**Economic Commission for Europe**

Inland Transport Committee

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

**110th session**
Geneva, 8 - 12 November 2021 24 August 2021
Item 5 (a) of the provisional agenda
**Proposals for amendments to annexes A and B of ADR: construction and approval of vehicles**

# Engine fire suppression systems and tyre fire protection systems to reduce the likelihood of a boiling liquid expanding vapor explosion (BLEVE) or other catastrophic failure of the tank due to a fire

## Transmitted by the Government of Spain on behalf of the BLEVE informal working group of the Joint meeting

This document contains links to the documents and reports of the BLEVE working group starting after its renewed mandate given in 2014.

**JOINT MEETING 21.SEP-01 OCT 2021**

**FORMAL 35 (SPAIN)**

**https://unece.org/sites/default/files/2021-06/ECE-TRANS-WP15-AC1-2021-35e.pdf**

**FORMAL 36 (LIQUID GAS EUROPE)**

**https://unece.org/sites/default/files/2021-06/ECE-TRANS-WP15-AC1-2021-36e.pdf**

**(not discussed at the time of submitting this document)**

**WP. 15- 3-7 MAY 2021**

**INFORMAL 7 (SPAIN)**

https://unece.org/sites/default/files/2021-04/ECE-TRANS-WP15-109-GE-inf7e.pdf

**INFORMAL 19 (OICA)**

**https://unece.org/sites/default/files/2021-05/ECE-TRANS-WP15-109-GE-inf19e.pdf**

**REPORT**

Report of the Working Party on its 109th session. Held in Geneva from 4 to 7 May 2021 paragraphs 26-29. Informal documents: INF.7 (Spain), INF.19 (OICA)

https://unece.org/sites/default/files/2021-05/ECE-TRANS-WP15-253e_0.pdf

26. The representative of Spain presented to the Working Party the proposals of the BLEVE working group of the Joint Meeting to equip vehicles with engine fire suppression and tyre fire protection systems.

27. The representative of Spain took note of the comments made during the session and the preferences regarding the different options proposed. There were mixed views on the best option.

28. The representative of Spain invited those delegations that wished to do so to study the various options and to send her their comments, if possible before the next meeting of the informal group scheduled for 27 May 2021. She also invited delegations interested in participating in this informal group to contact her.

29. The Working Party noted that the BLEVE working group would submit an official document concerning the fitting of vehicles with engine fire suppression and tyre fire protection systems at the next session. The Working Party also noted that proposals on safety valves would be presented separately to the Joint Meeting, as they were applicable to all land transport modes.

**JOINT MEETING 10-18 SEP 2020**

**FORMAL 42 (SPAIN)** (they were sent for the meeting 16–20 March 2020 but due to Covid they were postposed to the September meeting)

https://unece.org/fileadmin/DAM/trans/doc/2020/dgwp15ac1/ECE-TRANS-WP15-AC1-2020-42e.pdf

**INFORMAL 7 (SPAIN)**

https://unece.org/fileadmin/DAM/trans/doc/2020/dgwp15ac1/ECE-TRANS-WP15-AC1-20-BE-inf7e.pdf

**INFORMAL 7/Add.1 (SPAIN)**

https://unece.org/fileadmin/DAM/trans/doc/2020/dgwp15ac1/ECE-TRANS-WP15-AC1-20-BE-inf7a1e.pdf

**INFORMAL 2/Add.2 (SPAIN)**

https://unece.org/fileadmin/DAM/trans/doc/2020/dgwp15ac1/ECE-TRANS-WP15-AC1-20-BE-inf7a2e.pdf

INFORMAL 2 Add.3 (SPAIN)

https://unece.org/fileadmin/DAM/trans/doc/2020/dgwp15ac1/ECE-TRANS-WP15-AC1-20-BE-inf7a3e.pdf

INFORMAL 2 Add.4 (SPAIN)

https://unece.org/fileadmin/DAM/trans/doc/2020/dgwp15ac1/ECE-TRANS-WP15-AC1-20-BE-inf7a4e.pdf

INFORMAL 2 Add.5 (SPAIN)

https://unece.org/fileadmin/DAM/trans/doc/2020/dgwp15ac1/ECE-TRANS-WP15-AC1-20-BE-inf7a5e.pdf

INFORMAL 2 Add.6 (SPAIN)

https://unece.org/fileadmin/DAM/trans/doc/2020/dgwp15ac1/ECE-TRANS-WP15-AC1-20-BE-inf7a6e.pdf

INFORMAL 2 Add.7 (SPAIN)

https://unece.org/fileadmin/DAM/trans/doc/2020/dgwp15ac1/ECE-TRANS-WP15-AC1-20-BE-inf7a7e.pdf

INFORMAL 20 (UK)

https://unece.org/fileadmin/DAM/trans/doc/2020/dgwp15ac1/ECE-TRANS-WP15-AC1-20-BE-inf20e.pdf

**REPORT**

**Report of BLEVE Working Group meeting held on 22-24 October 2019 in Madrid paragraphs 50-51. Documents: FORMAL 42 (Spain), INF.7, INF.7/Add.1 to Add.7 (Spain) and INF.20 (United Kingdom).**

https://unece.org/DAM/trans/doc/2020/dgwp15ac1/ECE-TRANS-WP15-AC1-158e.pdf

50. The Joint Meeting welcomed the report on the meeting of the BLEVE Working Group held in October 2019 included in document ECE/TRANS/WP.15/AC.1/2020/42 and in informal document INF.7 and its addenda. The representative of Spain sought guidance on the six recommended measures to prevent future boiling liquid expanding vapor explosions (BLEVE): (a) installation of metallic mudguards), (b) installation of engine fire suppression

systems, (c) installation of a safety valve, (d) introduction of technical devices for general traffic safety, (e) heat resistant screen between cabin and tank, and (f) use of expanded aluminium alloys (EAA).

51. The Joint Meeting agreed to give priority on measures (a), (b) and (c). Some delegations pointed out that it would be useful to consider them in a combined manner. Considering informal document INF.20 on the mandatory application dates of safety provisions for new goods vehicles, delegates felt that the measures under (d) were already addressed by the World Forum for Harmonization of Vehicle Regulations (WP.29). The Joint Meeting also agreed to further assess measure (e). The representative of the Netherlands recommended to further investigate on thermal coating. He was invited to present new elements to the informal working group, if necessary. Measures under (f) were considered by the Joint Meeting as not relevant due to the uncertainty with respect to the efficiency, the impact on maintenance or inspections and the costs resulting from the use of EAA.

**JOINT MEETING 18-22 MARCH 2019**

**INFORMAL 8 (SPAIN)**
https://unece.org/DAM/trans/doc/2019/dgwp15ac1/ECE-TRANS-WP15-AC1-19-BE-inf8e.pdf
**INFORMAL 8 (SPAIN)/Add.1**
https://unece.org/DAM/trans/doc/2019/dgwp15ac1/ECE-TRANS-WP15-AC1-19-BE-inf8a1e.pdf
**INFORMAL 8 (SPAIN)/Add.2**
https://unece.org/DAM/trans/doc/2019/dgwp15ac1/ECE-TRANS-WP15-AC1-19-BE-inf8a2e.pdf
**INFORMAL 8 (SPAIN)/Add.3**
https://unece.org/DAM/trans/doc/2019/dgwp15ac1/ECE-TRANS-WP15-AC1-19-BE-inf8a3e.pdf
**INFORMAL 8 (SPAIN)/Add.4**
https://unece.org/DAM/trans/doc/2019/dgwp15ac1/ECE-TRANS-WP15-AC1-19-BE-inf8a4e.pdf
**INFORMAL 8 (SPAIN)/Add.5**
https://unece.org/DAM/trans/doc/2019/dgwp15ac1/ECE-TRANS-WP15-AC1-19-BE-inf8a5e.pdf
**INFORMAL 8 (SPAIN)/Add.6**
https://unece.org/DAM/trans/doc/2019/dgwp15ac1/ECE-TRANS-WP15-AC1-19-BE-inf8a6e.pdf
**INFORMAL 23 (SPAIN/FRANCE)**
https://unece.org/DAM/trans/doc/2019/dgwp15ac1/ECE-TRANS-WP15-AC1-19-BE-inf23e.pdf

**REPORT**

**Report of the Joint Meeting of the RID Committee of Experts and the Working Party on the Transport of Dangerous Goods on its spring 2019 session held in Bern from 18 to 22 March 2019 paragraphs 54-56. Documents: INF.8 and Adds.1 to 6 (Spain) and INF.23 (Spain, France).**
**https://unece.org/DAM/**trans**/doc/2019/dgwp15ac1/ECE-TRANS-WP15-AC1-154e.pdf**

54. The Joint Meeting took note of the report and the progress of the work of the informal working group, as well as of a presentation on the use of the 3D aluminium alloys described in informal document INF.23 to protect tanks and receptacles filled with flammable liquids and gases from exploding. The developers of this technology were invited to share test results and certification information with the informal working group.

55. The Joint Meeting entrusted the consideration of this technology to the informal working group on the risk of BLEVE, and in particular, the study of its characteristics from the point of view of safety improvements, costs, advantages and possible applications for other types of dangerous goods or situations encountered during the carriage.

56. The Joint Meeting noted that the next meeting of the informal working group will take place in Madrid from 22 to 24 October 2019.

**JOINT MEETING 17-21 SEPTIEMBRE 2018**

**INFORMAL 22 (SPAIN)**

https://unece.org/DAM/trans/doc/2018/dgwp15ac1/ECE-TRANS-WP15-AC1-2018-GE-INF22e.pdf

**REPORT**

**Report of the Joint Meeting of the RID Committee of Experts and the Working Party on the Transport of Dangerous Goods on its autumn 2018 session held in Geneva from 17 to 21 September 2018 paragraph 51. Document: INF.22 (Spain).**

https://unece.org/DAM/trans/doc/2018/dgwp15ac1/ECE-TRANS-WP15-AC1-152e.pdf

51. Following a request made by several delegations, the representative of Spain agreed to change the dates for the next meeting of the informal working group, initially scheduled in October, to 15 to 17 January 2019 to facilitate the participation of all those interested in the work of the group. She encouraged delegations to confirm their participation before 28 December 2018 and to provide information on the topics listed under paragraph 6 of informal document INF.22.

**JOINT MEETING 12-16 March 2018**

**INFORMAL 23 (SPAIN)**

https://unece.org/DAM/trans/doc/2018/dgwp15ac1/ECE-TRANS-WP15-AC1-18-BE-inf23e.pdf

**Report of the Joint Meeting of the RID Committee of Experts and the Working Party on the Transport of Dangerous Goods on its spring 2018 session held in Bern from 12 to 16 March 2018 paragraphs 67 y 68. Document: INF.23 (Spain).**

https://unece.org/DAM/trans/doc/2018/dgwp15ac1/ECE-TRANS-WP15-AC1-150e.pdf

67. The Joint Meeting took note of the report and agreed on the continuation of the work as described in paragraphs 7 to 10 of the informal document. 68. It was noted that the French National Institute for Industrial Environment and Risks (INERIS) expected to address in 2018 modelling of the three first scenarios listed in paragraph 3; fires involving additional substances (a gas and a liquid) and the effects of damage and local protection. Additional work could be undertaken subject to budget availability.

**JOINT MEETING 19-29 SEPTEMBER 2017**

**FORMAL 42 (FRANCE)**

https://unece.org/DAM/trans/doc/2017/dgwp15ac1/ECE-TRANS-WP15-AC1-2017-42e.pdf

INFORMAL 41 and Add.1 (France)

https://unece.org/DAM/trans/doc/2017/dgwp15ac1/ECE-TRANS-WP15-AC1-2017-GE-INF41e.pdf

INFORMAL 41/Add.1

https://unece.org/DAM/trans/doc/2017/dgwp15ac1/ECE-TRANS-WP15-AC1-2017-GE-_INF41a1e.pdf

INFORMAL 41/Add.1/REV.1

https://unece.org/DAM/trans/doc/2017/dgwp15ac1/ECE-TRANS-WP15-AC1-2017-GE-INF41a1r1e.pdf

**REPORT**

**Report of the Joint Meeting of the RID Committee of Experts and the Working Party on the Transport of Dangerous Goods on its autumn 2017 session held in Geneva from 19–29 September 2017 paragraphs 80-85. Documents: 42 (France), INF.41 and 41/Add.1 (France).**

https://unece.org/DAM/trans/doc/2017/dgwp15ac1/ECE-TRANS-WP15-AC1-148e.pdf

80. The Joint Meeting was informed of the progress of the modelling done by the French National Institute on the Industrial Environment and Hazards (INERIS) at the request of the Government of France in the context of the work of the informal working group on reducing the risk of a BLEVE during the transport of dangerous goods.

81. The Joint Meeting welcomed the results and highlighted the quality and usefulness of the modelling tool used.

82. The Joint Meeting confirmed the need first to reconvene the informal working group on the basis of the current mandate.

83. The working group was invited to redefine the mandate to take into account the comments made at the session, particularly when it came to the following matters:

- Need to adopt a risk management approach for further work and carry out a cost benefit analysis of the solutions explored;
- Consideration of solutions and scenarios that different methods could have in common and those that would need a differentiated approach, particularly in cases where protection against fires caused by equipment specific to the means of transport (e.g. tyres and engines in the case of road vehicles) was envisaged. To that end, the working group could go by the guidelines on decision-making prepared within the framework of the work of the ERA workshop.

84. It was also recalled that the work of the informal working group should concern all dangerous goods that might cause a BLEVE and not only LPG.

85. The next session would be held in Madrid, Spain from 20–22 February 2018. Interested delegations were invited to contact the representative of Spain.

**JOINT MEETING 13-17 MARCH 2017**

**INFORMAL 15 (FRANCE)**

**https://unece.org/DAM/trans/doc/2017/dgwp15ac1/ECE-TRANS-WP15-AC1-17-BE-INF.15e.pdf**

**REPORT**

**Report of the Joint Meeting of the RID Committee of Experts and the Working Party on the Transport of Dangerous Goods on its spring 2017 session held in Bern from 13–17 March 2017 paragraphs 43-47. Document: INF.15 (France).**

**https://unece.org/DAM/trans/doc/2017/dgwp15ac1/ECE-TRANS-WP15-AC1-146e.pdf**

43. The Joint Meeting was informed of the outcome of the work carried out by the French National Institute for Environmental Technology and Risks (INERIS) at the request of the Government of France in the context of the work of the informal working group on reducing the risk of a BLEVE during the transport of dangerous goods. It involved using a predictive tool developed by INERIS to forecast the behaviour of liquefied petroleum gas (LPG) tanks when exposed to fire, when fitted only with a safety valve, only with fire protection coating, or with a safety valve and fire protection coating, for different tank geometries and different kinds of thermal protection. The results were consistent with those of the experimental tests on tanks conducted by German Federal Institute for Materials Research and Testing (BAM) in 1998 and in 2013-2014. The digital predictive model presented the advantage of being able to cover a broad range of scenarios without the need for costly destructive tests. Additional tests might nevertheless be necessary for the final validation of the model and for studying the response of safety valves when directly exposed to fire.

44. The Joint Meeting welcomed the results of the work. Several delegations said they could provide additional experimental data to help with the validation of the model.

45. A technical discussion followed on the respective merits of the different ways of preventing BLEVE, some delegations expressing reservations about the use of thermal insulation, given both the possible economic drawbacks (cost and reduction in carrying capacity) and the safety concerns (risk of damage, corrosion, etc.). It was, however, recalled

that all the relevant elements need to be taken into account in the context of risk assessment and it would be preferable for the technical discussions to take place within the informal working group. The representative of Germany said that some of these questions had already been addressed by the working group and some of the fire tests had been conducted to investigate the effects of damage to the coating.

46. The representative of INERIS confirmed that the model could take account of various parameters, such as localized fires, goods other than LPG, other types of receptacle (e.g. vehicle tanks), reduced thickness of, and damage to coatings, aluminium mesh for tanks to allow heat transfer between the liquid and solid phases, etc.

47. It was finally decided to ask interested delegations to inform the representative of France before the end of May 2017 of the simulations they would like to see carried out. The results, which might also help in improving the model parameters, would be presented at the next session of the Joint Meeting, when a new mandate could be decided on for the continuation of the informal working group's activities.

**JOINT MEETING 15-19 SEPTEMBER 2014**

**FORMAL 53 (Netherlands)**

**https://unece.org/DAM/trans/doc/2014/dgwp15ac1/ECE-TRANS-WP15-AC1-2014-53e.doc**

**INF.8 (Netherlands)**

**https://unece.org/DAM/trans/doc/2014/dgwp15ac1/ECE-TRANS-WP15-AC1-2014-GE-INF.8e.pdf**

**INF.9 (Netherlands)**

**https://unece.org/DAM/trans/doc/2014/dgwp15ac1/ECE-TRANS-WP15-AC1-2014-GE-INF.9e.pdf**

**INF.25 (AEGPL/LPG)**

**https://unece.org/DAM/trans/doc/2014/dgwp15ac1/ECE-TRANS-WP15-AC1-2014-GE-INF.25e.doc**

**INF.37 (UIP)**

**https://unece.org/DAM/trans/doc/2014/dgwp15ac1/ECE-TRANS-WP15-AC1-2014-GE-INF.37e.doc**

**INF.25 (AEGPL)**

**https://unece.org/DAM/trans/doc/2014/dgwp15ac1/ECE-TRANS-WP15-AC1-2014-GE-INF.25e.pdf**

**INF.37 (UIP)**

**https://unece.org/DAM/trans/doc/2014/dgwp15ac1/ECE-TRANS-WP15-AC1-2014-GE-INF.37e.pdf**

**INF.38 (Chairman)**

**https://unece.org/DAM/trans/doc/2014/dgwp15ac1/ECE-TRANS-WP15-AC1-2014-GE-INF.38e.pdf**

**INF.42 (Italy)**

**https://unece.org/DAM/trans/doc/2014/dgwp15ac1/ECE-TRANS-WP15-AC1-2014-GE-INF.42e.pdf**

**INF.43 (United Kingdom)**

**https://unece.org/DAM/trans/doc/2014/dgwp15ac1/ECE-TRANS-WP15-AC1-2014-GE-INF.43e.pdf**

**INF.45 (Netherlands)**

**https://unece.org/DAM/trans/doc/2014/dgwp15ac1/ECE-TRANS-WP15-AC1-2014-GE-INF.45e.doc**

**INF.46 (EIGA)**

**https://unece.org/DAM/trans/doc/2014/dgwp15ac1/ECE-TRANS-WP15-AC1-2014-GE-INF.46e.pdf**

**INF.47 (France)**

**https://unece.org/DAM/trans/doc/2014/dgwp15ac1/ECE-TRANS-WP15-AC1-2014-GE-INF.47e.pdf**

**REPORT**

**Report of the informal working group on the reduction of the risk of a BLEVE Paragraphs 51-54. Documents: 53 (Netherlands), INF.8, INF.9 and INF.45 (Netherlands), INF.25 (AEGPL), INF.37 (UIP), INF.38 (Chairman), INF.42 (Italy), INF.43 (United Kingdom), INF.46 (EIGA), INF.47 (France)**

**https://unece.org/DAM/trans/doc/2014/dgwp15ac1/ECE-TRANS-WP15-AC1-136e.doc**

51. On the basis of the opinions of the government representatives who took part in the group's work, the report called for the introduction in RID and ADR of a requirement for a thermal coating on certain road and railway tanks, the objective being to ensure that they resist aggressive heating (engulfment in flames for 60 minutes) and thus to reduce the risk of a BLEVE. If the principle could be admitted by the Joint Meeting, the working group proposed that the work should continue, in particular on questions related to the certification of coating materials; their resistance to shocks and accidents; ageing; corrosion; inspections (including the question of removal of the coating for inspection purposes); practical consequences for the strategies employed by the emergency services in the event of a fire; and the list of entries for which coatings would be required.

52. The report elicited many reactions and a lengthy debate. Some delegations considered that the proposed requirement was not justified by European risk analyses, accident research and safety cost/benefit analyses. They considered that there was no reason to call into question the safety levels ensured by the current requirements; that making such coatings mandatory would increase vehicle costs and reduce their available carrying capacities; or that a distinction had to be made between rail and road tanks. Such arguments were reflected in the numerous informal documents submitted on the question.

53. Other delegations noted that States had the obligation to protect their citizens, that chapters 4.2 and 6.7 already contained provisions for protection of UN portable tanks against fire. Furthermore, the informal working group had already met 11 times, and the outcome of its work could neither be ignored nor dismissed from the point of view of safety techniques. Some delegations asked for further investigation of alternative methods. The Governments of Germany and France had invested heavily in the testing. If those who opposed the outcomes or conclusions of those tests wished to contest the validity of the test result extrapolation to other tanks or equipment, they would have to provide reasoned engineering demonstration or test results of equivalent relevance.

54. Following this discussion, while not ready to make any device even in principle, the Joint Meeting agreed that the informal working group should continue its work but that its mandate should be reworked and better targeted. It should therefore examine questions related to the protection of tanks against fire. The substances concerned were not limited to LPG. Other gases and flammable liquids should be considered. The group would have to examine protection measures to avoid a catastrophic failure of a tank when exposed to fire, such as thermal protection, safety valves and measures intended to prevent a fire starting. It would have to check the intrinsic safety of each of these measures and evaluate their impact (influence on other parts of the functioning/logistics of carriage). It would also have to study the relevance of these measures while taking account of the context of their use, for example the context linked to the specific mode of transport. Finally the group would have to evaluate the consequences of the measures envisaged on the organization of the interventions of emergency services.

**JOINT MEETING 17-21 MARCH 2014**

**INF.44 (FRANCE)**

https://unece.org/DAM/trans/doc/2014/dgwp15ac1/ECE-TRANS-WP15-AC1-14-BE-inf44e.pdf

**REPORT**

**Report of the Joint Meeting of the RID Committee of Experts and the Working Party on the Transport of Dangerous Goods on its spring 2014 session held in Bern from 17–21 March 2014, paragraph 58. Document: INF.44 (France).**

58. The Joint Meeting noted that the informal working group on telematics should meet in Bordeaux from 3 to 5 June 2014, and the group on BLEVE in Paris from 23 to 25 April 2014.