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Joint Meeting of the RID Committee of Experts and the
Working Party on the Transport of Dangerous Goods

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Item 6 of the provisional agenda

REPORTS OF INFORMAL WORKING GROUPS

Report of the informal working group on the reduction of the risk of a BLEVE

Transmitted by the Government of the Netherlands on behalf of the working group

1. The working group held a fourth session on 16 to 18 June 2008 in The Hague, the Netherlands, under the chairmanship of Mr. Peter de Leeuw (the Netherlands). The meeting was attended by representatives of Belgium, France, Germany, Italy, the Netherlands, Norway, Poland, Canada, the United Kingdom and the following non-governmental organisations: European Liquefied Petroleum Gas Association (AEGPL), European Industrial Gas Association (EIGA), International Technical Committee for the Prevention and Extinction of Fire (CTIF) and International Union of Railways (UIC).

2. The documents on the agenda were as follows:

- Report Joint Meeting March 2006, ECE/TRANS/WP.15/AC.1/102 (OCTI/RID/GT-III/2006-A), para. 5-12, 20 and 21,

- Report Joint Meeting working group on tanks, ECE/TRANS/WP.15/AC.1/102/Add. 1 (OCTI/RID/GT-III/2006-A/Add.1), item 4,

- Doc. ECE/TRANS/WP.15/AC.1/2006/8 (OCTI/RID/GT-III/2006/8) (NL),

- Doc. March 06/ INF. 3 (NL),

- Doc. March 06/ INF. 26 (AEGPL),

- Doc. ECE/TRANS/WP.15/AC.1/2007/11 - Report of the first informal working group on the reduction of the risk of a BLEVE (meeting in The Hague),

- Doc. March 07/INF.22 (AEGPL),

- Report Joint Meeting March 2007 ECE/TRANS/WP.15/AC.1/106 (OTIF/RID/CE/2007-A), para. 62,

- Doc. September 07/INF. 9 – Report of the second informal working group on the reduction of the risk of a BLEVE (meeting in Tønsberg)

- Report Joint Meeting September 2007 ECE/TRANS/WP.15/AC.1/108 (OTIF/RID/CE/2007-B), para. 105.

- Doc. March 08/INF.5 – Report of the third informal working group on the reduction of the risk of a BLEVE (meeting in Rome)

3. The meeting was welcomed by mr. Peter de Leeuw, Chairman of the working group session. The Chairman referred to the key elements of the mandate given by the RID/ADR/ADN Joint Meeting:

(a) Prevention of a BLEVE;

(b) Reduction of the effect of a BLEVE;

(c) Hot BLEVE and cold BLEVE should be considered;

(d) Technical and other measures should be taken into account;

(e) Other matters of principle.

4. The meeting discussed on a procedure to establish a method for ranking the measures with a good potential for reducing risks of BLEVEs. The method is not yet agreed upon.

5. France and AEGPL invite the working group for the next three-day meeting in Paris. The meeting will be held in the period from 26 January to 13 February 2009.

Annex to the report of the working group meeting in The Hague, June 2008

Discussion on measures

Presentation by the Netherlands (on progress coating implementation project)

The representative of the Netherlands presents the intermediate results of the 10 mm thermal epoxy coating implementation project in the Netherlands. On a national level approximately 40 LPG tank-vehicles will be thermally coated to reduce the risk of LPG-delivery at Dutch LPG refuelling stations. Without a thermal coating on the LPG tank-vehicles the risk is considered too high. Without additional risk reducing measures these stations have to stop the delivery of LPG. The Netherlands investigates some feasibility questions with respect to a thermal epoxy coating.

The intermediate results of TNO research show:

- Some tank supports are subject to material stress and require regular visual inspection. Therefore these tank supports cannot be coated. It will be investigated if these critical tank supports can be protected with a removable heat protection. Heat transfer calculation have been performed and determined that these tank supports cannot remain unprotected.
- New tank-vehicles in the Netherlands can be coated relatively easy, but tank vehicles built before 1995 give more problems due to the limited space between the tank and wheel construction.
- An assessment of the critical steel wall temperature has been made for a propane tank with a 2.4 m diameter, 9 mm wall thickness, constructed of Dillinal steel. The relation between the temperature of the tank wall/the gaseous phase and the time before rupture of the tank shows that the temperature of the tank wall above 500 °C is critical. In a situation when the temperature of the tank remains below 500 °C the tank will not burst.
- Effectiveness after a collision has a low priority in the research because it is not relevant for the unloading at LPG refuelling stations (static situation).

The representative of Canada says that the tank diameter, the wall thickness, the pressure in the tank and the wall temperature influence the probability of a BLEVE.

TNO mentioned that the temperature in a fire varies from 600 till 1250 °C, depending on fire conditions (inside/outside, wind velocity). The maximum temperature of a pool fire outside is approximately 900 °C.

The representative of the United Kingdom mentions that the temperature in a petrol fire in a rail tunnel with ventilation of air exceeded 1300 °C.

Presentation by Canada (on research in USA/Canada)

In Canada and the USA there is currently pressure on the regulators to improve the accident survivability of rail tank cars used for toxic by inhalation dangerous goods. This follows from 3 accidents with chlorine and anhydrous ammonia rail tank cars in the USA. Thermal protection systems for a chlorine rail tank car has to meet higher standards because carbon steel with a temperature above 250 °C. can react with the chlorine in the tank.

Especially for LPG rail tank cars two new intumescent coatings have recently been fire tested and approved by the US DOT/FRA. The next generation tank car project is also a joint industry effort with both US and Canadian government participation to design and built higher integrity tank cars. In relation to this project Transport Canada has funded work to assess the BLEVE prevention performance of new tank car design concepts. The chemical industry is playing an important role in the new generation tank car project.

The representative of Canada showed a few videos of some tank testing with a heavy impactor sized 58x43 cm and 15x15cm, on a speed of 14/15 miles per hour.

The representative of the UK says the size and shape of the impactor is important because a variety of objects can cause an impact.

The representative of Canada agrees and remarks that the goal is a requirement for a rail tank car to withstand a standardised impact that is representative of various potential impact objects. The rail tank car will never be indestructible, but should be strong enough to withstand significantly reduce the current probability of release.

The representative of the Netherlands asks if old rail tank cars are tested on this impact, because materials can deteriorate in time.

The representative of Canada answers negative, because old rail tank cars are currently phased out quite fast.

Presentation by the Netherlands (ranking method of measures)

The ranking method the Netherlands presented in Rome has been adapted after remarks of the working group in Rome. The representatives of the United Kingdom, UIP, UIC, AEGPL and Germany have made comments on the adapted ranking method. These comments have been made available to all participants in the TNO-document with the adapted ranking method.

The qualification of the measures should be discussed further on to come to a unified ranking method, because delegates look at it in various ways.

Presentation of Germany (accident data)

The representative of Germany says measures to be taken should be related to known accidents. It is not logical to require a measure that could not have prevented accidents in the past. Germany is not enthusiastic about a thermal coating because there is no proof it would have prevented accidents in the past. Beside that it is an expensive measure and difficult to apply on old tanks. The experience with storage tanks shows that it is not easy to guarantee the lifetime of a thermal coating. A pressure relieve valve (PRV) is a good measure to limit the pressure level in the tank and a release by the PRV indicates an explosion is near in time. A release is a sign for the fire brigade to keep distance.

The representative of the Netherlands agrees that accidents with dangerous goods are few. But the Netherlands makes use of a risk assessment method according to a generic guideline for the calculation of risk, that has been adopted by the RID Committee of Experts in 2005

and that has been adopted in principal by WP.15 in the last May meeting. Accident data on general freight transport are relevant in a risk assessment on the transport of dangerous goods, because they provide potential scenarios for accidents.

A cost-benefit analysis of a measure should include the societal costs when a BLEVE occurs and also the costs to prevent casualties when the risk of a BLEVE is near. For instance the societal costs of the evacuation of people from their homes and work is very high as well.

Even last Friday 3000 people were evacuated from the centre of Benidorm because a tank vehicle was venting propane and there was a risk of a BLEVE.

Presentation by AEGPL (ranking method)

The representative of the AEGPL says it is most effective to focus on the prevention of accidents in general by defensive driver training, because road accidents cost a lot of casualties every year. Human error is the main cause of accidents. Measures to avoid fire are protective in accident situations. A thermal coating is a mitigative measure in an accident with a fire. AEGPL prefers to take preventive measure because without accidents a BLEVE will not occur. Defensive driver training is guarantied to reduce accidents with 10%. A thermal coating is a good measure for a static (storage) situation, but on the road it is more complicated. He remarks that chapter 1.9 of ADR opens the possibility for specific national transport restrictions, such as routeing and areal restrictions.

The representative of the Netherlands says to use Chapter 1.9 already for routeing. The measure of defensive driver training is only very effective when every driver is trained and is acting upon it, and not only the drivers transporting dangerous goods. Preventive measures to avoid accidents are very important and the Netherlands has a firm and effective policy on that. But to avoid a hot BLEVE a measure to deal with the heating of the tank is in general more effective.

The AEGPL collected facts about the costs of various measures (road) that are presented in a scheme that will be discussed in the working group. The representatives made first remarks on the presented scheme (on the cost assumptions; it has sense to make difference between old and new tank-vehicles and between different sizes of tank-vehicles) and are invited to make further remarks on the scheme.

The representative of the United Kingdom says that UIP could be asked to give estimations of costs of specific measures for rail.

Discussions on the ranking method

The representative of France remarks that the costs/effectiveness scheme and the bow tie model are difficult to combine. He suggests to locate all measures in the event tree to show on which event the measure works as a barrier. A measure that works as a barrier for every event that can cause a BLEVE is more effective than a measure that only works for one specific event that can lead to a BLEVE. Some preventive measures can be effective only in combination. It is enough to define two categories, preventive and mitigative measures. The knot in the middle of the event tree should be an impact in a tank or a tank in a sizeable fire.

The need to avoid a BLEVE at certain costs is not purely a rational matter. After accidents or near accidents there can be political pressure to take further measures or a public call for prohibitions for the transport of dangerous goods. But at this moment good arguments are needed to explain the necessity of a measure.

The representative of Belgium is interested in the effectiveness of measures in the bow-tie model. But in Belgium the urgency with respect to BLEVEs is not high.

The representative of Italy says the ranking method of the Netherlands does not provide a clear analysis to justify a decision for a measure with good scores. He prefers a practical approach in the working group on this matter and a check by experts whether our ranking is good. The suggestion of the representative of France is supported.

The representative of the United Kingdom says the need for any measure is not yet demonstrated. Measures are possible on a voluntary basis like application of the PRV. To access the effectiveness of a measure is very difficult. And some measures are already discussed in other working groups.

The representative of Germany says effectiveness and costs of the measures are important criteria, but he doubts the effectiveness of a measure to prevent an event that never has happened.

The representative of Poland does not have realistic facts on costs or effectiveness of measures.

The suggestion of the representative of France – to locate all measures in event trees, to determine the probabilities of the events, and to decide where to put the barriers in the event trees - is supported.

Selecting/ranking measures

The representatives discuss what measures are mitigative or preventive: see list at the end of the report.

The representatives discussed what measures on the list need no further ranking for and will be skipped from the list for different reasons:

- Sunshield (A1.3): is not a relevant measure to avoid a BLEVE and can even increase the risk for a cold BLEVE because it combines with a lower thickness of the tank wall. The RID/ADR-tank working group can be asked to advise on the question if it is wise to allow a sunshield in combination with a lower thickness of the tank wall. Therefore elimination of the sunshield is recognized as a potential measure.

- Aluminium foils/balls inside tank (A1.4): is not a proven technology to avoid a BLEVE and has no practical use in the list of possible measures to avoid a BLEVE.

- Use of telematics (A1.10): can be beneficial to avoid a BLEVE, but is already discussed in another working group.

- Speed limitation (A2.3): cannot be regulated in RID/ADR in general; however countries can make use of RID/ADR Chapter 1.9 to make arrangements in this respect. The representative of the Netherlands refers to the introduction in the USA of a maximum speed limit of 50 mph for rail tank cars containing toxic by inhalation substances.

- Automatic battery switch (B1.11): This measure falls under the scope of the general measure B1.10.

- On train segregation/protection distance (C2.1): an extension of section 7.5.3 of RID has recently been rejected by the RID Committee of Experts. The representative of the United Kingdom states that based on a “broadly equivalent approach” such a measure could be an alternative for crash buffers and over-buffering/end impact resistance.

See at the end the list of remaining measures

In the next meeting the representative of Germany would like to discuss the definition of a hot and a cold BLEVE. The representative of Canada suggests to use the definition in his presentation for the first meeting. The representative of France warns for complicated criteria that have no value for selecting measures for BLEVEs caused by a fire and for BLEVEs not caused by a fire. The definition should be clear enough for this purpose. The participants are invited to send suggestions to Mr. J. Ludwig

Next meeting

- France and AEGPL invite the working group for the next meeting in the period from 26 January to 13 February 2009 in Paris. France is willing to chair the meeting. The Netherlands offers to make the report.

- TNO, AEGPL (for road) and UK (for rail) will send in event trees for discussion at the next meeting.

- AEGPL and UIP are invited to give (further) information on costs of measures for respectively road and rail transport.

	List of measures to reduce the risk of a BLEVE	**preventive/mitigative**
A1.1	Pressure relief valve	mitigative
A1.2	Complete thermal protection	mitigative
A1.3	(Elimination of) Sunshield	not relevant; to be discussed in the Tank working group
A1.5	Protection against overfilling	mitigative
A1.6	Additional impact protection	preventive
A1.7	Apply normalised carbon steel	preventive
A1.8	Heat treatment after welding	preventive; proposal in the Tank working group
A1.9	Excess flow valve	preventive
A1.10	Use of telematics	Working group Telematics
A1.11	Sufficient water supply near load/unloading sites	mitigative
A1.12	Tank size limitations	mitigative
A2.1	Additional checks during periodic inspection	preventive
A2.2	Routeing	mitigative
A2.4	Safety management system (includes A2.5, A2.6, A2.7, A2.8)	preventive/ mitigative
A2.9	Maintenance	preventive/mitigative
A2.10	(Near) accident investigation/reporting	preventive
A2.11	Emergency planning en preparedness	mitigative
B1.1	Only single rigid tank vehicle or semi-trailer	preventive
B1.2	Improve bumper/side/rear impact resistance	preventive
B1.3	Electronic vehicle stability control against overturn	preventive: is discussed in WP.29
B1.4	Monitoring systems for tyres/brakes/bearings	preventive
B1.5	Protection of fuel tank	preventive
B1.6	Automatic engine fire extinguisher	preventive
B1.7	Limit capacity of fuel tanks	preventive
B1.8	Aluminium foils/balls inside fuel tank	preventive
B1.9	Design and construction of fuel tanks	preventive
B1.10	Avoiding sources of ignition (includes B1.11)	preventive
B1.12	Higher integrity vessel closure, interlocked transfer	preventive
B1.13	Non-return valves	preventive: discussion in ad hoc Joint Meeting working group
B1.14	On-board fire extinguishing equipment	preventive
B2.1	Lane departure warning/distance warning	preventive
B2.2	Collision prevention systems	preventive
B2.3	Defensive driving training	preventive
C1.1	Improve side impact resistance wagon	preventive
C1.2	Over-buffering / end impact resistance tank wagons flammable gasses and liquids	preventive; already prescribed for toxic gasses
C1.3	Crash elements tank wagons flammable gasses and liquids	preventive: already prescribed for flammable gasses
C1.4	Derailment detection	preventive
C1.5	Enhanced “Hot box” detection systems	preventive
C1.6	Control systems for brakes wagon	preventive
C1.7	Recessed valves	preventive
C1.8	Impact resistance wagons	preventive