was considered not to lead to the release of quantities of gas that could endanger drivers or other participants in a transport chain, compared with quantities that could be released from larger cylinders or tanks exempted under the conditions of 2.2.2.3 of the UN Model Regulations.

28. The derogation took in a first stage the form of an ADR multilateral agreement initiated by Austria in 2001 and signed by three more countries. It was then introduced with the same derogation conditions in ADR and RID as special provision 653 of their 2007 version.

29. The derogation was later extended to compressed nitrogen (in 2011), compressed argon and compressed helium (in 2013). These extensions led to the replacement of the 0.5 litre maximum capacity of the CO_2 cylinders by a limit (152 bar.litre) on the product of the water capacity of the cylinder by the test pressure required for the cylinder depending on the gas contained, corresponding to the product test pressure multiplied by the capacity for CO_2 cylinders of a 0.605 litre water capacity which were widely used in Europe.