Economic Commission for Europe

Inland Transport Committee

Working Party on the Transport of Dangerous Goods

110th session
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Item 5 (a) of the provisional agenda
Proposals for amendments to annexes A and B of ADR: construction and approval of vehicles

Experiences with fires involving battery vehicles for compressed flammable gases, relevant to BLEVE

Transmitted by the European Industrial Gases Association (EIGA)

1. The government of Spain transmitted ECE/TRANS/WP.15/2021/11 which summarizes and puts into context the work that has been done in the BLEVE Working Group on engine fire suppression systems and tyre fire protection systems to reduce the likelihood of a boiling liquid expanding vapour explosions (BLEVE) or other catastrophic failures of the tank due to a fire.

2. At the working group meeting on the 16th of June 2021, it was first suggested that the proposed measures (engine fire suppression system and tyre fire protection) should also be applied to FL vehicles carrying compressed flammable gases.

3. From then on, “compressed flammable gases” was included in the proposed text in square brackets, indicating that a decision on this matter was still pending. A reference to this is given under item 13 in the justification of ECE/TRANS/WP.15/2021/11.

4. EIGA is not in favour of having the proposed measures also apply to compressed flammable gases. This position has also been shared with the BLEVE WG on several occasions.

5. EIGA submitted to the BLEVE working group a document summarising EIGA’s experiences with fires involving battery vehicles for compressed flammable gases, showing that tyre or engine fires have not led to catastrophic failure, see thereafter.

6. The main dangerous good transported by the industrial gases industry in battery vehicles is UN 1049 HYDROGEN, COMPRESSED. Due to the light weight of the gas, the payload carried is typically only 200-400 kg. There are newer battery vehicle or MEGC designs on the market with pressure receptacles made of composite materials. These can have payloads of up to approximately 1000 kg. However, the vast majority of existing transport units uses seamless steel cylinders or tubes as elements with lower payloads.

7. In addition to the fact that the need of applying the measures to compressed flammable gases has not been analysed or proven by the BLEVE WG, the additional weight of the new measures will significantly reduce the payload of the existing transport units, hence requiring the gases industry to perform a significant amount of additional dangerous goods transports.

8. In ECE/TRANS/WP.15/2021/11 the transitional measures already state that the measures need not be retrofitted to existing FL vehicles. However, specifically engine fire suppression systems on new motive units will still pose the same problem with existing battery vehicles.

9. EIGA proposes that engine fire suppression systems and tyre fire protection systems do not become mandatory for compressed flammable gases.

10. However, if it is agreed to apply these measures to transport units for compressed flammable gases, EIGA proposes that transitional measures allow the use of motive units

without engine fire suppression systems in combination with battery vehicles and MEGC first registered or entering into service before 1 January 2027.

EIGA Comments to Draft Paper for WP-15

Engine fire suppression systems and tyre fire protection systems to reduce the likelihood of a BLEVE or other catastrophic failure of the tank due to a fire

Executive Summary

Industrial gases companies have been transporting compressed, flammable gases for over 100 years. This started with individual cylinders and then bundles of cylinders and battery vehicles (classified as FL vehicles). Battery vehicles have now been in service for many decades.

Whilst EIGA broadly supports the proposals in 9.7.9.1 and 9.7.9.2, specifically we do not agree with the inclusion of compressed flammable gases into this proposal as there is no evidence of explosions or catastrophic failures involving battery vehicles with compressed flammable gases.

Comments

EIGA's primary function is to act as safety and technical organisation and part of this role is to collect safety data and share significant incidents from members so lessons can be learnt and applied by the industry.

EIGA members report the total number of kilometres driven and as an industry our members drive more than 700 million kilometres per year which is split approximately one third cylinder delivery vehicles and the rest "bulk" delivery vehicles which includes battery vehicles.

In addition to transport statistics, any significant incidents (included transport and non-transport activities) are required to be reported and then discussed by senior industry safety professionals. For example, a tyre or cabin fire would be considered a significant incident and would be reported.

EIGA maintains a number of safety related databases, Road Accident Statistics platform database, Work Injury Statistics and Safety Incident database. These databases go back over thirty years and assist the industry in identifying issues and being proactive rather than reactive. From the data it suggests that a tyre fire that has escalated to a significant event is reported approximately once every 700 million kilometres. A significant event is one requiring third party intervention such as the fire brigade. None of these have resulted in explosion or catastrophic failures.

It is acknowledged that tyre fires do occasionally occur. The frequency of tyre fires has been significantly reduced through advances in technology which include the move to single tyres rather than twin tyres on a hub, improvements in tyre technology, tyre pressure monitoring systems and improvements to braking systems. To help reduce the possibility of a tyre fire EIGA has provided guidance to its members on prevention of tyre fires; this is Safety Information 17, and is accessible on the EIGA website, www.eiga.eu.

Whilst it is difficult to quantified, advances in technology, such as mobile phones and real time vehicle monitoring mean that in the event of an incident, e.g., a tyre fire,

assistance can be summoned much quicker than in the past, reducing the severity of an incident.

EIGA members have, some examples of fires on battery vehicles, see below. None of these cases led to catastrophic failure of the elements of the battery vehicle.

Fig. 1: 2003, Italy, full fire engulfment, no catastrophic failure.

Fig. 2: 2009, Germany, full fire engulfment, leakage of some but not all elements, no rupture

Fig. 3: 2019, Italy, tyre fire, no leakage, no rupture

The design of the elements of battery vehicles is such that in the unlikely event of failure they will not fragment but fail in a single piece. [1]

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1 In addition, in the 1980s EIGA member companies carried out extensive research on seamless steel tubes in order to understand and improve their behaviour in case of failure. The gases industry developed the" leak before break" criteria for these tubes, which make up a significant number of the elements of battery vehicles on the market. This criterion warrants that tubes tear open and leak and do not burst violently creating shrapnel. This is proven by research in the so-called "Hürther Schwellversuche", performed by Messer Griesheim at the time. Experiences of this research have gone into creating EN ISO 11120 - Gas cylinders — Refillable seamless steel tubes of water capacity between 150 l and 3000 l — Design, construction, and testing.

Future requirements for hydrogen

There is much comment about the future of hydrogen, e.g. as a fuel and how this will be transported and increases in the volumes transported. The development of the hydrogen economy and infrastructure is at a very early stage and many aspects are still to be confirmed. Still, it is thought that there will be a significant increase in hydrogen transported by pipeline. Moreover, on-site generation, for example from electrolysis will also avoid vehicle transportation and further reduces climate impact. In addition, to achieve higher energy density, refrigerated liquid hydrogen will be one of the key transportation modes. Finally, another method of delivering hydrogen which is being explored is transportation of ammonia, (NH_3) from large scale production site, followed by on-site cracking of the ammonia to produce hydrogen.

Consequently, whilst there will most likely be an expansion in the vehicle transportation of gaseous hydrogen, this type of transport will only see a moderate increase.

Conclusion

Whilst EIGA broadly supports the proposals in 9.7.9.1 and 9.7.9.2, specifically we do not agree with the inclusion of compressed flammable gases into this proposal as there is no evidence of explosions or catastrophic failures of elements of battery vehicles with compressed flammable gases.