OTIF/RID/CE/GTT/2020/INF.1

17 September 2020

Original: German

RID: **18th session of the RID Committee of Experts' working group on tank and vehicle technology**

(Video-conference, 6 and 7 October 2020)

Subject: **Extra-large tank-containers – Questions relating to safety**

Proposal transmitted by Germany

Introduction

1. At the last session of the RID Committee of Experts' standing working group (Vienna, 25 to 28 November 2019), Germany submitted INF.8, which set out its provisional assessment of various questions on the risk assessment submitted by BASF and the safety of extra-large tank-containers.

2. In so doing, the representative of Germany said in particular that based on the statement that the extra-large tank-containers and innovative carrying wagons met the current requirements, it could not be concluded that the provisions would not have to be adapted. Without wishing to question the conclusions, they would still have to be examined with a view to developing the provisions. Several delegations supported the call to adapt the provisions; see also paragraphs 48 and 49 of the final report of the 11th session of the RID Committee of Experts' standing working group.

Preliminary results of the German competent authorities' examination of the risk assessment commissioned by BASF

3. The competent authorities in Germany have examined the risk assessment carried out on behalf of BASF. In view of the resources available, a comprehensive evaluation of the scientific work was not possible.

   However, in addition to the questions raised in document INF.8, the following points were identified:

General preliminary comments

4. The subject of the risk assessment was a 45’ B-TC with tank code L4BH, loaded onto a 45’ iCTW and a 52’ iCTW. However, according to INF.2 from the 16th session of the working group on tank and vehicle technology, there are also varieties of the B-TC that are 52’ long, and tank codes L4DH, L10BH and L10DH.

   There is thus no clear explanation of the extent to which the variant chosen in the risk assessment is representative of the other variants or the extent to which the other variants can be classified as less critical in all relevant aspects.

5. The B-TC/iCTW are compared with two conventional tank-containers on a conventional carrying wagon and a tank-wagon.

   The objects compared are not comparable with regard to the materials used or the equivalent wall thicknesses (see also WP1, page 34, WP4, page 415 of the risk assessment). Simply focusing on comparable tank codes introduces too big a variation in terms of wall thicknesses, which means that it is not possible to make a meaningful comparison of the safety levels.

6. There is also a lack of explanation as to how such a wide discrepancy between equivalent wall thickness and actual wall thickness can be reached for B-TC and tank-containers and the extent to which certain concessions had perhaps to be made in risk assessments here compared with more conservative conditions for the tank-wagon. In the tests carried out though, these aspects are not considered further.

Other comments on work package WP1 (Risk assessment) of the risk assessment

7. There is some lack of precision in the statements on work package WP1. For example, in contrast to what is said in the risk assessment, the spigots do not secure the B-TC and classic tank-containers against becoming detached and overturning (WP1, page 13) and at the moment, the same provisions of RID still apply to B-TC and tank-containers. WP1, page 19 (Minimum shell thickness); page 24 (design and testing requirements) and page 31 (degree of filling).

8. With regard to the degree of filling, it is said that from the point of view of rail transport, it only needs to be ensured that the total weight of the iCTW with the B-TC does not exceed 90,000 kg (see also section 4.2.5 of work package WP1 on page 31). As the gross weight of the B-TCs tested is limited to 75,000 kg and the iCTWs used weigh around 16,500 kg, the recommended threshold of 90,000 kg is exceeded (see also section 3.3.4 of work package WP1 on page 25).

9. In the risk assessment under “hazard 5”, non-compliance with the permissible load dimensions and selection of the correct carrying wagon are investigated. The conclusion (without any analysis or discussion) is as follows: “These hazards are mostly the result of human error and are at the same level as for tank-containers and conventional tank-wagons”, see also section 4.3.2 on page 35.

   Conventional tank-containers are carried on conventional carrying wagons. Extra-large tank-containers require special carrying wagons. So long as there is no clear marking, there is also the risk that extra-large tank-containers are loaded onto carrying wagons that are not equipped for the carriage of extra-large tank-containers.

The question therefore arises which measures or stipulations can ensure the correct use of carrying wagons until there is marking for the carrying wagons. From the regulatory perspective, this question should be viewed in the abstract in relation to a generally applicable solution, even if the conclusion is reached that in the specific case of BASF's usage, suitable in-house processes are implemented.

<u>Comments on work packages WP2 (Investigation of sloshing movements) and 3 (Multi-body simulation of sloshing movements and buffing) of the risk assessment</u>

10. In WP2 and WP3, the tests carried out focus on an assessment of the surge movements. The aim here is to demonstrate an acceptable risk for any degree of filling (by derogation from the current limits that apply under RID) in rail transport. To this end, tests and simulations were carried out on a specific track geometry with a 100%, 50% and 0% degree of filling.

11. However, there is no explanation as to why the track geometry chosen and the associated execution of the tests can provide generally applicable evidence as regards surge movements in the tank on any infrastructure. What is required here is further consideration and explanation of the infrastructures that actually exist in the RID area, together with their maximum permissible speeds, depending on the curve radius (non-EU, as partially contained in WP3, page 300) and some information on the transferability of the findings obtained in this respect. It also remains unclear why divergent curve radiuses were modelled for the simulations (WP2, page 65; WP3, page 258), whereas the practical tests were carried out on a curve radius of 190m (WP2, page 67).

12. There is also no information on the transferability of the findings obtained to other tank/vehicle combinations, divergent tank volumes, different densities of goods loaded and degrees of filling other than the 50% that was tested. With regard to the latter point, reference is made to ORE report B57 from 1962, which deals primarily with the assessment of surge plates. Contrary to the source drawn on here, that report identifies a 75% degree of filling as a critical case – this at least provides an indication that further analysis of the effects of different degrees of filling on surge movements is necessary.

<u>Comments on work packages WP4 (FEM Simulation) and 5 (Impact tests) of the risk assessment.</u>

13. In WP4 and WP5, the tests also look at penetrations of the tank wall as a result of collisions with overriding buffers and side impacts. Tests and simulations on this were carried out.

14. Basically, it should be pointed out again that the various test objects had no comparable equivalent wall thicknesses (WP1, page 34, WP4, page 415), so it is not possible to compare the safety levels in this respect, and in particular, the calculation of safety margins (WP5, pages 415 and 419) can hardly be meaningful.

15. The relevant minimum end wall thickness of 6.49 mm (metal sheet before shaping 7.90 mm) of the Van Hool 45' B-TC is derived by taking into account the dynamic forces (2g) and the maximum load in the calculation under operating conditions (in accordance with the supplied calculation of the tank). It should be noted that for the Magyar 45' B-TC tank-container, only 5.20 mm is given for the end wall thickness, although the same tank material was used and the tanks have almost the same dimensions (Magyar's calculation is not available and Appendices 1 and 2 to the data sheets for both the B-TCs and iCTWs in Chapter 2.1, page 11 and Chapter 2.3, page 14 are missing and are not listed in the table of contents either). Owing to the presumably different calculations, the wall thicknesses of the ends cannot be compared with each other.

16. For the investigations on impacts, reference is made to standard EN 15227 (WP5, page 444). However, according to RID 6.8.2.1.2, the relevant standard for these stresses is standard EN 12663-2. What is missing here is a more precise description of what requirements are contained in standard EN 15227, how they differ from the stipulations of standard EN 12663-2 and what effects this has on the test results.

17. As a protective option for the shell, the effect of minimum distances between the headstock plane and the most protruding point at the shell extremity was investigated. The findings reached in this case relate solely to the penetration of the shell, but for B-TCs and tank-containers, they do not take account of any of the piping and fittings situated in front of the tank end or of any possible damage and the resulting leakages. However, in order to assess the risk from impacts, assuming such protective measures if necessary, failure of the external piping and fittings would also have to be taken into account.

18. In the investigations on side impacts, the only scenario considered was “tank-wagon hits the various test vehicles sideways on”. The extent to which this scenario can be carried over to side impacts from other vehicles or loads with the B-TC, particularly more aggressive shapes and detachable elements of construction, such as box containers, is not considered and remains open. Moreover, the findings obtained in this scenario cannot be carried over to the opposite case where the “test vehicle hits the tank-wagon sideways on”. Of particular interest here would be the impact of a B-TC on a tank-wagon with internal solebars, as in this set-up, there would be direct contact between the end of the B-TC tank and the tank of the tank-wagon. Failure of the external piping and fittings positioned in front of the tank end of B-TCs and tank-containers would also have to be taken into account here.

19. The findings obtained from the risk assessment investigations are underpinned by findings from records of test vehicles in real continuous operation. However, the transport operations used for this only cover certain routes, for which there are no sufficient assessments in terms of whether the findings can be carried over to any other transport operation. Both the infrastructure and operational aspects should be considered here and should be seen in context with the particular characteristics within the scope of application of RID.

20. One finding obtained is that above 5 km/h impact speed, strength threshold values for the subframe of the carrying wagon are exceeded. However, the ability to be hump shunted cannot be derived from this finding, as the relevant regulations do not currently differentiate between impact speeds. To offset this, the risk assessment proposes longer intervals between subframe inspections, but these are not currently implemented in the regulations and must be discussed separately before B-TCs and iCTWs are operated in hump shunting. As the risk assessment comes to the conclusion that there is an acceptable risk, assuming an increased probability of detection, this point at least would have to be reassessed.

21. In the risk assessment, there are no comparative considerations of the extent of damage in the event of penetration of the tank in relation to the likelihood of such damage occurring. For this type of damage, the increased volume of the tank also increases the extent of any damage; the extent to which the risk here is also comparable for B-TCs and tank-wagons with comparable equivalent wall thicknesses and tank volumes remains open.

22. In the risk assessment, the way the B-TCs performed in a collision was investigated using two different collision scenarios – a frontal collision and a side collision. The wall thicknesses of the ends of the tanks tested in frontal collisions were in the range of 5.2 mm to 7.9 mm. The wall thicknesses of the cylindrical part in the sideways collisions were in the range of 3.4 mm to 6.3 mm. The failure performance in the event of stresses caused by penetration correlates with the wall thickness. In our view, it is not possible from the investigations to draw any conclusion with regard to the minimum wall thicknesses of 3.0 mm for tank-containers and 4.5 mm for tank-wagons, as no evidence with regard to the minimum wall thicknesses required was provided. In addition, the minimum wall thickness has a major effect on the stability of tanks that have a large self-supporting length.

23. Furthermore, the test conditions in this respect are questionable. Chapter 2, “Procedure”, of work package WP5 says on page 447: “For a realistic test, the corner fittings of the tank-container were not blocked by the spigots. Movement along the longitudinal axis was therefore possible”. In practice, this seems to be a realistic scenario, but does not reflect the strictest test conditions, as prescribed for example for the dynamic collision test for portable tanks in accordance with the Manual of Tests and Criteria, Part IV, section 41 (or in accordance with standard ISO 1496-3). According to this, the container to be tested must be so placed in the impact test that the strictest test conditions result. The container has to be fixed onto the testing platform in such a way that it is secured to prevent movement in any direction when all 4 corner fittings are used.

24. With regard to the test conditions, it should also be noted that in section 2.1.1 of work package WP5, on pages 448/449 the weight of the impacting wagon is documented as 80.22 tonnes. The sum of the tare weight of the wagon of 22.3 tonnes and the load consisting of 10 blocks of 4 tonnes and 3 blocks of 1 tonne gives a total weight of around 65 tonnes. This reinforces the thesis that the test results or even the testing scenario do not enable any conclusions to be drawn with regard to the wall thicknesses required.

25. In severe accidents involving rail tank-wagons, the tank-wagon can also overturn onto the cylindrical surface of the tank. In this respect, the possible behaviour of the shell in the event of penetration (comparison of lateral position with 3.0 mm and 4.5 mm wall thickness), bearing in mind possible leakage of the product (risk = frequency x consequence) would also have to be considered.

26. Possible leakage of the product in severe railway accidents and the resulting increased consequence compared with conventional tank-containers were not considered in the risk assessment submitted. Consequently, the discussion on the minimum wall thickness for extra-large tank-containers should also take account of the possible consequences of a catastrophic failure. Increasing the minimum wall thickness is one way of offsetting an increased consequence when the risk is the same.

27. As a result, the various volumes should be considered in a risk assessment. There also needs to be further discussion of the safety level if these large tank-containers are to be used on the roads and the safety gain provided by the special carrying wagons is lost (e.g. in the event of frontal collisions).

28. In conclusion, loading B-TCs onto carrying wagons that are not equipped for them is considered to be a generally accepted risk on the basis of the wagon inspection carried out in each case. This analysis is at the least questionable, because carrying wagons thus equipped constitute a new system that has not yet been used and they have not so far been specially marked either. The effects of such a scenario are not given further consideration.

Preliminary summary of the results and Germany's observations

29. The existing provisions of dangerous goods law for tank-containers have been developed on the basis of a tank-container with a maximum capacity of around 36,000 litres. Germany is of the view that for extra-large tank-containers, which are more than twice the size of conventional tank-containers and which correspond to a tank-wagon in terms of volume, in principle the stricter provisions for tank-wagons must also partly apply. For a comparison of the provisions applicable to tank-wagons and tank-containers, see also documents OTIF/RID/CE/GTP/2018/1 (Germany) and -2018/2 (United Kingdom). It cannot be concluded from the risk analysis that it is not necessary to adapt the provisions with a view to extra-large tank-containers.

30. It should be checked whether a new definition should be introduced for extra-large tank-containers so that extra-large tank-containers can be taken into account accordingly in the provisions for the construction, approval, use and loading onto corresponding carrying wagons.

31. Moreover, a tank-container in accordance with Chapter 6.8 is an intermodal means of transport which is designed for carriage by road and rail. As a result, this or that provision should not be dispensed with on a mode-specific basis. Consequently, we see no need to dispense with the provisions of, for example, 4.3.2.2.4 (degree of filling) just for the rail transport part.

32. Germany would like to request that the discussion at the RID Committee of Experts' working group on tank and vehicle technology be continued on the basis of document INF.8 and this document and that the Joint Meeting's working group on tanks again be asked to deal with this subject.

33. Germany would also like to point out that the examination will be continued and that the expertise of the German Centre for Rail Transport Research (DZSF) will also be called upon. DZSF was set up within the Federal Office for Railways in 2019 in order to provide the Federal Ministry for Transport and Digital Infrastructure with technical advice on issues concerning rail transport, independently of any economic interests. The results of the examination are not yet ready and will be submitted once they become available.