

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

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Item 7 of the provisional agenda

Reports of informal working groups

Follow up to the work of the informal working group on reducing the risk of a BLEVE – simulations of the behaviour of tanks exposed to fire in complement to document ECE/TRANS/WP.15/AC.1/2017/42

Transmitted by the Government of France

Summary

Executive summary: Produce a summary of the results reached so far in relation with the calculation model

Action to be taken: Decide what are the further steps for this work.

Introduction

1. Since the March session of the Joint Meeting France has provided some calculations to assess the behavior of tanks when exposed to a fire. These are meant to complement the results from tests conducted by France and Germany in the context of the “BLEVE working group”.
2. During the March 2017 session of the Joint Meeting the calculation model has been validated and some first fire cases have been simulated. The advantage of a calculation model compared to testing is that a bigger variety of cases at a lower cost may be assessed.
3. In the annexed presentation, all simulated cases from March to September are shown to allow the Joint Meeting to have a proper overview.

Logic for the different cases studied

4. The calculations are concerning different types of tanks within different types of fire. The tanks may be equipped with different type of safety valves and/or with thermal coating.
5. As the main doubts were linked to the efficiency of safety valves, most of the simulations are concentrated on this feature in this first group. Indeed the tests conducted at

BAM showed that tanks equipped with safety valves only, did not survive a fire as real case accident showed that in some cases safety valves helped to avoid an explosion of LPG tanks. This aspect is important also because it is clear that a safety valve is easier to fit than other solutions and is a well-known technique already in place on many tanks.

6. The calculations were conducted in such a way that the results of one first simulation helped to define the next one. For example, reducing the amount of fire energy each time the result was a failure...

7. So, calculations were done:

- On tanks with different types of safety valves. Also with some "theoretical" safety valve not yet on the market to see if improvement in safety valve technology would help;
- On similar equipped tanks under different fire condition: full fire engulfment or only lower half of the tank exposed to fire;
- On similar equipped tanks with different filling ratio;
- On tanks equipped with thermal coating and safety valves and tank with a thicker wall thickness.

Conclusions

8. The results show clearly that tanks equipped with safety valves only would not survive a full fire engulfment. The reason is not related to the dimension of the valve or its technical characteristics but it is mainly caused by the reduction in the steel resistance due to high temperature.

9. When the heat is kept lower, for instance by means of thermal coating, a tank with an appropriate safety valve could survive a full fire engulfment until it empties completely. Increasing the wall thickness is another way to reach that goal but in practice it would lead to unrealistic wall size (3 cm).

10. Tanks with safety valves only would surely survive a smaller size fire (as demonstrated in a real-life case) but not if the filling rate is too low.

11. The last refinement that could not be calculated on time for this meeting would be to assess what would be the maximal fire a tank equipped with the best safety valve would survive even under low (unfavorable) filling ratio conditions.

12. Comparing this value with the fire most likely to happen would allow to assess the efficiency of safety valves in terms of risk reduction even if they would not ensure total resistance to fire in 100% of the cases. This last calculation cannot be made by the simulation model but requires some statistical assessment.

13. Any comment from the Joint Meeting on how to continue this work is most welcome.
