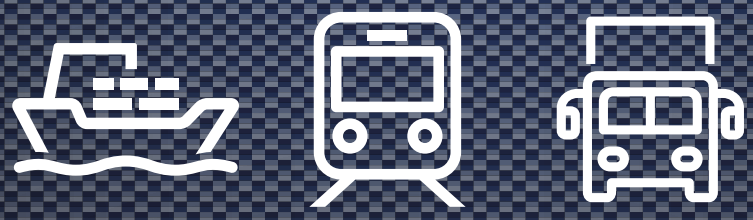
European Commission

Framework guide

Multimodal



Risk management framework for inland transport of dangerous goods

Mobility and transport

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Risk management framework for inland transport of dangerous goods

Framework guide

(version applicable to the voluntary implementation scheme during the test phase period 2018-2020)

Version 1.0/2018

Executive summary

In 2006 and 2008 two important guidelines were published in order to provide assistance to RID and ADR Contracting Parties using risk analysis techniques for the purpose of assisting the Transport of Dangerous Goods Competent Authorities in implementing chapter 1.9 of RID/ADR:

- The "General Guideline for the Calculation of Risks in the Transport of Dangerous Goods by Rail" (see A81-03-501.2006/Add.2 on OTIF website) and,
- The "General Guideline for the Calculation of Risks in the Transport of Dangerous Goods by Road" (see ECE/TRANS/WP.15/2008/6 on UNECE website).

However a survey[1] of the actual implementation indicated that these techniques were only used by a very limited number of stakeholders.

Considering the importance of the risk-based decision-making approach for the safety of TDG operations and the numerous issues which have to be faced by the users of these techniques (weaknesses in input data, risk estimations applicability, management of uncertainties, need for improvement of decision-making processes…) it was proposed (see ECE-TRANSWP15-AC1-2014-GE-INF16e) to develop more practical guidelines, going beyond basic risk analysis principles, for improving further the assistance to the users of risk management techniques.

Therefore, as a complement to the initial guidelines, the risk management framework presented here seeks to offer a more detailed and more complete suite of guides allowing less experienced users and also potentially new users to implement the risk management techniques applied to inland transport of dangerous goods.

In particular, this framework of guides widens the applicability of the former guidelines on the following aspects:

- it is designed for the use of any interested stakeholders and in various types of risk management situations, including for the implementation of chapter 1.9 of RID/ADR/ADN provisions,
- it provides a level of detail which allows a user to implement step by step a harmonised approach while remaining consistent with the former RID/ADR/ADN risk analysis guidelines,
- it is designed to provide solutions to the issues listed by transport of dangerous goods experts at the beginning of the development of the framework,
- it adds a detailed decision-making guide that complements a risk estimation guide,

1 See International survey of transposition of chapter 1.9 of RID/ADR/ADN among users of risk evaluation procedures in the field of dangerous goods transport, UNECE-OTIF ECE/TRANS/WP.15/AC.1/2011/INF.19.

- it integrates practical detailed guidance and tools which allow better recognition by interested stakeholders of the results obtained from the implementation of the framework,
- it is also a starting point to improve crucial access to information and data to widen the implementation of risk-based decision-making.

Emphasis was also given to the long term objectives of the framework during the design of this first version of the framework.

In particular, the conclusions of the study "Harmonised Risk Acceptance Criteria for Transport of Dangerous Goods"[2] provided key policy orientations for the development of this harmonised multimodal framework which was seen as a necessary step towards a potential future revision of the legislation applicable to the risk management of inland transport of dangerous goods.

While remaining compatible with the currently applicable legislation and with the general principles expressed in the former RID and ADR guidelines for risk analysis, this framework of guides offers a sustainable and integrated approach to risk-based decision–making applicable to TDG, including a process for its own maintenance and developments.

The Inland TDG risk management framework allows the interested users to:

- implement a harmonised method for decision-making, briefly presented in section 3, and detailed in the Guide for decision-making,
- implement a harmonised method for risk estimations, briefly presented in section 4, and detailed in the Guide for risk estimation,
- use a common set of terms and definitions compiled in a glossary applicable to the whole framework (see section 5 and annexes I and II),
- implement a structured process of maintenance and improvement of the framework with the support of an Expert Users and Development Group (see section 6).

2 "Harmonised Risk Acceptance Criteria for Transport of Dangerous Goods", DNV-GL, Final Report No.: PP070679/4, Rev. 2 - Date: 2014-03-25, for the European Commission DG MOVE

Acknowledgements

This guide was developed under the TDG Roadmap project (phase I) coordination managed by the European Union Agency for Railways with the contributions of the following experts involved in the management of risks posed by the Rail, Road and Inland Waterways transport of dangerous goods.

The DG Mobility and Transport of the European Commission and the European Union Agency for Railways warmly thank all the participating experts for their fruitful contributions to the creation of the Inland TDG risk management framework.

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1. The framework design phase

The TDG roadmap project (first phase) establishing the risk management framework presented here started on the basis of the conclusions of the workshop organised by the European Commision in February 2014 concerning "the feasibility to harmonise the approach to inland TDG risk management".

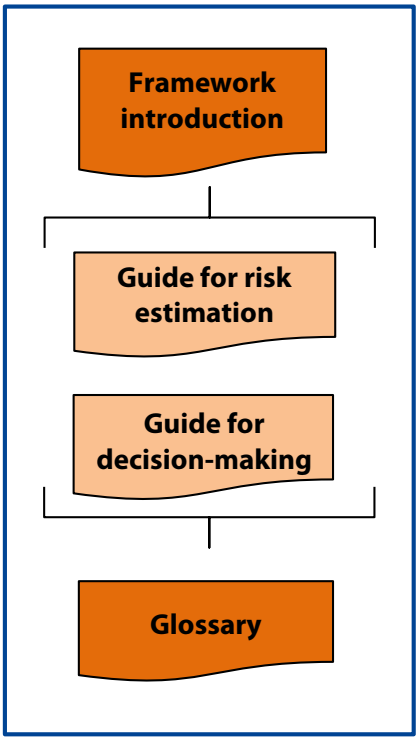
At this workshop States representatives and professional associations considered that, due to the big disparities in existing Inland TDG risk management practices and legal framework, the best instrument to standardise the approach and level the legislative playing field would be the adoption of **a harmonised multimodal legal framework for Inland TDG risk management, possibly in the form of a EU Directive.**

However, it was also considered that the potential development of such a Directive could only take place after a first phase of voluntary technical harmonisation which may be used to pave the way for potential future legislative changes.

It was decided that this technical harmonisation should take the form of guides. The framework of guides presented here is the deliverable corresponding to that objective.

This document (framework guide) provides background and general information on the framework, brief introductions to the guides composing the framework, and information on the future maintenance and development of the framework.

Figure 1: Inland TDG Risk management framework



1.1. Development principles

The framework was developed by the participants in the first phase of the TDG roadmap, anticipating the possibility of future legislative developments.

At the time of the publication of the first version of the framework it is considered that a period of experimentation and further improvements may be necessary in order to gain experience. This is why the publication of the guides will be accompanied by the establishment of a maintenance and improvement process (see section 6 and 7) and the dissemination of information and tools to users having an interest in implementing the framework.

During the development process the contributing experts have considered many risk management situations they have addressed in their professional career and the issues they have faced, and finally agreed on the proposed framework as the starting point for a new harmonised and multimodal approach to risk-based decision-making.

Risk analysts and decision-makers are encouraged to implement the harmonised framework in order to avoid issues typically experienced with these methods in the past, and to allow better recognition of risk estimation results and the processes for assessment of risk control measures.

1.2. Transport safety and risk management

The framework is also based on the principle that international Transport of Dangerous Goods is regulated by RID/ADR/ADN which are also the applicable annexes to the Directive (EU) 2008/68 on the Inland Transport of Dangerous Goods, as amended for technical and scientific progress. From this perspective transport complying with the applicable legal provisions is considered safe and shall be authorised for carriage of dangerous goods on the transport networks of the contracting parties.

Therefore this framework should mainly be used to manage the remaining risks posed by Inland Transport of Dangerous Goods in a practicable, systematic, optimal and traceable way. This management activity may also encompass the assessment of potential improvement of existing legal provisions.

From the viewpoint of the existing transport systems (roads, railways, inland waterways) the transport of dangerous goods is one type of service integrated into the same infrastructures as other, non-dangerous, goods services (passengers, normal freight). Therefore an integrated approach is absolutely necessary for promoting consistent development and continuous improvement of transport safety, integrating transport of dangerous goods services within the wider transport environment.

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This is why the consideration of the transport safety regulations and of the management of remaining TDG risks are integrated in this framework:

- RID/ADR/ADN provisions are taken into account, where relevant in the risk management framework, to clarify the influence of the provisions on the risks posed by the transport of dangerous goods within their environment,
- the Framework on Inland TDG Risk Management proposes an holistic and multimodal approach compatible with the applicable legislation on transport with the view to efficiently manage the (remaining) risk posed by inland transport of dangerous goods services.

This integration can be identified at several places in the guides by the users of the framework, for example:

- the classification of goods is used to support the identification of relevant DG hazards when applying the guides to a given transport plan,
- the statistics on transport are used to estimate the frequency of occurrence of these hazards within a given transport plan.

The framework also addresses integration from the point of view of the users, which may originate from TDG experts or from transport systems experts or both. This is why the framework offers:

- TDG experts a realistic approach to the description of transport operations, and
- Transport experts a realistic approach to the risks posed by TDG services within a transport system.

With this approach both types of framework user may find useful information supplementing their existing expertise and achieve a common approach to the management of Inland TDG risks.

1.3. Mutual recognition of risk assessments

Because the framework was developed in a collaborative manner and because it is based on the experience of many categories of user, as mentioned earlier, it is envisaged that the framework will allow for an improved mutual recognition of results obtained from its implementation.

In particular, the design of the framework fully takes into account the experience of contributing participants. They have extensive experience of implementing risk-based decision making in several countries and of using existing methods developed by consultants or international organisations.

The participants in the development of the framework have sought harmonised solutions to recurring issues that are faced in the management of TDG risk scenarios, and have embedded these solutions in the framework guides.

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Constant focal points in the process were the design method (collaborative) and the objective of mutual recognition of the results obtained from the implementation of the guides.

As a result, the framework fully considers quality objectives, transparency and structured communication between stakeholders. In particular, the framework includes solutions for:

- Improving the quality and transparency of assumptions made in risk estimations, including those concerning the source of data used to propose reference values for model parameters,
- Establishing a process of continuous improvement of the harmonised methods, including the process for collecting and improving the availability of reference data,
- Clearly segregating the roles and duties of risk analysts and decision-makers with two guides that each address the needs of one of these two key users of the framework,
- Establishing a list of harmonised decision-making principles to balance various interests in a consistent way between decision-makers and stakeholders, and promote recognition of decisions,
- Requesting transparency of relevant information and the justification of assumptions made by risk analysts and decision-makers at many points in the process,
- Preserving the safety of all people through the principles of continuous improvement, avoiding the transfer of uncontrolled risk and avoiding global risk increase,
- Allowing the assessment of local risk scenarios where the risk exposure of specific groups of people may need specific treatment.

These embedded solutions support the objectives of recognition and acceptance of future risk management decisions by stakeholders.

1.4. Improved access to risk management data

The usage of risk-based decision-making is suffering from a vicious circle arising from limited access to applicable knowledge about past incidents and accidents and to relevant information on transport statistics.

During the development of the framework these difficulties were considered and several solutions were proposed for careful consideration by the users of the framework before further implementation:

- A structured list of parameters for the reporting of information on dangerous goods events in existing databases (see the draft list in annex I) which may be used for the future development of improved data collection systems,
- The list of parameters used in the harmonised risk estimation model (see annex II) which may also be used to prioritise the collection of relevant data on transport events by future data collection systems,
- The possibility for users to use harmonised templates (see harmonised templates published here and also to incorporate country-specific information, to facilitate its use in the context of the framework,

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- A process of maintenance and improvement (see section 6 and 7) which will allow the prioritisation of future improvements of the harmonised risk estimation model in coordination with improvement of the collection systems, for example for parameters whose reference statistical values cannot yet be established due to the lack of relevant data.

These solutions should form the basis for future developments in the accessibility of relevant data for risk-based decision-making, as already envisaged through collaboration with the UNECE/OTIF Joint Meeting of RID/ADR/ADN experts and the Common Occurrrence Reporting project of the European Union Agency for Railways.

1.5. Achieved harmonisation

The following level of harmonisation has been established:

- Harmonised philosophy on the objectives and implementation concepts of TDG risk-based decision-making,
- Harmonised approach to the use of information collected from past incidents and accidents,
- Compatibility of the harmonised framework with existing transport systems, Transport of Dangerous Goods and land-use planning policies,
- Multimodal approach, with inland transport modes covered by all the guides of the framework,
- Independence of the roles and responsibities of the risk analysts and of the decision-makers,
- Explicit links between the guides, as follows:
  - o General approach and maintenance of the guides that constitute the framework described in this guide,
  - o Harmonised method for the definition of the risk estimation objectives that are to be communicated between the decision-makers and the risk analysts,
  - o Compatibility of risk estimation results with assessment performed using the harmonised decision-making principles,
  - o Traceability of information exchanged between the risk analysts and the decision-makers.

This level of harmonisation allows the correct usage of all the information necessary for implementing recognised and well-controlled risk-based decision-making processes.

In this respect the guides forms a complete and coherent framework, therefore it is strongly recommended to use the system as a whole.

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2. Scope of application of the framework

Important note:

The scope of application of the framework is voluntary and the users of the framework shall consider the proposed harmonised method as:

- (a possible tool) for implementing legal requirements applicable to the management of the risks from transport of dangerous goods operations,
- (a possible tool) for assessing potential risk reduction measures,
- (a possible tool) for assessing the efficiency of potential new legal provisions.

2.1. Transport operations scope

Because of the integrated approach it was relevant to align the scope of the implementation of the framework both with the scope of RID/ADR/ADN and with the specific legislation applicable to roads, railways and inland waterways. In particular this means:

- The transport operations considered by the framework follow the transport operation chain in its entirety from filling (or loading) operations to emptying (or unloading) operations,
- The infrastructure used for performing the transport operations, including roads, railways and waterways as well as any other infrastructure required for transport operations, including loading and unloading sites, multimodal platforms, parks, inland harbours, shunting areas,
- The risk scenarios considered by the framework involve railway, road and inland waterway modes of transport, in isolation or in combination,
- The various types of risk studies which are foreseen by the experts developing the framework, namely the assessment of local risk management scenarios, route alternatives, new voluntary or regulatory safety measures, support to companies' safety management systems, general network risk studies by agencies or international organisations.

The framework was developed as a system for assisting risk analysts and decision-makers in their tasks. The Guide for risk estimation and the Guide for decision-making refer to each other where necessary and may be used in combination or independently.

The framework is completed with a Glossary containing definitions of the terms used in the framework, based on a review of relevant existing definitions in the field of risk analysis and risk management, and in the field of dangerous goods.

The framework is applicable to the three inland modes of transport as well as to multimodal scenarios where, for example, potential transfer of risk should be assessed.

2.2. Potential users of the framework

The framework takes into account transport systems, TDG operations and the transport operations environment. This is why it is expected that the framework will be used by many different types of users.

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For example,

- Companies may use the framework for preparing business risk estimations, assess the risk posed to the operations environment and/or assess internal risk control measures,
- Professional associations may recommend the use of the framework to their members, allowing easier exchange of each others' experience and simplifying recognition of their risk management method by authorities,
- Local, National, Regional or International authorities may use the framework for preparing risk estimations and related decisions that are more readily recognised by stakeholders and by the general public,
- International organisations, European Union institutions, bodies and agencies as well as TDG regulators may use this guide as an aid to evaluating potential amendments to the harmonised Transport of Dangerous Goods legislation and/or for modal-specific requirements.

Important note:

The application of the entire framework is voluntary for any category of user and the user is fully responsible for its use.

The period 2018-2020 is considered as a first (test) phase for the voluntary implementation of the framework. During this period individual users are invited to provide feedback to the Expert Users and Development Group of the framework and report on lessons learned[3].

2.3. Assessable risk management plans

A wide range of risk management planning may also be assessed with the help of this framework.

For example:

- The management of risks posed by the transport of dangerous goods in relation to local, regional or national land use planning,
- The assessment of optimal routing in order to manage risk, or optimal usage of transport modes,
- The assessment of potential risk reduction measures of different types and at different scales of implementation,
- The avoidance of uncontrolled transfer of risk between modes that results in global increase of risks for citizens.

As a result many participants in the transport of dangerous goods, and also those using or regulating the transport systems in general, may implement the framework for the purpose of managing TDG risks within the broader context of safety management of the inland transport systems.

3 Please provide feedback by using the contact template available on the site https://www.era.europa.eu/activities/transport-dangerous-goods/inland-tdg_en or by e-mail to Inland-TDG@era.europa.eu

3. The guide for decision-making

3.1. Purpose

The purpose of the guide on decision making is to describe how decision-making should be performed in a harmonised way in order to be recognised by stakeholders. To achieve this, the guide on decision-making establishes a decision-making process and explains how harmonised risk estimates should be used to assess the harmonised decision-making principles. It establishes harmonised principles and explains how they should be evaluated in various risk management scenarios. The guide identifies which quality and communication objectives should be observed for maximising stakeholder acceptance of the decisions related to the management of risks posed by the transport of dangerous goods.

The guide on risk management and decision-making will supplement the existing RID/ADR guidelines with additional harmonisation of risk-based decision-making processes.

The guide on risk management and decision-making will fully cover the risk evaluation and decision-making parts of a risk management process. It will facilitate the preparation of risk-based decisions by decision-makers based on harmonised decision-making principles and harmonised decision-making indicators.

3.2. Content

The decision-making process will follow the structure shown in the following diagrams, comprising three key aspects:

- Risk management quality objectives,
- Optimisation cycle for risk-based decision-making,
- Justification and Communication of decisions.

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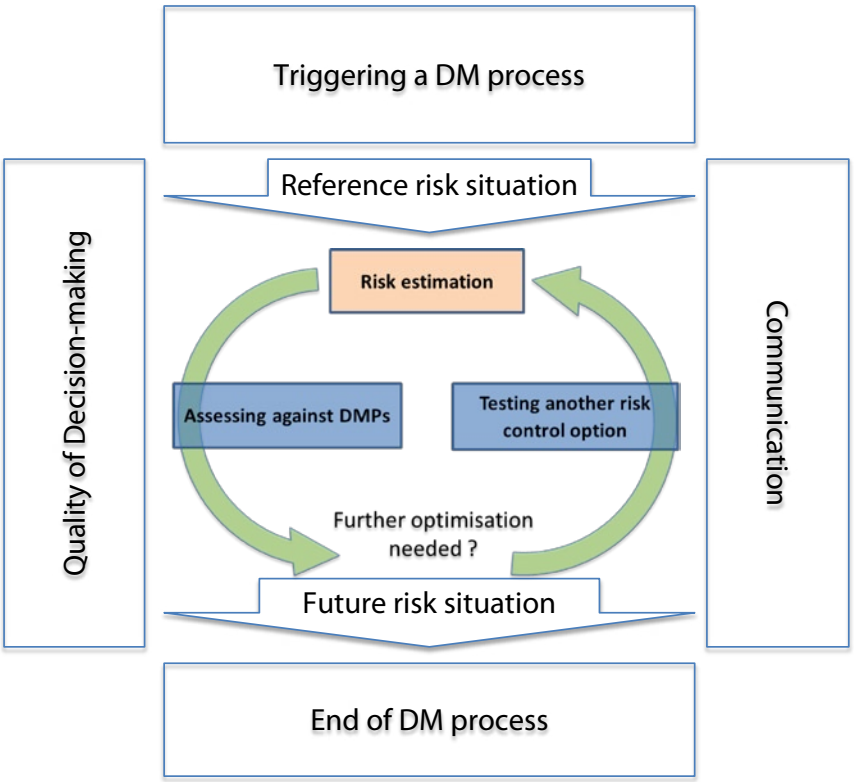
Figure 2: Decision-making harmonised process



3.3. Applicability

The content of the guide covers the topics that are generally covered in decision-making literature, while proposing a specific process designed to solve the issues reported in annex of the document ECE-TRANS-WP15-AC1-2014-GE-INF16e, as identified at the beginning of the TDG roadmap. The guide also uses some of the decision-making principles proposed in the DNV-GL study performed on behalf of the European Commission in 2014.

However, in contrast to one of the proposals of the DVN-GL study, the TDG roadmap participants considered that it was not desirable to introduce risk acceptance criteria in the first version of the guide. Instead, a process taking care of the recurring issues encountered in TDG decision-making processes but leaving the final responsibility for the actual (end of process) decision to the decision-maker was preferred. Put simply, the guide does not make the decision for the decision-maker but assists the decision-maker in the analysis of important decision-making steps.

3.4. Decision-making method

The decision-making process describes how to integrate risk estimation results into the process and how to evaluate the extent to which the harmonised risk-based decision-making principles have been applied.

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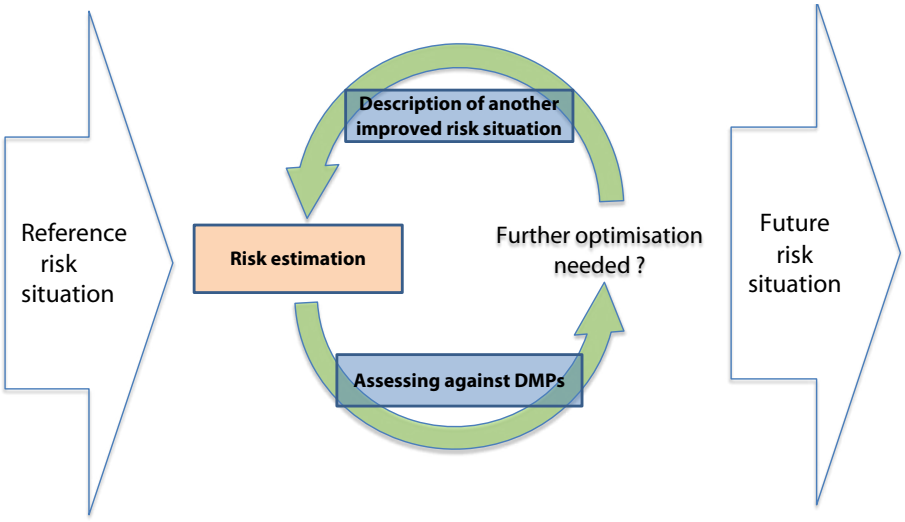
Figure 3: Risk-based optimisation cycle



The decision-making principles were inspired by the DNV-GL study and have been collectively reviewed and agreed by the TDG roadmap participants in order to address identified risk management issues.

The harmonised decision-making principles, which are detailed in sections 3 and 4 of the Guide for decision-making, are as follows:

- No reduction in the system's existing safety level,
- Continuous safety improvement,
- Utility for society of the assessed transport service,
- Fair treatment of individuals and groups of individuals,
- Avoidance of uncontrolled transfer of risk.

During the evaluation phase each decision-making option is assessed against its compliance with these principles. On this basis the options (i.e. risk control measures) can be ranked against their risk performance to identify the most suitable.

The risk-based decision-making indicators are derived from risk estimation results, which are obtained by using the risk estimation guide.

Overall the harmonised decision-making method allows full consideration of societal and individual risk results, obtained by using the guide for risk estimation. The decision-making method also allows the economic practicability of decision options to be assessed using a risk-based safety/economy test.

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Important notes:

In addition to the risk-based assessment of the harmonised decision-making principles, the decision-maker may wish to add externally-derived decision-making criteria. The decision-maker is fully responsible for such additional criteria.

It must also be noted that although assessment of decision-making principles integrates risk estimation results, no decision-making thresholds are used.

This means that the current version of the harmonised decision-making method does not set explicit acceptance criteria for assessing the control of risks. It establishes a level playing field for good decision-making applicable to all Inland Transport of Dangerous Goods.

This has two practical consequences for users of the framework:

1) For all inland transport modes, the levels of the quantified risks assessed using the risk estimation method cannot be directly related to harmonised quantified acceptance thresholds. However they can be used to compare different risk scenarios.
2) In addition to the first point, for the railway mode within the EU and COTIF regions, the current applicable legislation contains explicit acceptance criteria 'for technical systems based on the use of harmonised design targets (see Commission Implementing Regulation (EU) 2015/1136). Therefore the first quality principle of the harmonised decision-making: "*Consider compliance with legal requirements as a minimum standard*" is particularly relevant here. It means that the requirements of the CSM on risk evaluation and assessment shall be implemented, particularly in respect of the legally binding harmonised design targets for technical systems.

3.5. Quality and Communication of decisions

The harmonised decision-making process is integrated with quality and communication principles for the overall management by the user of the guide of the risk scenarios under consideration.

The section of the guide dealing with quality of risk management describes the main principles that are considered important, as follows:

- Consider compliance with legal requirements as a minimum standard,
- Manage risks in accordance with best practice,
- Inform all concerned parties about the risk scenario as required,
- Reduce the risk in proportion with its level taking care of economic practicability,
- Identify possible solutions to a risk scenario within a given tier actor (risk owner/ geography combinations),
- Avoid solutions involving uncontrolled transfer of risk,
- Ensure that risks are monitored on a regular basis at all levels,
- Evaluate whether implemented solutions sufficiently address the identified risk scenario.

The justification and the communication sections of the guide describe the good practices to be considered by the user on the following aspects:

- Justification of decisions when they are made (Ex-ante),
- Justification of decisions when they are reviewed (Ex-post),
- Transparency,
- Shared information,
- Recognition of decisions by third parties.

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4. The guide for risk estimation

4.1. Purpose

The purpose of the guide for risk estimation is to describe how to perform harmonised risk estimates whose results are recognised by interested stakeholders.

It establishes a full multimodal approach to the description of given risk management situations: it explains how to perform every step of a risk estimation as accurately as possible, taking into account the achievable state of the art, the limitations related to the availability of relevant data and the objectives of the related decision-making case.

The risk estimates resulting from the implementation of this guide can be used as inputs to the method described in the decision-making guide

4.2. Content

Part A of the guide provides a general description of the harmonised risk estimation method and all necessary information for a user of the guide to describe a risk situation that is to be assessed.

The method follows the well-known bow-tie approach.

Part B provides a detailed information on each step of the risk estimation method based on a harmonised description of the situation under consideration, in accordance with part A.

Support to users of the guide is also provided by harmonised templates (appendices) that allow a well-structured and shareable description of risk estimation studies and of their results, including intermediate estimation steps.

4.3. Applicability

The harmonised risk estimation method is, at the conceptual and methodological levels, fully compatible with the current non-harmonised practices for risk estimations.

Stakeholders already practising these techniques may start using the harmonised method without undergoing any drastic change to their current approach, and may migrate towards the full implementation of the harmonised method within a few years, taking into account the planned second TDG Roadmap phase that aims to disseminate and facilitate the implementation of the harmonised method.

It also means that inexperienced users will have the advantage of starting to implement a method which can be readily recognised by experienced practising risk analysts. In combination with the facilitation activities that are planned for the second Roadmap phase

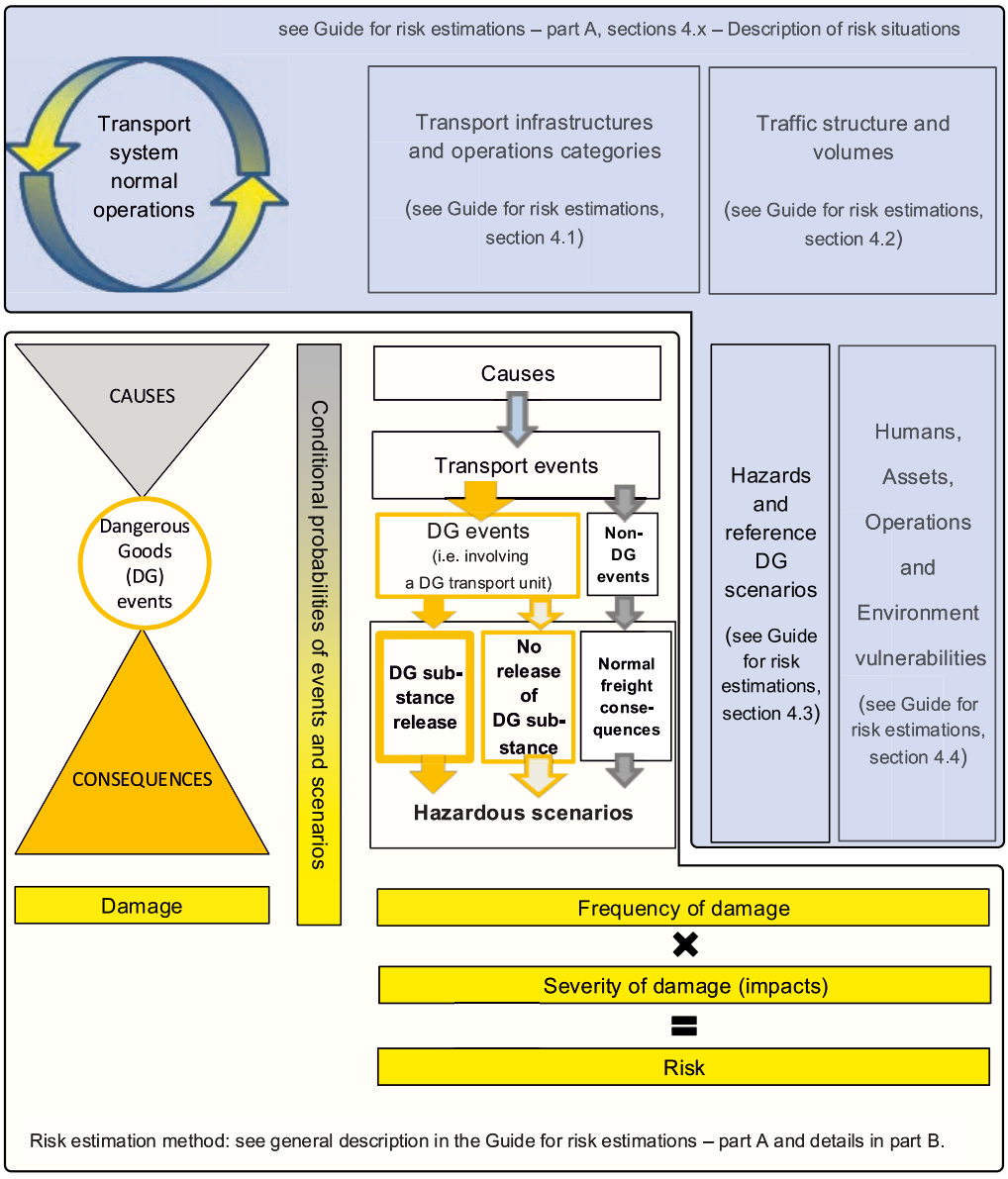
it may allow a significant increase of the number of users of risk-based decision-making techniques.

As a result of the harmonisation the information used as input to a given harmonised risk estimation will also be traceable and, if necessary, may be scrutinised by interested parties.

4.4. Risk estimation approach and steps

The diagram below shows the overall content of the Guide for risk estimation, including reference to the applicable sections of this guide.

Figure 4: Overview of the risk estimation approach



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In practice, the user of the guide will be able to perform harmonised risk estimation when implementing the following harmonised steps:

- Description of the infrastructure on which the transport operation(s) are performed,
- Description of the DG traffic/operation volumes/characteristics,
- Harmonised analysis of hazards and of the corresponding reference DG scenarios,
- Description of the vulnerabilities (humans, assets, operations, environment) potentially exposed to the DG scenarios.

The above steps are covered in section 4 of the Guide for risk estimation with the help of descriptive templates accessible at https://www.era.europa.eu/activities/transport-dangerous-goods/inland-tdg_en

Part B of the guide describes the actual risk estimation process including the description of the main risk estimation formulas (when resource are available, basic formulas may be further developed within a specific Risk Management Platform ; see Impact Assessment of the Risk Management Platform here).

This part of the guide describes all the steps for the calculation of risk indicators, combining estimation of the frequency of DG scenarios and severity of potential damage with the various types of vulnerabilities under consideration.

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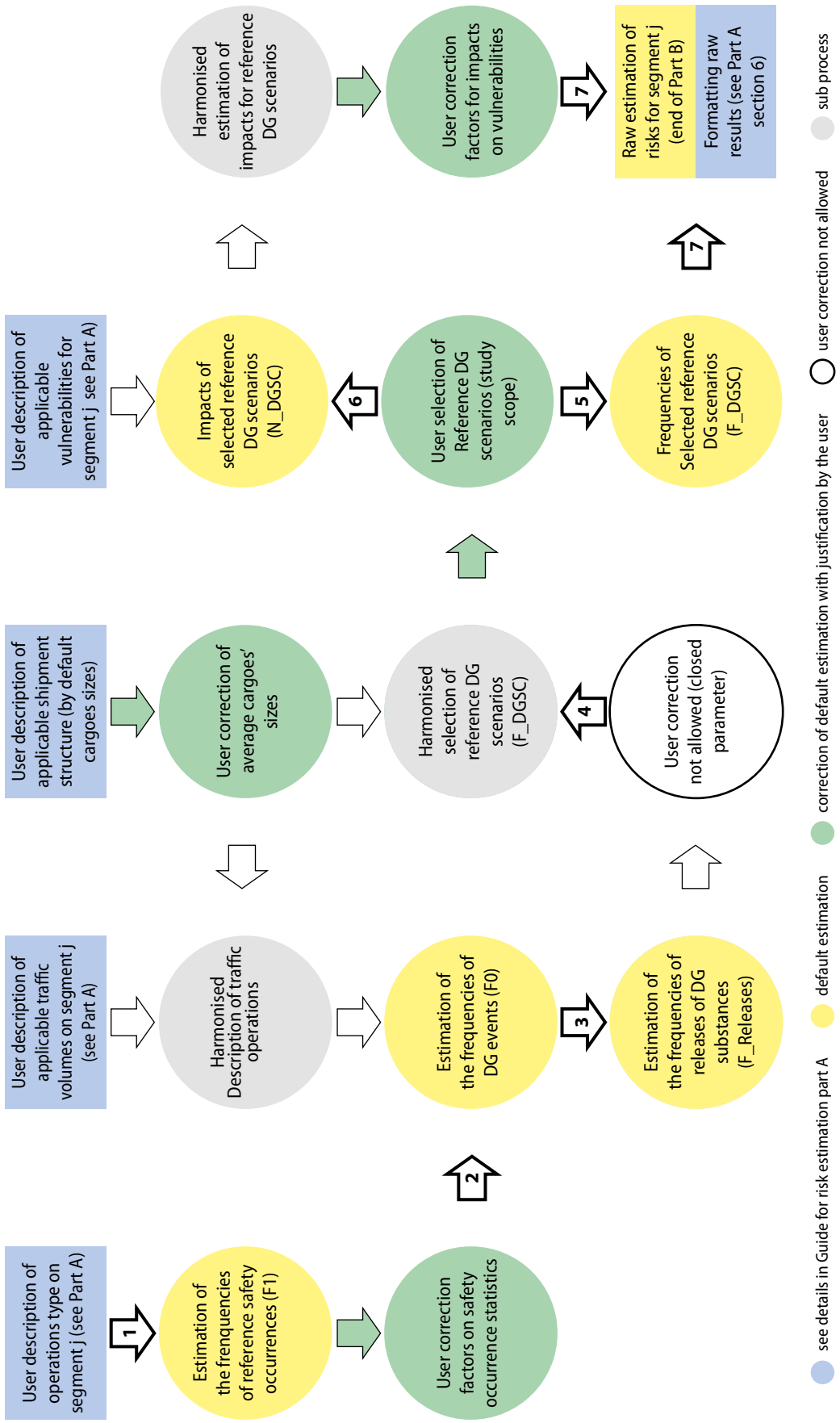

Figure 5: Risk estimation steps described in the Part B of the Guide for risk estimation

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4.5. Flexibility and scaleability of the method

At every step of the risk estimation workflow (in part A and part B), the concepts of 'by default', 'fixed' and 'open' parameters are used (see Guide for risk estimation, section 2.3.2).

These concepts allow for flexibility of the model and widen its potential application scope. For example:

- It allows less experienced users to obtain basic risk estimations more easily by using 'by default' reference values for some parameters,
- It allows more experienced users to set more relevant values than those available 'by default' in the guide, when it is necessary in order to achieve the quality objectives for the risk estimation set by the risk analyst or the decision-maker,
- It may also be used for setting regional/national reference values for the risk estimation model parameters,
- It allows experienced users to test the potential effect of varying risk control measures for comparison with the estimation of the risks posed by a reference situation.

Important note:

Where possible, the harmonised risk estimation model suggests the use of default pre-defined reference values that are valid for the indicated application scope, for example 'Average EU transport network' reference values.

The list of parameters used by the harmonised risk estimation model is accessible here. The parameters for which default values are established are listed.

4.6. Harmonised risk results

The results obtained from the application of the Guide for risk estimations can take several harmonised formats:

- Quantitative indicators of risk or safety levels,
- Qualitative indicators of risk levels (harmonised text to express quantitative risk levels),
- Frequency/Severity curves, or tables.

The risk estimation results can be used in combination with relevant economic data to estimate the Safety/Economy indicator for ranking the efficiency of potential risk control measures. They are also used for the assessment of harmonised decision-making principles described in the guide for decision-making.

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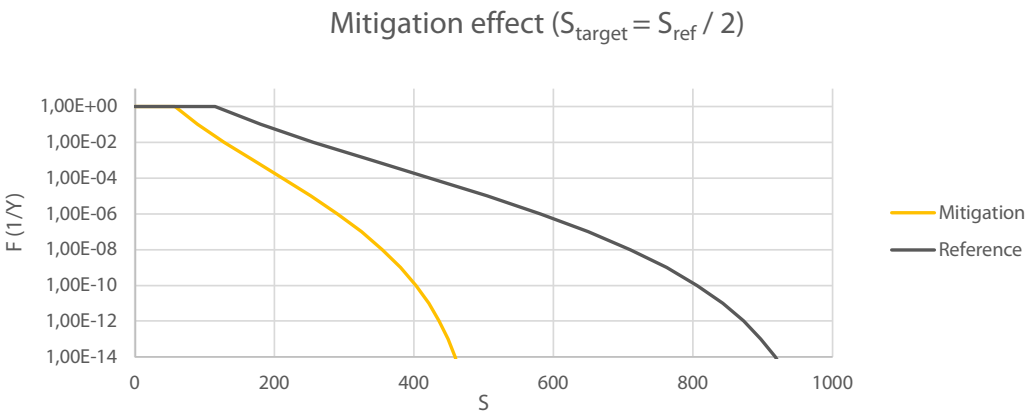
Figure 6: Example of the effect of a pure mitigation measure that halves the extent of given impacts (linear scale) without changing the frequency of occurrence (Starget = target severity, Sref= reference severity)



Important note:

The guide for risk estimation, while already providing improved assistance to the potential users of risk-based decision-making approach mostly stays at a methodological and practical implementation level. It introduces simple tools to assist the user in the implementation of some parts of the guides.

However, at present, the numerical application of the risk estimation formulas described in the guide is not supported by a harmonised IT tool, meaning that the user of the framework cannot obtain risks estimation results directly from the implementation of the framework.

While considerable progress will be made with this new guide at methodological level and in terms of harmonisation, such an IT tool is still missing for completing the support to interested users, and in particular to the numerous users who do not currently use quantitative risk estimation because of the competencies and resources required.

In 2018, a second phase of the TDG roadmap started with the collaboration of the Expert Users and Development Group (see section 6) to develop the specification of a shared web application allowing standardised implementation of the method described in the Guide for risk estimation and genuine comparability of the results obtained with this harmonised method.

The impact assessment report of a potential future web application called 'Risk Management Platform' is published on the ERA website, as well as an executive summary.

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5. The framework glossary

It was necessary to develop a framework glossary in order to give the user sufficient understanding of the content of the guides. Many reference documents were considered for this purpose but, with the exception of some definitions already given in the RID/ADR guidelines, these were considered too general, too specific, or not adapted to the jargon used in the TDG sector.

Therefore the framework glossary was established, giving priority to the definitions already in use in international legislative texts, followed by those in international norms, and finally those in recognised international guides. Where necessary, definitions derived from these references were adapted to the framework of the guides.

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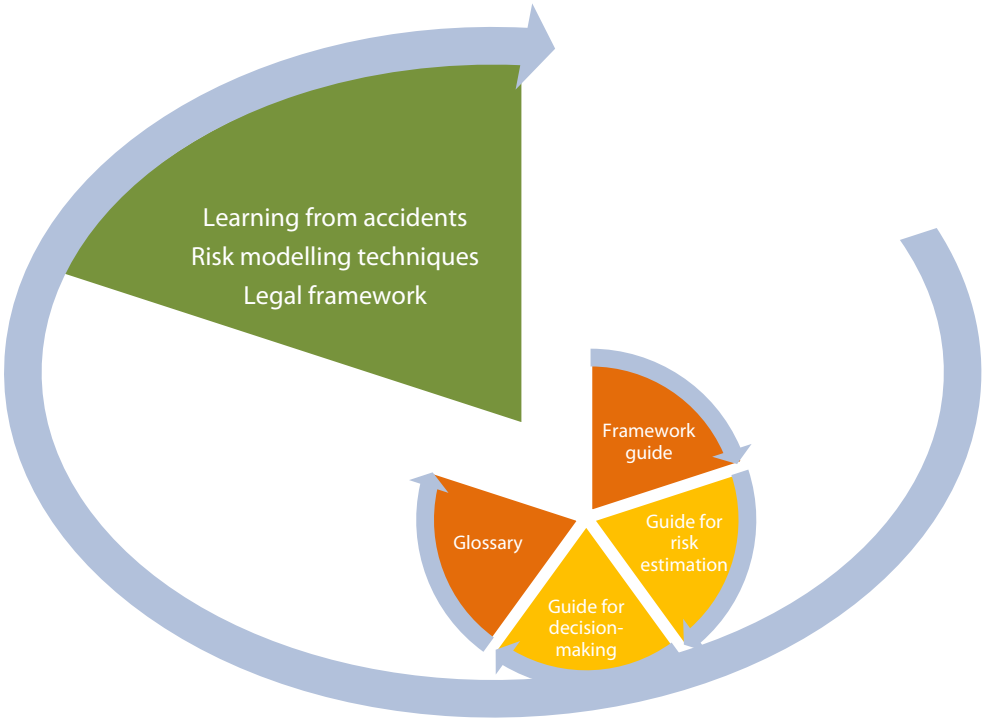
6. Continuous improvement of the framework

In itself, the framework provides *modelling* of the real-world risks arising from the Inland transport of dangerous goods (Guide for risk estimations) and of the approach to risk management decisions (Guide for decision-making).

This *modelling* shall also be subject to an improvement loop based on the learning from past incidents and accidents, the risk modelling techniques, and the evolution of the legal framework.

Figure 7: Continuous improvement of the Inland TDG Risk management framework



6.1. ERA coordination

As proposed by the participants in the first phase TDG Roadmap, ERA will continue its coordination role for future improvements and revision of the framework during the coming implementation period on behalf of the European Commission / DG Move.

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This role will ensure the necessary coordination with the following committees:

- Joint Meeting of the RID Committee of Experts and the Working Party on the Transport of Dangerous Goods from the Inland Transport Committee of the United Nations Economic Commission for Europe,
- Inland Transport of Dangerous Goods Committee, EC,
- Railway Interoperability and Safety Committee, EC.

Along these lines ERA presented the foreseen 2nd phase TDG Roadmap to the above mentioned Working Party and Committees as described in the following sections.

6.2. Expert Users and Development Group

As acknowledged in the introduction of this document the experts who have participated in the development of the first version of the framework are kindly invited to join the Expert Users and Development Group (EUDG) to contribute to the following categories of activities, including maintenance and improvement activities:

1. Dissemination of information on the Inland TDG risk management framework,
2. Development of examples and implementation on real cases,
3. Publication of reference and training material (including simple use cases),
4. Monitoring and analysis of user feedback on the implementation of the framework,
5. Practical support to the users of the proposed Inland-TDG website,
6. Specification of future public web applications that will assist users in the implementation of the framework,
7. Identification of the development needs of the framework,
8. Preparation of future versions of the framework.

The invitation to join the EUDG was officially launched at the Spring 2018 session of the Joint Meeting and a nomination form is available for any interested experts at https://www.era.europa.eu/activities/transport-dangerous-goods/inland-tdg_en with reference to a required set of competencies and professional experience.

6.3. Details of planned activities
(at the date of publication of the first framework version)

The table below contains the list of developments that have been already identified by the participants to the first phase TDG Roadmap and integrated into the ERA Single Programming Document 2018 for actions where the Agency has responsibility.

Table 1: List of planned continuous improvement activities (using categories defined in 6.2)

Activity Category	Tasks	Who
Coordination activities	Organising and hosting two TDG workshops per year	ERA
	Preparing the terms of reference of the EUDG	ERA + interested participants in the first phase TDG Roadmap
	Setting up administrative support to the EUDG	ERA
	Coordinating and providing secretariat for EUDG meetings	ERA
	Hosting EUDG meetings	Interested members of EUDG with ERA coordination
Category 1 activities	Preparing information for the Joint Meeting for the potential revision of provisions relating to the collection of TDG occurrences	ERA + EUDG
	Developing a dedicated Inland-TDG risk management website	ERA
	Disseminating the risk management framework	ERA + interested members of EUDG
Category 2 activities	Developing use case examples	Any interested user of the framework
	Reviewing and formatting of examples as public material	ERA + interested members of EUDG
	Publishing official reference material on the public website	ERA
Category 3 activities	(actions to be defined)	
Category 4 activities	Regularly analysing user feedback	ERA + EUDG
Category 5 activities	Using the TAF TSI as a means of setting EU railways reference values for the harmonised risk estimation model	ERA
	Developing relevant reference values for the parameters of the harmonised risk estimation model, with consideration of national or regional settings.	Any interested user of the framework
	Continuing the development of pre-calculated tables for DG reference scenarios, as reference material for users.	Any interested user of the framework
	Maintaining support to users with simple tools. Priority given to developing (missing) harmonised templates to support the use of the guides, in response to the needs reported by users of the framework.	Any interested user of the framework
	Reviewing and formatting inputs from public users to use as public reference material	ERA + interested members of EUDG
	Publishing official reference material on the public website	ERA
Category 6 activities	Initiating the specification of a public risk estimation engine	ERA + interested members of EUDG
Category 7 activities	Identifying the development needs of the framework should be a standing item of TDG workshop and EUDG meeting agendas	ERA + EUDG
Category 8 activities	(actions to be defined when deemed necessary)	ERA + EUDG

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6.4. How to send a change request to ERA/EUDG

In accordance with the working Terms of Reference of the EUDG, a request form and user instructions will be made available at this address: https://www.era.europa.eu/activities/transport-dangerous-goods/inland-tdg_en.

6.5. Future editions of the framework of guides

Besides the regular publication of reference and supporting material for users of the public Inland-TDG website it is foreseen that feedback from users through the monitoring activity may lead to the publication of a new (updated) version of the framework.

ERA will take care of the need for triggering the publication of updated versions of the framework, in collaboration with the EUDG.

It is anticipated that triggering events may include:

- progress/change in the collection of data by the introduction of new databases or automated generation of statistics with ICT,
- scientific and technological progress, leading to the consideration of new characteristics and new risks realting to the transport systems,
- identification of a new type of accident or of recurring causes or consequences,
- a new type of substance involving particular hazards and significant risks which should be taken into account by the harmonised risk estimation model,
- new principles or acceptance criteria to be considered in risk-based decision-making, due either to a change in relevant legislation or to new societal expectations,
- feedback on the practical implementation of the harmonised framework...

It is also anticipated that the extent of updating will depend on the future context:

Full revisions may take place when amendments to the framework would involve its structure, fundamental definitions or principles, concepts and methodologies. In such a case it is foreseen that every guide should be updated at the same time and a new version of the framework would then be applicable.

Updates may take place for small amendments or corrections of mistakes which would not necessitate a full revision of the framework. Updates should principally be elaborated through supplementary corrective material, without re-publishing the whole framework.

Harmonised reference material will regularly supplement the initial publication of the framework, through the publication of new material on the Inland-TDG webpages coordinated by ERA. New material will be based on the information publicly available to ERA, the contributions of any interested users and the contributions of the EUDG members. For example, the publication of harmonised pre-calculated tables of reference DG scenarios, or the setting of new reference values for the model parameters, would fall in this category of framework updating.

7. Longer term developments

7.1. Transition period

After the publication of the first version of the framework all interested stakeholders may implement, on a voluntary basis, the harmonised approach to TDG risk management.

It is also understood that the full implementation of the proposed approach within a short period of time would not be feasible because of the need for convergence of existing practices.

This situation is fully recognised and managed in the proposed framework through improvement activities described in previous sections. This is why it is not foreseen to publish a new version of the framework guides before few years but to actually complement it with facilitation activities, reference material and supporting tools.

7.2. Re-evaluation of the need to amend TDG legislation

The first phase TDG roadmap and the development of the framework defined here was an action derived from the conclusions of the workshop on "Harmonised Risk Acceptance Criteria for Transport of Dangerous Goods" organised in February 2014 by the European Commission.

During the first implementation phase of the framework of guides the practices of interested users should evolve towards a better harmonised usage of risk-based decision-making techniques.

It is anticipated that when the framework and the experience of the users have improved in tandem the need to amend the relevant legal framework should be re-evaluated.

At this future time, the European Commission might consider appropriate actions.

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8. Document navigation

8.1. References

Table 2: Table of Reference Documents

Title	Reference	Version
Commission regulation (EU) No 1299/2014 of 18 November 2014 on the technical specifications for interoperability relating to the 'infrastructure' subsystem of the rail system in the European Union (Text with EEA relevance) – (INF TSI)	European Union – EU 1299/2014 (OJ L 356/1 12/12/2014)	Commission Regulation available in all official EU languages here
Commission regulation (EU) No 1302/2014 of 18 November 2014 concerning a technical specification for interoperability relating to the 'rolling stock — locomotives and passenger rolling stock' subsystem of the rail system in the European Union (Text with EEA relevance) – (LOC & PAS TSI)	European Union – EU 1302/2014 (OJ L 356/228 12/12/2014)	Commission Regulation available in all official EU languages here
Commission decision of 9 November 2007 adopting a common specification of the national vehicle register provided for under Articles 14(4) and (5) of Directives 96/48/EC and 2001/16/EC (notified under document number C(2007) 5357) – (NVR) (2007/756/EC)	European Communities 2007/756/EC (OJ L 305 23.11.2007)	Commission Decision available in all official EU languages here
Commission implementing regulation (EU) No 402/2013 of 30 April 2013 on the common safety method for risk evaluation and assessment and repealing Regulation (EC) No 352/2009 (Text with EEA relevance)	European Union – EU 402/2013 (OJ L 356/228 12/12/2014)	Commission Implementing Regulation available in all official EU languages here
Commission implementing regulation (EU) 2015/1136 of 13 July 2015 amending Implementing Regulation (EU) No 402/2013 on the common safety method for risk evaluation and assessment (Text with EEA relevance)	European Union – EU 2015/1136 (OJ L 185/6 14.7.2015)	Commission Implementing Regulation available in all official EU languages here
Code of Federal Regulations – Title 49 Transportation	US DOT USA Federal Register National Archives and Records Administration Published by the Office of the Federal Register National Archives and Records Administration as a Special Edition of the Federal Register As of October 2011	Parts 100-177 available in EN Parts 300-399 available in EN
Major Accidents Ordinance of Switzerland Verordnung über den Schutz vor Störfällen (Störfallverordnung, StFV)	Der Schweizerische Bundesrat 27. Februar 1991 (Stand am 1. Juni 2015)	DE, FR, IT, EN
Commission staff working document - Better Regulation Guidelines	European Commission Brussels, 7.7.2017 - SWD(2017) 350 final	EN

Title	Reference	Version
Guideline for risk assessment	Joint Meeting RID/ADR/AND (WP.15/AC1) Informal document 8, Berne, 20-23 March 2006 INF.8 from the OTIF secretariat submitted to the Joint Meeting at its March 2006 session –Economic Commission for Europe – Inland transport Committee - Working Party on the Transport of Dangerous Goods	EN
CaDaS (Common Accident Data Set) - Community database on road accidents resulting in death or injury - Glossary	Version 3.6 - 2017 European Union – EU Directorate-General for Mobility and Transport	EN
SULID - Site (Un) Loading Information Document	The European Chemical Industry Council (CEFIC) – the European Chemical Transport Association (ECTA) – The European Association of Chemical Distributors (FECC)	EN
Taking Safe Decisions - How Britain's railways take decisions that affect safety	Version 2.1 The Rail Safety and Standards Board (RSSB)	EN
Harmonised Risk Acceptance Criteria for Transport of Dangerous Goods, Final Report	Report drafted by DNV GL for the European Commission, DG MOVE PP070679/4, Rev. 2 – 2014-03-25	EN
Review of data quality and approach of the Agency – Annual report on safety. Assessment of existing national occurrence reporting regimes and systems	Report drafted by DNV GL for the European Railway Agency Task 1, Rev. 2 / 1LDI90Z-12 / 2015-12-09	EN
International survey of transposition of chapter 1.9 of RID/ADR/ADN among users of risk evaluation procedures in the field of dangerous goods transport	UNECE – OTIF ECE/TRANS/WP.15/AC.1/2011/INF.19	EN, DE
Towards a new risk-calculation method for rail transport of dangerous materials:Technical report: failure frequencies for Dutch freight wagons based on incident cases - Technical report on failure frequencies of Dutch freight wagons based on incident data	Dutch Ministry of Health, Welfare and Sport National Institute for Public Health and the Environment RIVM report 620550010/2014	EN
Information concerning risk evaluation procedures in the context of transport of dangerous goods by rail	March 2013/INF.29 Transmitted as informal document to the Joint Meeting of the RID Committee of Experts and the Working Party on the Transport of Dangerous Goods - Economic Commission for Europe Inland Transport Committee Working Party on the Transport of Dangerous Goods by ERA	EN
Report on the 1st workshop on risk evaluation and assessment in the context of rail, road and inland waterways Transport of Dangerous Goods, 8 and 9 October 2013	March 2014/INF.14 Transmitted as informal document to the Joint Meeting of the RID Committee of Experts and the Working Party on the Transport of Dangerous Goods - Economic Commission for Europe Inland Transport Committee Working Party on the Transport of Dangerous Goods by ERA	EN

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Title	Reference	Version
Roadmap on risk management in the context of inland transport of dangerous goods	September 2014/INF.16 Transmitted as informal document to the Joint Meeting of the RID Committee of Experts and the Working Party on the Transport of Dangerous Goods - Economic Commission for Europe Inland Transport Committee Working Party on the Transport of Dangerous Goods by ERA	EN
Report on the 2nd workshop on risk management in the context of rail, road and inland waterways Transport of Dangerous Goods, 28-30 October 2014	March 2015/INF.29 Transmitted as informal document to the Joint Meeting of the RID Committee of Experts and the Working Party on the Transport of Dangerous Goods - Economic Commission for Europe Inland Transport Committee Working Party on the Transport of Dangerous Goods by ERA	EN
Report after the 3rd workshop on risk management in the context of rail, road and inland waterways Transport of Dangerous Goods, 17-19 February 2015	March 2015/INF.30 Transmitted as informal document to the Joint Meeting of the RID Committee of Experts and the Working Party on the Transport of Dangerous Goods - Economic Commission for Europe Inland Transport Committee Working Party on the Transport of Dangerous Goods by ERA	EN
Report on the 4th Workshop of the roadmap on risk management in the context of rail, road and inland waterways transport of Dangerous Goods and invitation to the 5th workshop	September 2015/INF.7 Transmitted as informal document to the Joint Meeting of the RID Committee of Experts and the Working Party on the Transport of Dangerous Goods - Economic Commission for Europe Inland Transport Committee Working Party on the Transport of Dangerous Goods by ERA	EN
Report on the 5th and 6th Workshops of the roadmap on risk management in the context of rail, road and inland waterways transport of Dangerous Goods and invitation to the 7th workshop	March 2016/INF.43 Transmitted as informal document to the Joint Meeting of the RID Committee of Experts and the Working Party on the Transport of Dangerous Goods - Economic Commission for Europe Inland Transport Committee Working Party on the Transport of Dangerous Goods by ERA	EN
Report on the 7th Workshop of the roadmap on Risk Management in the context of rail, road and inland waterways Transport of Dangerous Goods	September 2016/INF.14 Transmitted as informal document to the Joint Meeting of the RID Committee of Experts and the Working Party on the Transport of Dangerous Goods - Economic Commission for Europe Inland Transport Committee Working Party on the Transport of Dangerous Goods by ERA	EN
Report on the 10th Workshop of the roadmap on Risk Management in the context of rail, road and inland waterways Transport of Dangerous Goods	September 2017/INF.5 Transmitted as informal document to the Joint Meeting of the RID Committee of Experts and the Working Party on the Transport of Dangerous Goods - Economic Commission for Europe Inland Transport Committee Working Party on the Transport of Dangerous Goods by ERA	EN

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Title	Reference	Version
Overview of the future framework of guides on Inland TDG Risk management	September 2017/INF.7 Transmitted as informal document to the Joint Meeting of the RID Committee of Experts and the Working Party on the Transport of Dangerous Goods - Economic Commission for Europe Inland Transport Committee Working Party on the Transport of Dangerous Goods	EN
Second phase of the TDG Roadmap	September 2017/INF.6 Transmitted as informal document to the Joint Meeting of the RID Committee of Experts and the Working Party on the Transport of Dangerous Goods - Economic Commission for Europe Inland Transport Committee Working Party on the Transport of Dangerous Goods	EN
Report on the results of the international survey on implementation of chapter 1.9 of RID/ADR/ADN by users of risk evaluation procedures in the transport of dangerous goods	Transmitted by the Government of Germany to the Joint Meeting of the RID Committee of Experts - Working Party on the Transport of Dangerous Goods - Economic Commission for Europe Inland Transport Committee Bern, 18–22 March 2013	EN, FR, RU
General Guideline for the Calculation of Risks in the Transport of Dangerous Goods by Road - An introduction to the basic principles of risk assessment for chapter 1.9 ADR	Document adopted at the 84th and 85th sessions of the Working Party on the Transport of Dangerous Goods (WP.15) in May and October 2008	EN
Guideline on Safety measures catalogue of Art. 3 of Major Accidents Ordinance of Switzerland - Richtlinie - Stand der Sicherheitstechnik für Eisenbahninfrastrukturen Massnahmenkatalog Art. 3 StFV Art. 3 und 23 Störfallverordnung (StFV; SR 814.012)	Federal Office of Transport (FOT) of Switzerland	DE, FR, IT
Guide for land use planning - Planungshilfe Koordination Raumplanung und Störfallvorsorge	Federal Office for Spatial Development (ARE) of Switzerland	DE, FR, IT
Dangerous goods transportation – practical risk analysis approach	Presentation held by the representative of Rail Transportation and Engineering Center (RailTEC), University of Illinois at Urbana-Champaign, U.S.A.	EN
Methodikberichte: Screening Personen- und Umweltrisiken	Federal Office of Transport (FOT) of Switzerland	DE, FR, IT
Risk Acceptance Criteria for Dangerous Goods Inland Transportation 2001 - Beurteilungskriterien II zur Störfallverordnung StFV. Richtlinien für Verkehrswege (PDF, 66 kB, 26.01.2011)	Federal Office for the Environment (FOEN) of Switzerland	DE, FR, IT
Modelling release, dispersion and effects on humans of highly flammable liquids (petrol): Definition of the-state-of-the-art	Federal Office of Transport (FOT) of Switzerland	DE, FR, IT
Etude de l'accidentologie liée au Transport de Marchandises Dangereuses sur les sites Européens de Triage de Wagons – phase 1	Report PP063376-1 of 10 January 2014 from Det Norske Veritas France SARL for Mission Transport de Matières Dangereuses, Ministry in charge of Transport, France	

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Title	Reference	Version
Etude de l'accidentologie liée au Transport de Marchandises Dangereuses sur les sites Européens de Triage de Wagons – phase 2	Report PP063376-2 of 10 January 2014 from Det Norske Veritas France SARL for Mission Transport de Matières Dangereuses, Ministry in charge of Transport, France	
Etude de l'accidentologie liée au Transport de Marchandises Dangereuses sur les sites Européens de Triage de Wagons – phase 3	Report PP063376-3 of 10 January 2014 from Det Norske Veritas France SARL for Mission Transport de Matières Dangereuses, Ministry in charge of Transport, France	
Note Note technique du 22 juin 2015 relative aux études de dangers remises en application de l'article L.551-2 du code de l'environnement et au porter-à-connaissance concernant les gares de triage	Direction des services de transport (Ministry in charge of Transport) France	
Handbook of Scenarios for Assessing Major Chemical Accident Risks	Technical report by the Joint Research Centre (JRC), the European Commission's science and knowledge service ISBN 978-92-79-66670-4 ISSN 1831-9424 doi:10.2760/884152 European Union 2017	EN

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8.4. Definitions and Abbreviations

Please refer to the framework glossary published at https://www.era.europa.eu/activities/transport-dangerous-goods/inland-tdg_en

ANNEX I:

Structured list of parameters for the reporting of TDG events in existing databases

Important notes:

This annex is based on the work delivered by the TDG Roadmap working group on the management of information and data during the first phase of the roadmap. In particular this group reported that:

- Very basic sets of data are generally not available to risk estimation users or simply do not exist. In this case, the situation can only be improved by regulators involved in the organisation of the collection of transport statistics and reporting of accidents if political attention is given to the practical implementation of risk-based approaches,
- Many databases contain data that are not suitable for risk estimation but only allow outcome-based supervision of safety performance. This situation does not fully support the analysis of potential improvement solutions because the data are only available at a macro level and do not provide the detail that is necessary for risk control improvement analyses,
- Priority should be given to the development of future data collection systems which support risk estimation as, at least in the EU, a risk-based approach is the norm and impact assessments require more detailed and better targeted information,
- The structured list reported in this annex may be used to define improved requirements for future systems for the collection of shared information on transport events, in order to fill the gap in comparison with risk estimation needs (see link in Annex II).

One quick win in the field of TDG legislation would be to require the reporting of information necessary for the implementation of the guide for risk estimation (see list of parameters in Annex II of this guide) and at the same time to establish a level playing field between all inland transport modes.

As this list of parameters may be updated regularly, please use this link to obtain the up-to-date document applicable to the current version of the Framework here.

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ANNEX II:

List of parameters used in the harmonised risk estimation model

As the list of parameters may be regularly updated in accordance with the process of improvement described in section 6 of the Framework guide, please use this link to obtain the currently applicable document.

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Risk management framework for Inland transport of dangerous goods:

- **Framework guide**
- Guide for decision-making
- Guide for risk estimation
- Framework glossary

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