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 8 of the provisional agenda
Any other business

07 January 2013

Result report of the international survey of implementation of chapter 1.9 of RID/ADR/ADN by users of risk evaluation procedures in the field of dangerous goods transport

Responses by Netherlands

Annexe 1
(en anglais uniquement)

International Questionnaire (INF.19): Netherlands

Questionnaire

Referring to carriage by rail, carriage by road, carriage by inland waterways:

1. Transposition into National Law

How and on what legal basis is chapter 1.9 of RID/ADR/ADN transposed into national law?

The whole RID/ADR/ADN, including chapter 1.9, is transposed by direct translation into the Dutch Transport of Dangerous Goods Act, and for the three modalities separately incorporated in the Dutch versions of RID (=> VSG), ADR (=> VLG) and ADN (=> VBG).
Chapter 1.9 itself, and the principles behind it, is extensively applied in practice within the so called "Basisnet" (Base transport network) for each of the modalities. For this moment the regulation is part of a Circular, which is called the Circular Risk standards for transport of dangerous goods. Circulars do not have the status of laws, but they have a juridical position just below them. For the legal implementation of the Base transport networks two new laws are in the latest stage of design and completion, i.e. they are discussed in the governmental organizations and the Parliament. These news laws are interconnected and they regulate the coordination between (the safety issues of) dangerous goods transport on the one hand and land-use-planning on the other.
For two individual goods, the toxic gases chlorine and ammonia transported by rail, even more stringent rules have been adopted.

Are there sub-legal regulations on this matter (technical rules or similar)? If yes, please specify.

As said above, in the present Circular a whole regulation system is described.

2. Risk Analysis Basics

Are risk analyses carried out? yes

If yes, for what purpose:

To identify the risk and decide on passage restrictions/approvals for certain dangerous goods for	
Tunnels	Yes
Bridges	No
Residential Areas	Yes, this is the key purpose. In fact residential areas are in general the main representatives of the surrounding parameters, but other areas with a high population density are also relevant for the risk calculations.
Other	Marshalling yards ; sea and inland ports; loading and unloading activities.
To identify the risk of accident effects and decide on further technical and/or organizational measures (if appropriate)	
BLEVE	Yes. Belongs to the main national topics ; explicit measures are taken to diminish the risk of BLEVE's, especially concerning LPG, both for road and rail modality (e.g. heat resistent covers for tank-vehicles and tank-wagons ; hot BLEVE proof composition of freight trains)
Other	Yes. This comprises a list of many examples of measures. We mention the following: - {Prevention against} the transport accident itself -> [collisions:] better signalling, intrinsic exclusion of traffic conflicts ; [derailments:] detection devices ;

	- Pool fires (from all kinds of flammable liquids) -> safety zones (road, rail, shipping) and construction measures for buildings in those zones - Toxic clouds -> evacuation plans
Other purpose: in general and nationwide: land-use planning as well as routing of the transports.	

Are all modes of transport (road, rail, inland navigation) taken into account? Are different approaches used for the individual modes of transport?

Yes, all modes are taken into account. Inland navigation receives much less attention however than road and rail, because nearly all situations on the waterways meet the risk standards.
The approaches can best be described as similar. The effect calculations are the same, independent on the modality. Also the population data are comparable.
In the details, differences can be found.

General description of the method(s):

The methods are comparable with the ideas of the RID and ADR Guidelines, mentioned in the footnote under RID-1.9.3, i.e. “Generic guideline for the calculation of risk inherent in the carriage of dangerous goods by rail”, respectively the analogous guideline mentioned in relation to ADR-1.9.4.
The methods have a straightforward approach and are developed using certain basic physical, chemical and toxicological properties of the dangerous goods as well as assumptions and calculation rules to obtain a standardized way of risk analysis
In general, three main domains are considered: the transportation process (infrastructure, vehicles and traffic process), the dangerous goods transported (identity, mass, means of transport) and the surroundings (people possibly present in the – built – area)
The calculation is based on the following steps: 1] a ship, vehicle or train has a chance to get involved in a transport accident (like collision, derailment, slipping) ; 2] then there is a certain chance that the tank fails and that the dangerous good is released by this physical impact ; 3] If any loss occurred, the hole and the loss can be of small, medium or great size ; 4] the dangerous good will sometimes have an immediate effect (explosion, fire) or more likely disperse following its physical properties and the wind circumstances and may express their dangerous behaviour (toxic, heat radiation, blast etc.) later on and further away, e.g. by sudden ignition ; 5] people in the surroundings up to tens, hundreds or even thousands of meters can possibly be lethally hurt by the effect that is caused by the dangerous good released.
The two main results from the risk calculations are the location-based risk (iso-risk contours) and the societal risk (Fn-curves)

3. Clustering of Hazardous Substances / Definition of Accident Scenarios

What hazardous substance clusters or main substances are laid down?

In the Dutch approach two substance clustering methods have been developed independently. Road and inland navigation have the same classification method, and rail a different one. The differences are not very essential, but in the details, i.e. concerning individual chemicals and goods, many differences can be found. The common approach is that only goods transported in large quantities (in tanks) with a far reaching effect are selected, and therefore especially many solids are excluded and also most water-based liquids like inorganic acids. Typical classes included in the risk analysis are (pressurised) toxic and flammable gases and toxic and flammable liquids. Some specific categories are excluded for other reasons than their hazardous effects, for example because of the limited number of actual transports.
Road and navigation use a classification method that is derived from the physical, chemical and toxicological properties, such as boiling points, flash points, vapour pressures and LC-50’s. The method is related with the classes and packaging groups in ADR and ADN.
Rail uses a classification method that is based on the hazards, i.e. the H($_{azard}$)I($_{dentification}$)N($_{umber}$) in the RID (Main table of chapter 3.2, column 20).

What percentage of the carried dangerous goods is covered by the clusters/main substances?

In the Netherlands we have never made a specific analysis on this. We estimate that the number of transports included in the quantitative risk analyses is between 40 and 70%. However, only *loaded* ships, road and railway tank cars and tank containers are taken in account in the calculation system, so that this estimation given here is meant as a part of all loaded transports. When all empty uncleaned RID/ADR/ADN-transports are considered too, the ratio is of course substantially lower.

Is there a coupled classification of accident scenarios and substances? (see also question 4)

Yes, there is a coupled classification of accident scenarios and substances, although this coupling is not a strict, systematic condition.

Comments (Experiences, problems, need for improvement, …):

Using the physical properties on the one hand or the HIN on the other as the criterion and given the list of groups and HIN's chosen in the Netherlands, compounds such as carbon monoxide and hydrogen [road and waterway category 'GT0 and GF0'], and also diesel and kerosene [rail: both HIN 30] are not taken into account in the risk calculations in all modes.

4. Accident Effect Models

Which damage indicators are taken as a basis?

Fatalities:	Yes
Seriously injured persons: (with permanent impairments?)	No
Slightly injured persons:	No
Damage to the environment:	No
Material damage:	No
Other:	No

What accident scenarios are considered? Are event trees used for process modelling?

For each modality several initial (transport-based) accident scenarios are considered, with the use of event trees. Without being complete, we mention some scenarios for roads, railways and waterways. After the initial incidents the event tree gives subsequent chances concerning for example the type of tank wagon (wall thickness) or the type of ship (single or double hull).
Road: type of road (highway, local roads in or outside the built-up area) is discriminating factor, not the type of accident
Railway: 1] derailments and collisions at higher or lower speed sections ; 2] iderailments and collissions near switches or near level-crossings ; 3] hot BLEVE (escalating fire);
Waterway: 1] collisions between different types of ships ; 2] effusion dependent on type of ship (atmospheric, cooled or under pressure)

Which effects are considered and which (limit) values are defined as "critical effects"?

Explosion /pressure	Yes; limit value is 0.3 bar overpressure (outdoor) and 0.1 bar (indoor)
Fire	Yes: limit value is 35 kW/m^2 (indoor) and varying (outdoor)
Heat	Included in explosion and fire calculations
Toxicity	Yes: on base of probit functions down to 1% lethality
Release of toxic substances	No
Other	No

Which dispersion scenarios are taken as a basis?

Heavy gas dispersion and Gaussian dispersion

How severe were the considered accidents?

The accidents considered to design the calculation models (casuistry used) have a broad range of small mechanical damage to huge fires, only in the Netherlands
The maximum accidents proposed to be credible are severe (cold and hot BLEVE; instantaneous release of toxic gases), dependent on the modality.

Which hazardous substances/main substances involved in the accidents were considered and what amounts of these substances were released?

Four to five main categories are defined, i.e. flammable liquids, flammable gases, toxic liquids and toxic gases. In-between we find the liquids that are both flammable and toxic. Within these groups a subdivision is possible. For the calculation representative compounds for these categories are prescribed, e.g. propane for the flammable gases.
Depending on the modality, the scenario, the type of tank and the category different amounts are prescribed in the Manuals. For example, for road tankvehicles with ammonia the average amount is 16 ton, for railway 50 ton, for ships 75 m^3.
The tonnages mentioned correspond with whole loss of the contents of the tanks, except for the ships. Only one vehicle (also by trains with more wagons) is taken into account.

What probabilities regarding the manner of release of the dangerous good and an ignition are taken as a basis for the consideration? (Specify e.g. as a percentage)

	The ratio between spontaneous and continuous is dependent on the modality and on the category of goods. One example given here is for the road and pressurised, flammable gases:
Release: spontaneous	0.35 (<- see above, this is only one example)
continuous	0.65
Ignition: instantaneous	0.8
delayed	0.2
none	0.0

On what basis have these probabilities been determined (analysis of data, estimates…)?

In principle these probabilities are based on the Dutch accident statistics, and where necessary estimates from experts are used for completion.

Are data on vehicles and transport specifications as well as infrastructure information considered? If so, what data are considered?

Vehicle type:	Road: tank-vehicles and vehicles with tankcontainers Railroad: tank-wagons and wagons with tankcontainers Ships: tankers and containerships
Tank type:	Corresponding to the vehicles
Specific safety measures:	Are included if quantified by an accepted argumentation
Transport time:	24 hours, divided in daytime and nighttime ; Weekend seperately from working days
Specific infrastructure characteristics:	Examples: Roads: broadth, fly-over situations

	Railroads: broadth, presence of signalling Waterways: navigable class (CEMT)
Other:	Transport speed ; transport/traffic control

Is the level of harm/the spatial or frequency distribution determined?

Yes, the effect calculations give the spatial distribution from 100 to 1% lethality

What calculation models are used (see also question 7)?

For the calculations for road, railroad and waterways the government has designated only one calculation programme (RBM-II software) as the compelled instrument. This software is as maximum as possible designed conform the specifications of the Purple Book and the models behind it in the other coloured Books.

Comments (Experiences, problems, need for improvement …):

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5. Statistical Data

What data on dangerous goods transport are required for the risk analyses?

Accident frequency	Yes
Share of relevant releases	Yes
Accident effects	(More or) less
Dangerous goods volume: Total	Yes
on certain sections	Yes
Overall transport mileage	Yes
Share of dangerous goods transport in overall transport	Yes
Heavy goods mileage	Yes
Share of dangerous goods transport in heavy goods transport	Yes
Composition of dangerous goods	Yes
Other	Loaded vs. empty, uncleaned

Dangerous goods volume per mode of transport:

	Road	*Rail*	*Waterway*
Accident frequency	Yes	Yes	Yes
Share of relevant releases	Yes	Yes	Yes
Accident effects	(More or) less	(More or) less	(More or) less
Dangerous goods volume: Total	Yes	Yes	Yes
on certain sections	Yes	Yes	Yes
Overall transport mileage	Yes	Yes	Yes
Share of dangerous goods transport in overall transport	Yes	Yes	Yes
Heavy goods mileage	Yes	Yes	Yes
Share of dangerous goods transport in heavy goods transport	Yes	Yes	Yes
Composition of dangerous goods	No	Yes	Yes
Other			

Are these data available?

They are available.

How current are these data?

They can be considered as rather outdated ; an actualization is made and planned.

Are national as well as international sources used?

Mainly national sources are used, in the details international information is applied.

Comments (Experiences, problems, need for improvement …):

See question 11.

6. Risk Analysis Procedure

How is the division into sections effected?

For all three modalities (the length of the) sections can be chosen by the analyst. The choices depend on the specific case that is investigated.

What data are considered in the risk analysis?

Data on dangerous goods transport[1] (see question 5)	Yes
Accident data (see question 5)	Yes
Data on overall volume of transport[2] (see question 5)	Yes
Data on technical specifications	Yes, possibly
Equipment of the dangerous goods vehicle	No
Equipment of the structure	?
Data on the surroundings	Yes
Routing data	Yes
Other	For example the weather station nearby

Are correction factors used e.g. to consider other substances with characteristics comparable to the main substances?

No, correction factors are not used. We use “voorbeeldstoffen” (representative substances), i.e. these are representative for a group of substances with similar hazard characteristics. The risk of the actually transported substances can therefore be somewhat higher or lower. For example, the hazardous effects of butane are actually less than those of propane, but in the prescribed method for the QRA the transport of butane is determined with the data of propane.

Which risk parameter is determined?

Individual risk:	Yes
Societal risk:	Yes
Environmental risk:	No
Other:	--

[1] e.g. type of the hazardous substances carried, transport volume for each mode of transport.

[2] Overall volume of transport also includes data on heavy goods transport or freight transport, passenger transport etc.

How are the risks depicted in the method? (iso-risk contours, harm/frequency graph, …)

The individual risk is depicted by iso-risk contours (usually 10-6, 10-7, 10-8) and also indicated in a Table with the corresponding distances in meters.
The societal risk is depicted in a casualties/frequency graph (Fn-curve).

How are uncertainties in the method (data, hypotheses, clustering, …) addressed?

They are not always openly discussed or revealed. The uncertainties (e.g. is a BLEVE possible with non-flammable gases, and, if so, what happens?) are only treated if sufficient attention is given to them. It's a constant study for getting better know how.
Intrinsic uncertainties are accepted as a fact.

Comments (Experiences, problems, need for improvement …):

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7. Computer-aided Calculation Models

What models/programmes are used for risk analyses in the field of dangerous goods transport? (e.g. OECD/PIARC on tunnel categorisation …)

RBM-II for road, rail and inland navigation.
Others, among which the own software of TNO (Riskcurves®), can sometimes be found in reports but the use of RBM-II is actually prescribed by the government.
RWSQRA for tunnel safety investigations.

What other programmes such as flow/dispersion models/programmes are used?

Only in specific studies, used in or for selected groups of stakeholders, other programmes or models (e.g. Computational Fluid Dynamics) can sometimes be found.

Are these freely accessible, up-to-date, thoroughly tested in practice, specifically developed?

RBM-II is indeed specifically developed and freely accessible and thoroughly tested in practice
RWSQRA (formerly known as TunPrim) is also specifically developed and freely accessible, but on a smaller scale tested in practice.
Safeti, SAVE II, Riskcurves® and other software is commercial.

What individual adaptations are necessary for the application of the programmes? (e.g. as regards scenarios, hazardous substance clusters, national need/circumstances ...)

On the one hand adaptations are always welcome, because no programme is ever perfect.
On the other hand adaptations are strongly dependent on the context. Legislation, the state-of-the-art of knowledge and science, digital possibilities, personal preferences => too many factors could be a reason for adaptation. It is however not attractive to edit new versions frequently, because unification and comparability of calculation results is desirable over a longer period.
RBM-II is edited with the explanation that it is not suitable for certain situations such as the presence of 'roofs' (buildings above the infrastructure) or noise reduction shields at the sides.

Information technology: Are the programme versions adapted on a regular basis?

Yes, programme versions of RBM-II are adapted on a regular basis

Question on the OECD/PIARC model: What improvements to the OECD/PIARC model should be made, to what extent should they be made and what priority should be assigned to them? (e.g. modern model platform, more realistic sub-models, flexibility, modularity …)

The use of the OECD/PIARC model is commonly outside the attention of safety engineers in the tunnel field, because another programme (RWSQRA) has been developed in the Netherlands for the same purpose

Comments (Experiences, problems, need for improvement …):

The further upgrading of RBM-II is ongoing business. All users had and have easy access to the helpdesk to give their comments. The process of improvement is continuous and rather open.

8. Risk Evaluation

What risk evaluation criteria have been established? (limiting curves, thresholds, …)

In the Netherlands for various safety issues (transport, industry) always the same two evaluation criteria are applied: the location-based risk (individual risk) and the societal risk
Standards are laid down in legislation and policy for both type of risks
Location-based risk (after the calculation expressed in several iso risk contours) is a measure of the transport situation itself ; Explicit values (especially the 10^{-6} contour) have a meaning as a strict limit for acceptation of the transport situation.
Societal risk (expressed in a Fn-Curve) is a measure of the chance that groups of people of certain sizes could be lethally hurt. The criterion is a specific line in the diagram, connecting points (i.e. 10^{-4} for 10 people ; 10^{-6} for 100 people etc.). The criterion is an orientation standard.
The societal risk criterion is involved in a special procedure that is dominant in the decision processes (see under question 9 on Risk management). This procedure is the societal risk accountability.

How have these criteria been laid down or who decided on them?

The criteria have been laid down after a large investigation project about 20 years ago; the government has decided to introduce them in the policy and legislation.

Comments (Experiences, problems, need for improvement …):

For this moment there is no evident need for improvement, because all parties are familiar with the evaluation practice.

9. Risk Management

How is the effectiveness of risk minimisation measures determined and/or how are the measures established?

It is very important to understand the compulsory process of societal risk accountability. In this procedure, the administration or the initiator of a transport (road, rail, navigation) or land-use development has to explain how the societal risk level is influenced, why the development is necessary, and whether or how the (increased) level can be diminished by measures. In the process it is also compulsory to ask an advice from the fire brigade. The existing and the resulting 'new' level of the societal risk must be compared and is the responsibility of the local government..
Given the new, analysed situation, certain measures are indicated and mentioned in the report on the accountability.
The establishment of the measures is, however, not guaranteed. In practice there are many examples of actual implementation of the suggested measures, but there also examples where the implementation failed. Reasons for failing vary widely, from juridical aspects to insufficient management.

Comments (Experiences, problems, need for improvement …):

The need for improvement in the realisation of measures is admitted. National and regional projects have been started up to improve processes and to insure the actual implementation of the planned measures.

10. Special case: Categorisation of Tunnels

As the approach is based on harm levels and pre-sorting, the current definition of tunnel categories is not geared to commonly used risk analyses and evaluations of individual scenarios in accordance with sub-section 1.9.5.1.

How is the issue as regards the tunnel categorisation under ADR by means of risk analysis addressed and what experiences have been gained concerning this matter?

A logical and adequate coupling between tunnel categorisation and transport risk analyses is in development for new tunnels in main roads. The method for tunnel categorisation takes into account the elements listed in 1.9.5.1 ADR, including risk assessment.

Is there a need to discuss a possible optimization of the tunnel categories or the tunnel restriction codes at international level?

As far as we can see there is no urgent need for an optimization of the tunnel categories or restriction codes.

Comments (Experiences, problems, need for improvement …):

In fact the categorization is helpful for the quantitative analyses of the risk of tunnel users, as required by European Directive 2004/54/EC. Because specific dangerous goods are not expected to be transported through tunnels in the higher categories, their risks can be excluded in the calculations, making the analyses less complex. These substances however have to be rerouted given risks at other places. This is one of the elements addressed in the method mentioned above.

11. Other

From your perspective, in which areas of risk analysis for the transport of dangerous goods is there a need for discussion at international level?

There is a large need of suitable accident and incident data. Official, commercial and open sources of accident data are known, but the reliability is often inferior. Even the obligations from RID, ADR and ADN to report on heavy accidents seem to be ‘paper rules’ in practice, instead of guarantees.
A second point of interest is which types of harm and damage should be included (see question 4).

Where do you see further need for harmonization or possibilities for harmonization?

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Thank you very much for your support.

Please send the completed questionnaire by 31 October 2011 to
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