An Overview of Methodologies for Hazard Rating of Industrial Sites

A joint publication of the European Commission's Joint Research Centre and the United Nations Economic Commission for Europe

Anandita SENGUPTA and Maureen Heraty WOOD (European Commission)

Claudia KAMKE and Nikolay SAVOV (UN Economic Commission for Europe)

Special Preview Pre-Publication Edition for the Webinar (November 2014)

The mission of the IPSC is to enhance safety and stability of the European society on the basis of an agreed EU agenda by creating scientific results and turning them into measurable impact. Based on a combination of advanced ICT and engineering expertise, IPSC provides European policy makers with scientific and technology advice on issues that are relevant to safety, security and stability within and outside the EU. Due to the horizontal nature of its work, the IPSC closely collaborates with a large number of European and international stakeholders from different expert communities.

European Commission
Joint Research Centre
Institute for the Protection and Security of the Citizen

Contact information
Maureen Heraty WOOD
Address: Joint Research Centre, Via Enrico Fermi ,2749, TP 72, 21027 Ispra (VA), Italy
E-mail: Maureen.Wood@jrc.ec.europa.eu
Tel.: +39 0332 78 9140

http://ipsc.jrc.ec.europa.eu/
http://www.jrc.ec.europa.eu/

JRC2#####

ISBN #########
ISSN ########
doi: ########

Luxembourg: Publications Office of the European Union, 2014

Printed in Italy

Abstract:

This report provides an overview of hazard rating systems used by competent authorities in various ECE member countries for prioritising resources and directing attention to chemical hazard sites and industries where it is most needed. The report describes each system without attempting to analyse or compare differences or similarities. The purpose of the report is to give ECE countries insight into various approaches as they are seeking to establish or modify the same or similar systems in future to support effective implementation of chemical accident prevention and preparedness policy. The information in this report is summarised from responses of the featured ECE countries to a survey distributed by the United Nations Economic Commission for Europe (ECE) Convention of the Transboundary effects of Industrial Accidents (Industrial Accidents Convention) and the Major Accident Hazards Bureau of the European Commission's Joint Research Centre. For this reason, this document should be an encouraging input to countries who have not yet established their own rating systems but are considering it. r

Preface

The need for developing a guide on methodologies for hazard rating was identified at the workshop on costs-effectiveness for major accident prevention (12 October 2011, Warsaw), organised within the framework of the United Nations Economic Commission for Europe (ECE) Convention on the Trans-boundary Effects of Industrial Accidents (Industrial Accidents Convention). Moreover, different Parties and Beneficiary countries to the Assistance Programme within the Industrial Accidents Convention indicated in their reports on implementation for the sixth (2010-2011) and seventh (2012-2013) reporting round that the capacity-building in the area of risk-assessment techniques, such as accidents hazard rating, is a priority in order to serve as a basis to plan and prioritise inspections, taking into account the complexity and extent of the hazards and the compliance history of the hazardous activities.

At its seventh meeting (14-16 November 2012, Stockholm), the Conference of the Parties of the Industrial Accidents Convention included the development of a guide on methodology for hazard rating as one of the priorities into the Convention's work plan for 2013-14. The Conference of the Parties also stipulated that the activity should be accomplished with suitable partners.

The Industrial Accidents Convention's Bureau identified the the Major Accident Hazards Bureau (MAHB) of the European Commission's Joint Research Centre (JRC), in particular, as a possible partner, since hazard rating systems and methodologies are also relevant to the work of MAHB, especially in the context of the Seveso Directive.

This document was prepared jointly by MAHB and the secretariat of the Industrial Accidents Convention, using information on existing systems, practices and methodologies in the area of hazard rating, developed and used by EU and ECE member countries for ranking major hazard establishments, using, processing or storing hazardous substances. The document does not recommend any single methodology nor evaluates or compares the methodologies used in the different countries. It is expected to support ECE countries – in particular countries from Eastern and South-Eastern Europe, the Caucasus and Central Asia to strengthen their capacity in the area of industrial accident prevention and control.

The information about available systems, practices and methodologies for hazard rating could be used for planning and prioritising inspections, regulatory purposes, identifying safety performance trends or contributing to the development of future policy strategies in the area of accident prevention and control.

List of abbreviations

ECE - United Nations Economic Commission for Europe

EEA - European Economic Area

EFTA - European Free Trade Association

EU – European Union

JRC – the Joint Research Centre of the European Union

LOPI - Level of Protection Indicators

MAHB - Major Accident Hazards Bureau

MAO - Major Accident Ordinance, Switzerland

RRT - Rapid Ranking Technique

SINTEF - The Foundation for Scientific and Industrial Research, Norway

UK - The United Kingdom of Great Britain and Northern Ireland

WRC - water risk classes

WRI - Water Risk Index

Table of Contents

Executive Summary 1

1. Background 3

1.1. Rationale and objectives of the guide 3

1.1.1. The ECE Industrial Accidents Convention 3

1.1.2. The Seveso II Directive 4

1.1.3. History of hazard ranking systems applied to major hazard sites 4

1.1.4. Objectives of the study report and expected users 5

1.1.5. Definition and characteristics of a hazard rating system 6

1.1.6. Typical components and outputs of hazard rating systems 7

1.2. Project methodology 8

2. Findings 10

2.1. General overview of responses and respondents 10

2.1.1. By response rate 10

2.1.2. By geographic range 11

2.1.3. By competent authorities 11

2.2. Summary of descriptions of hazard rating systems surveyed 12

2.2.1. Name of the hazard rating systems 13

2.2.2. Purpose of the hazard rating system 14

2.2.3. Scope of the hazard rating system or methodology 16

2.2.3.1. Establishments covered 16

2.2.3.2. Thematic scope (legal requirements) covered 18

2.2.4. Development of the system 19

2.2.5. Users of the hazard rating methodologies 21

2.2.6. Legal status of the hazard rating methodologies 22

2.2.7. Age of the systems 23

2.2.8. Structure and outputs of the hazard rating systems 25

2.2.8.1. Authority performing (conducting) the hazard rating exercise 25

2.2.8.2. Frequency of hazard rating exercise 26

2.2.8.3. Structural elements of the hazard rating systems 28

2.2.8.4. Data evaluation 30

2.2.8.5. Type of output 31

2.2.8.6. Distribution of outputs of the rating system 32

2.2.9. Accessibility of the methodologies of the hazard rating systems 34
2.2.9.1. Availability of the hazard rating methodology to the public 34
2.2.9.2. Sharing the methodology with ECE member countries 35
2.2.9.3. Availability of IT or web-based tools 36
2.2.10. Strengths and weaknesses of the systems 38
2.2.10.1. System validation by independent external experts 38
2.2.10.2. Updates and modifications over time 40
2.2.10.3. Effectiveness in achieving the purpose 40
2.2.10.4. Ease of application 42
2.2.10.5. Transparency of the results 44
2.2.11. Suitability of the results for risk communication to the public 45
3. Conclusions 47
3.1. Purpose and use 47
3.2. Availability of hazard rating methodologies 48
3.3. Common design elements 48
3.4. Strengths and weaknesses 49
3.5. Final observations 49
Annex 1: Case studies for selected hazard rating systems 50
CASE STUDY 1: UNITED KINGDOM 50
CASE STUDY 2: SWEDEN 52
CASE STUDY 3: BELGIUM - RRT 54
CASE STUDY 4: BELGIUM - LOPI 56
Annex 2: Copy of the survey 59

List of Tables

Table 1: ECE countries requested and responded (per region) 10

Table 2: Main competences of responding organisations 12

Table 3: Name of the hazard rating system 13

Table 4: Kind of establishments covered in countries 17

Table 5: Link of the rating system with legislative requirements in different countries 19

Table 6: Various ways used to develop the system in respondent countries 20

Table 7: Users of the system 22

Table 8: Age of the systems 24

Table 9: Authority conducting the hazard rating exercises in different countries 26

Table 10: Structure elements of the hazard rating systems 29

Table 11: Methods used for data evaluation 30

Table 12: Recipients receiving a formal copy of results 33

Table 13: Availability to the public 35

Table 14: Opinion on effectiveness of the system 41

Table 15: Opinion on ease of application 43

Table 17: Use of output for risk communication 46

List of Figures

Figure 1: Purpose of the hazard ranting system (N=17) 14

Figure 2: Different purposes indicated by various countries (N=17) 15

Figure 3: Kind of establishments covered by the hazard rating systems in percentage (N=17) 17

Figure 4: Various ways used to develop the system in respondent countries (N=16) 21

Figure 5: Status of formal adoption into legal requirements (N=16) 23

Figure 6: Number of systems distributed by different age groups (N=15) 24

Figure 7: Authority conducting the hazard rating exercise (N=14) 25

Figure 8: Frequency by which the hazard rating exercise is conducted (N=16) 27

Figure 9: Structure elements of the hazard rating systems (N=17) 28

Figure 10: Methods used for data evaluation in percentage (N=15) 31

Figure 11: Output of the system (N=16) 32

Figure 12: Recipients receiving a formal copy of results (N=15) 33

Figure 13: Availability to the public (N=15) 35

Figure 14: Willingness to share details with ECE countries (N=16) 36

Figure 15: Availability status of IT or web-based tools (N=16) 37

Figure 16: Language(s) of the hazard rating systems (N=15) 38

Figure 17: Independent validation of the system conducted (N=16) 39

Figure 18: Update or modification conducted since initial system launch (N=15) 40

Figure 19: Opinion on effectiveness of the system (N=15) 41

Figure 20: Opinion on ease of application (N=15) 43

Figure 21: Transparency of the system results (N=16) 45

Figure 22: Suitability of output for risk communication (N=16) 46

Executive Summary

This report provides an overview of hazard rating systems used by competent authorities in various ECE member countries for prioritising resources and directing attention to chemical hazard sites and industries where it is most needed. The report describes each system without attempting to analyse or compare differences or similarities. The purpose of the report is to give ECE countries insight into various approaches as they are seeking to establish or modify the same or similar systems in future to support effective implementation of chemical accident prevention and preparedness policy. The information in this report is summarised from responses of the featured ECE countries to a survey distributed by the United Nations Economic Commission for Europe (ECE) Convention of the Transboundary effects of Industrial Accidents (Industrial Accidents Convention) and the Major Accident Hazards Bureau of the European Commission's Joint Research Centre.

Section 1. Background

The report is divided into three sections, Background, Findings and Conclusions. The Background section explains the growing demand for hazard rating systems to support implementation of authority obligations for chemical accident prevention and preparedness legislation, and more specifically, the EU Seveso Directive and the ECE Industrial Accidents Convention. It summarises the historic development of such systems particularly to implement inspections targeting industrial establishments where dangerous substances are produced, used or stored in large quantities (Seveso establishments). It also explains what is generally meant by a hazard rating system in the context of a chemical accident prevention and preparedness programme. It is noted particularly that the systems in this study are specifically aimed to rate sites considered hazardous on the basis that they process, store or handle dangerous substance in such volumes that release of the substance(s) could cause a serious accident onsite or to the surrounding community.

Section 2. Findings

The Findings section is the core of the document, summarizing the responses of the survey on a wide range of aspects pertaining to the development, context, content, methodology, outcomes of the methodologies and their application, and accessibility of results as well as the hazard rating methodology itself. From this section, users of this report can obtain information on different ways to develop methodologies, gain a perspective on both objective and subjective methods that can be applied, and also review the specific inputs that have been considered useful for producing a credible result across a diverse range of hazardous sites.

In this section a number of commonalities can also be observed, for example, the purpose for which the system is used, the types of sites, structural elements (i.e., inputs) of the hazard rating systems. Nearly two-thirds of the systems specifically target Seveso sites and the most common inputs are type of hazardous substance, followed by potential risk recipients, and production and process

conditions. Most outputs are at least partially quantitative, with some systems also producing both a quantitative and a qualitative result.

A majority of respondents were willing to share their methodology with other ECE countries. However, the survey responses also noted that most of the methodologies currently exist only in the native language. Four methodologies are available in English and two methodologies are available in Russian. A handful of the methodologies are supported by online web tools.

More than half of the respondents indicated that they were generally satisfied or very satisfied with the methodology and its results. A number of systems had also been modified over time after a few years' experience which may also have contributed to a relatively positive feedback in this regard from several countries. Likewise, most countries reported that the systems were easy or somewhat easy to use.

Section 3. Conclusions

The Conclusions section provides a brief summary of the main findings of the study. Common elements of the systems are cited and strengths and weaknesses of the systems evidenced in the survey responses are briefly described. Notably, feedback in regard to the transparency of results was mixed and it appears that in many cases output of the methodology is not entirely intuitive and needs to be interpreted by someone who has expert knowledge of the system. Nonetheless, more than half of the respondents considered that the results of the rating system could possibly be considered appropriate for risk communication to the public.

Annexes

The annexes contain case studies describing selected hazard ranking systems from the United Kingdom, Sweden and Belgium in detail. While the survey responses address different inputs and outputs of hazard ranking, the case studies describe complete hazard ranking systems,d which inputs and outputs have been selected. The case studies describe each hazard ranking system systems as a whole, and in the context of its purpose and intended use. The input elements, output calculations, and uses intended for each system can vary considerably from one country to the next.

In addition, a copy of the survey is included in the Annex.

1. Background

1.1. Rationale and objectives of the guide

The development of a guide on hazard rating system or methodology is one of the priority objectives of the United Nations Economic Commission for Europe (ECE) Convention on the Transboundary effects of Industrial Accidents (Industrial Accidents Convention). Hazard rating methodologies are also relevant to the work of the Major Accidents Hazard Bureau (MAHB) Unit of the Joint Research Centre, European Commission; especially in the context of the Seveso II Directive as such system or methodology could assist in various policy decisions.

1.1.1. The ECE Industrial Accidents Convention

The ECE region is historically one of the most industrialised regions of the world. The industrialization, coupled with the growth of the population and the development of residential areas near major industrial plants and estates, have led to increased risk for the human health and the environment caused by industrial accidents. Industrial operations may involve substances that do not usually represent a great threat to our health or our environment but are nevertheless potentially hazardous. In Europe, the well-publicised industrial accidents at Seveso in Italy in 1976 and Basel in Switzerland ten years later have brought this message home to us. These accidents, but also disasters in other areas of the world, such as the Bhopal and Mexico City 1984 accidents and the more recent accidents in Baia Mare, Toulouse, Buncefield and Kolontar, have caused us to recognise that industrial accidents do not recognise borders and severely punish any lack of measures for accident prevention, preparedness and response as well as public information, accident notification and mutual assistance in case of a major accident.

Recognising the challenges ahead for the Member States, since the early 1990s the ECE has concentrated its efforts on preventing industrial accidents and especially their trans-boundary effects in the region. Its work led to the adoption of the Convention on the Transboundary Effects of Industrial Accidents on 17 March 1992. The Convention was signed by 26 ECE member countries and the European Union (EU) and entered into force on 19 April 2000. Currently there are 41 Members to the Convention, including the EU. Following the Convention's entry into force, the ECE carries out the secretariat functions for the Convention.

The Convention aims at protecting human beings and the environment against industrial accidents by preventing such accidents as far as possible, by reducing their frequency and severity and by

mitigating their effects. It promotes active international cooperation between the contracting Parties, before, during and after an industrial accident.

1.1.2. The Seveso II Directive

The Seveso accident in 1976 also prompted the adoption of EU legislation aimed at the prevention and control of such accidents. The resulting Seveso Directive now applies to around 10,000 industrial establishments in the European Union where dangerous substances are used or stored in large quantities, mainly in the chemicals, petrochemicals, storage, and metal refining sectors. The Seveso Directive (currently Directive 96/82/EC to be replaced 1 June 2015 with Directive 2012/18/EU) obliges EU Member States to ensure that operators have a policy in place to prevent major accidents. Operators handling dangerous substances above certain thresholds must regularly inform the public likely to be affected by an accident, prepare safety reports, have a safety management system in place and an internal emergency plan developed. EU Member States must also ensure that external emergency plans are in place for the surrounding areas and that mitigation actions are planned. Land-use planning must also take into account the potential risks of major hazard establishments.

Since the European Union's 28 Member States form an important part of the ECE region, provisions of the Industrial Accidents Convention and the Seveso Directive share the same principles. Moreover, the Seveso III Directive is considered as the legal and technical instrument for fulfilling the obligations of the European Community arising out of the Industrial Accidents Convention to which the EU is a Party. The synergies between the two legislative instruments makes collaboration between the European Union - its Member States and the ECE particularly advantageous and has resulted in a number of joint activities over the years in the form of emergency response exercises, training and technical tools and reference materials. This particular study represents one such collaboration and has been created through the joint contribution of ECE and the European Commission's Major Accident Hazards Bureau (MAHB) with the support of the Directorate-General for the Environment of the EU.

1.1.3. History of hazard ranking systems applied to major hazard sites

Risk governance of chemical hazard sites became an important focus of government policy in developed regions of the world about 30 years ago, about the same time that the EU's Seveso Directive became law in 12 European Member States. Since then there has always been a portion of government resources devoted to the development, study, and dissemination of methods to assess risks of industrial hazards on individual sites. More recently, authorities are giving attention to evaluation of site risks from a relative standpoint, as a way of prioritising resources and directing attention to industries and sites where it is most needed.

The Seveso II Directive (96/82/EC) first introduced a legal basis for introducing a hazard rating system in 1996, with the introduction of an option under Article 18 to apply a systematic appraisal system to prioritise inspection of Seveso upper tier sites in lieu of conducting an inspection of each of these sites automatically once a year. Over the years since the Seveso II Directive came into law, several EU Member States have taken on board this concept, often not only rating their upper tier sites but all Seveso, lower and upper tier inclusively, to produce an overall prioritisation of all Seveso sites for inspection. The system allows rationalization of enforcement resources in such a way that sites that are perceived as higher safety challenges can be inspected with greater frequency than others, particularly in the short space of a year when some sites with urgent risk situations need on-going attention from authorities to ensure that they are monitored and addressed in due time. The hazard rating system is not a justification for foregoing inspections or extending the interval between inspections to several years.

Outside the Seveso regime, a few other regional hazard rating systems for similar types of hazards are known to exist, although their application is not particularly wide spread. For example, the survey conducted by this study received a set of responses relative to a rating system developed to support environmental protection of the Danube River. This relatively new system was developed exclusively to manage risks associated with water pollution, including determining alert thresholds in case of a high volume substance release into water, as well as identifying accident risk spots in river basins. There also appears to be significant interest in risk mapping systems for developed countries that tend to have incomplete data on their hazard sites but methods in development are still largely untested. In any case, it is not yet clear to what extent risk mapping techniques will aid authorities in prioritising interventions between sites. They may complement risk rating systems by showing where clusters of risk are located in relation to dense populations and natural hazards, for example.

More recently, Seveso countries are looking at systems for evaluating the effectiveness of risk management measures on industrial hazard sites. This type of rating system is relatively new and only a few countries are in the process of implementing such a system, so feedback from that experience is still somewhat limited. The survey also received a set of responses on one such system, newly developed by Belgium, and featured as a case study in Annex 1.

1.1.4. Objectives of the study report and expected users

The purpose of this study was to collect and disseminate information on existing practices and methodologies in the area of hazard rating methodologies, developed and used by EU Member States and ECE member countries. This document reports the findings from the study. The document does not recommend any single methodology nor does it evaluate or compare the methodologies used in the different countries subjectively. Rather, on the basis of information

provided from several ECE member countries, it draws attention to various models used in current practice as a mechanism to help authorities develop their own systems or benchmark their existing practice. As such, the document is expected to support ECE countries to strengthen their capacity for industrial accident prevention and control.

Hazard rating systems are generally used to optimise use of resources of competent authorities and to measure and direct the influence of established chemical accident prevention policy. As such they may be developed to support policy development and implementation in a number of ways. Most commonly, in EU Member States they have been applied to assist planning and prioritising of inspections. Recently, some countries have also been applying hazard rating systems to evaluate the effectiveness of enforcement actions and other interventions. Hazard rating systems can also be used for regulatory purposes (review and assessment of safety reports, issuing of permits or consents, etc.), identification of safety performance trends, and for development of future policy strategies in the area of accident prevention and control.

The primary users are expected to consist of Seveso and ECE Industrial Accidents competent and enforcement authorities. Operators may also find the document useful when developing, implementing or updating their management systems for industrial accident prevention and control.

1.1.5. Definition and characteristics of a hazard rating system

For the purposes of this document a hazard rating methodology is a system for estimating the major accident hazard potential of an industrial site that processes, handles or stores dangerous substances. Its purpose is to assist competent authorities in strategy development, and planning and prioritising of interventions in support of chemical accident prevention and preparedness policy. The output following application of the method may be *relative* (functioning only as a way to compare the site to other sites) or *absolute* (a ranking of risk independent from other sites). In the latter case, a certain level of scientific rigour is required to structure the method so that its results can be interpreted independently without reference to the risk indicated for other sites.

A hazard rating system for major accident hazards is distinct from other types of hazard assessment methods in the following ways:

- Its focus is on ranking *hazard sources*. In the case of this document, the sources are industrial sites.
- The hazard sources targeted are those sites that process, store or handle dangerous substances in such volumes that a release of the substance(s) could cause a serious accident onsite or to the surrounding community or region, including transboundary impacts.

The system should take into account the intrinsic hazards, that is, the substance(s) and their dangerous properties and typical quantities on site, as well as external hazards (e.g., potential natural hazards affecting the site) and vulnerabilities (population, public buildings, natural resources, etc.).

Hazard rating is not a substitute for risk assessment. Risk assessments are typically technically exercises in which particular methodologies are applied to a specific site to identify precise nature of hazards, establish potential accident scenarios, and predict possible consequences, with the view to defining a detailed risk management strategy of the site. A risk assessment is a site-specific activity whose inputs and methodical approach are uniquely determined by the individual characteristics of a site.

1.1.6. Typical components and outputs of hazard rating systems

Hazard rating systems can be based on both objective and subjective components. Typical components include:

- Hazardous substances present (e.g., quantities, properties, etc.)
- A standardised hazard rating methodology (e.g., MOND Index, Dow FE&I, etc.)
- Regulatory status (if any) in relation to the hazard
- Size of the site (e.g., number of employee, production volume, etc.)
- Production or process conditions
- Inspection records/compliance history or enforcement record
- Enforcement record (e.g., penalties and other legal interventions, etc.)
- Accident and near miss history
- Natural phenomena that could lead to an accident
- Possible risk recipients (e.g., residential areas, public facilities, natural resources, etc.)

Depending on the information available, the system may also use information from the operator (e.g., supplied in the safety reports) on installations design, maintenance practice, age of the operation, operator audit or self-assessment, safety performance indicators and safety culture measurements. The systems may be designed to produce either a qualitative or quantitative evaluation. A number of methods for combining inputs are also possible. Some systems may quantify all inputs to produce one output. Some systems may weight different inputs before summarising them with others. There also may be separate categories that are not added together but viewed separately and then weighed against each other (e.g., intrinsic hazard vs. potential consequences of an accident). Experience with good practice suggests that many different approaches may be considered valid, but it is important that the method for producing the final rating is both logical and transparent.

1.2. Project methodology

The current document was developed after conducting a bilingual (English and Russian) survey on hazard rating methodologies used by EU and ECE member countries for the prioritisation and evaluation of hazardous establishments. The survey aimed at eliciting information about available hazard ranking systems targeted any type of evaluation used for ranking or evaluating such establishments.

In particular, the survey aimed at obtaining information on the following:

- Hazard rating and ranking methodologies used for inspections (such as 'systematic appraisal' that can be used to prioritise Seveso inspections);
- Methodologies that rate individual sites for the purposes of tracking overall policy effectiveness or safety performance or trends on major hazard sites or other similar purposes.

The survey was designed by MAHB in collaboration with the secretariat of the ECE Convention on the Transboundary Effects of Industrial Accidents. In January 2014, the survey was distributed for completion by the by representatives of the competent authorities nominated for the implementation of the EU Seveso Directive and the ECE Convention on Transboundary Effects of Industrial Accidents. For countries in the EU as well as the European Economic Areas (EEA) and the European Free Trade Association (EFTA), the request to complete the survey was also copied to the representatives of the Technical Working Group on Seveso Inspections. In total, the survey was distributed to total 48 countries including 28 EU Member States, 3 EEA/EFTA[1] countries and 17 other countries covered by the UN ECE Industrial Accidents Convention.

The survey focused on gaining understanding on the methodology or system used, how it is applied, what kind of outcomes are expected, and how results are used. A respondent country could submit more than one set of survey responses, if it applied more than one hazard rating system to major hazard sites. However, it was required that each hazard rating system would be the subject of a separate survey. It was also explained to potential respondents that the system could be relevant for any major hazard sites or for a subset of sites in the country. Respondents could also describe hazard rating systems that covered a broader range of substances (not only acute chemical hazards) that are outside the scope of Seveso or the Industrial Accidents Convention (e.g., sites below the Seveso lower tier), but that are focused on chemical accident prevention. Methodologies or systems that

[1] Iceland and Norway belong to the European Economic Area (EEA). Members of the EEA must implement all European community legislation relevant to trade and therefore, implement the Seveso Directive along with EU Member States. Together with EU Member States, these countries are all Seveso-implementing countries. Switzerland belongs to the European Free Trade Area and implements chemical accident prevention policy that has many similarities with the Seveso Directive.

cover a subset of chemical hazard based on other criteria, e.g., establishments at risk for environmental accidents, were also of interest for the survey.

The survey (see Annex 2) contained the following six main groups of questions:

- Respondent organisation's details,
- Summary description of the system or methodology,
- Structure and outputs of the system or methodology,
- Availability and access to the system or methodology,
- Strengths and weaknesses of the system or methodology, and
- Background materials.

2. Findings

2.1. General overview of responses and respondents

In order to obtain a comprehensive understanding about the existing hazard ranking systems, EU and ECE member countries were requested to complete the on-line survey form (see Annex 2). For this purpose, the survey was distributed to a total of 48 countries in the Economic Commission for Europe region including 28 EU Member States, 3 EEA/EFTA countries and 17 non EU/EEA/EFTA ECE member countries. This section summarises the overall response rate to the survey, geographical location of the respondent's country as well as the respondent's organisation affiliation as exist in various countries.

2.1.1. By response rate

Out of the 48 countries targeted, 9 EU Member States and 7 non-EU countries responded to the survey (29%). Of the non-EU countries, 2 countries belong to the EEA/EFTA category, one from Southeast Europe, two from Eastern Europe, and two from Caucasus and Central Asia. Notably, one EU Member State (i.e. Belgium) provided two sets of survey responses for two different hazard rating systems applied to the country's major hazard sites. In addition, a respondent from Germany responded on behalf of the rating system used by the International River Commissions of the Danube, Elbe and Odra rivers. Numbers corresponding to the countries solicited vs. those that responded to the survey are listed in the Table 1.

Table 1: ECE countries requested and responded (per region)

Category	Requested	Responses	Countries
EU	28	10	Belgium[2], Bulgaria, Croatia, Czech Republic, Finland, Germany, Poland, Sweden, United Kingdom
EEA/EFTA	3	2	Norway, Switzerland
Outside EU			
Southeast Europe	5	1	Serbia
Eastern Europe	4	2	Republic of Moldova, Ukraine
Caucasus	3	1	Armenia
Central Asia	5	1	Kyrgyzstan
International		1	International River Commissions of the Danube Elbe and Odra rivers

[2] Belgium provided two responses for two different hazard rating systems.

N=17

In general, the quality of the responses received was very high. Seventeen (17) respondents completed the survey and provided the requested information; however a few surveys were submitted with incomplete responses. Two respondents mentioned that they did not yet have a system. One of these respondents (i.e., Norway) provided responses on the basis of expectations for their new system and those when relevant are included in the analysis. The other respondent (i.e., Kyrgyzstan) did not specially indicate in its responses about its expectations for the new system, and therefore, its response is not considered for the analysis. Among the 17 respondents, a few respondents only replied to some of the questions. For this reason, responses to several questions are less than 17.

Nevertheless, a wide-range of diversity was observed amongst the respondent’s country profile, in particular, in regard to the following perspectives:

- Politically – Both EU and non-EU countries responded to the survey.
- Population size – The population size of countries ranged between 3 and 80 million inhabitants.
- Number of Seveso sites (EU only) – The number of Seveso sites in each country ranged from nearly 200 to over 2000, based on the most recent SPIRS[3] data.

2.1.2. By geographic range

The majority of the responses (71%) were provided by the northern and western European countries and somewhat less contributed by the south and eastern European countries and Central Asia (29%).

2.1.3. By competent authorities

The respondents also identified the organisation with which they were affiliated. These responses are summarized in Table 2 (opposite) according to their area of competence (e.g. environment, civil protection, employment and labour, industrial safety, etc.). It can be noted that majority of the respondents are associated with organisations dealing with environmental issues (7).

[3] EU and EEA countries are required to report their inventory of Seveso sites to the European Commission’s Seveso establishments reporting system (SPIRS).

Table 2: Main competences of responding organisations

Competence	Organisations
Environment	• Ministry of Environment and Water - Bulgaria • Ministry of the Environment - Czech Republic • Ministry of Environment and Nature Protection - Croatia • Federal Environment Agency (Umweltbundesamt) - Germany • Chief Inspectorate for Environmental Protection – Poland • Darmstadt Regional Council, Occupational Safety and Environment (Regierungspräsidium Darmstadt Abt. Arbeitsschutz und Umwelt) - Germany • Federal Office for the Environment, Major Accident and Earthquake Mitigation Section - Switzerland • Ministry of Energy, Development and Environmental Protection – Serbia
Civil Protection	• Norwegian Directorate for Civil Protection - Norway • Swedish Civil Contingencies Agency – Sweden • Ministry of Emergency Response – Armenia • The State Emergency Response Service - Ukraine
Employment and Labour	• Federal Public Service Employment, Labour and Social Dialogue - Belgium • Darmstadt Regional Council, Occupational Safety and Environment (Regierungspräsidium Darmstadt Abt. Arbeitsschutz und Umwelt) - Germany* • Health and Safety Executive – United Kingdom (UK)
Industrial Safety	• Finnish Safety and Chemicals Agency – Finland • Secretary of National Group for Implementation of the Industrial Accidents Convention – Republic of Moldova
Other	• The Intersectoral Training Centre under the State Agency for Geology and Mineral Resources – Kyrgyzstan

N =17

*Also listed as an organisation with competence in environmental affairs

2.2. Summary of descriptions of hazard rating systems surveyed

This section summarises the survey responses to comprehend the structure of each hazard rating system as well as their similarity (if any) as exist in various countries. For this purpose, each system was analysed from different perspectives in regard to availability, purpose, scope, development, owner, user community, legal status, age, as well as their structure and output. In the following sections, a brief overview of each of these aspects of the systems is presented with substantial facts and figures as derived.

2.2.1. *Name of the hazard rating systems*

Eight respondents, including 2 responses each from Belgium and one on behalf of an international body, confirmed the existence of the hazard rating system in their respective countries (see Table 3 below). Seven respondents did not provide a name for their system, and three (i.e., Norway, Republic of Moldova and Kyrgyzstan) of them did not provide the name because development and implementation of the system had not been completed. Kyrgyzstan provided responses to other questions in the survey on the basis of the system that was previously used but no longer active.

Table 3: Name of the hazard rating system

Country[4]	Name
Belgium	Rapid Ranking Technique (RRT)
Belgium	Level of Protection Indicators (LOPI)
Bulgaria	Hazard rating methodology
Germany	Major Hazard Enforcement Guide (Vollzugshandbuch Störfall) (Hessen)
International	Water Risk Index (WRI)
Poland	Multi-criteria risk analysis
Serbia	Rulebook on the Scope of Accident Prevention Policy and Scope and Methodology of the Safety Report and Contingency Plan and Development
United Kingdom	Control of Major Accident Hazards (COMAH) Competent Authority: Site Prioritisation Methodology, Intrinsic Hazard (Safety and Environment) and Performance

N = 8

The Republic of Moldova indicated that it did not yet have a hazard rating system, but it is in development. The intention is to develop such a system for implementation of the inspection requirements of the Seveso Directive. At present, Republic of Moldova uses separate rating systems for inspections conducted by the various inspectorates associated with different ministries with responsibilities associated with chemical accident prevention and preparedness. The civil protection authority uses a hazard rating system to assign one of 4 levels of risk[5], based on the number of population exposed to the risk.

[4] Sweden, Norway, Czech Republic and Switzerland skipped this question.
[5] Four levels of risk
Class I - The possible chemical contamination includes more than 75 thousand people
Class II - The possible chemical contamination includes from 40 till 75 thousand people
Class III - The possible chemical contamination includes less 40 thousand people
Class IV - The possible chemical contamination does not exceed the limits of the object and the protection of health.

2.2.2. Purpose of the hazard rating system

A hazard rating system may be used for a number of different purposes, such as scheduling an inspection, evaluating the effectiveness of the enforcement or the performance of operator on an individual basis, etc. Hence, the survey asked respondents to give the purpose of the hazard rating system. Purposes of the system as identified by respondents are presented in Figure 2.

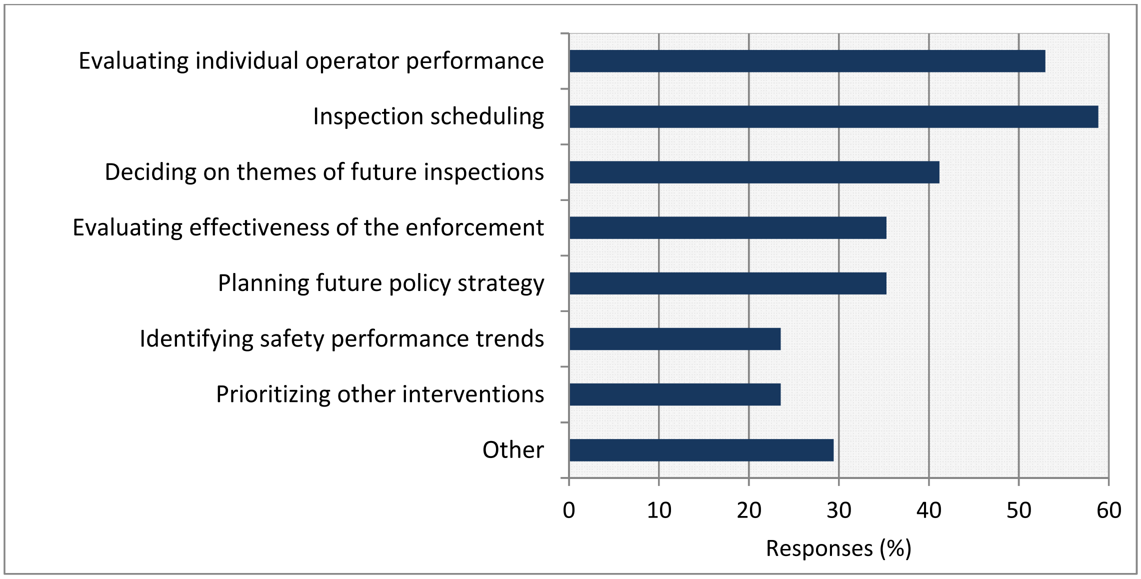

Figure 1: Purpose of the hazard ranting system (N=17)

Several respondents provided more than one purpose in their response (see Figure 1). Inspection scheduling and evaluating the performance of individual operator were the most commonly cited by respondents (10 or 59% and 9 or 53%, respectively), followed by deciding on the themes for future inspections (7 or 41%), evaluating effectiveness of the enforcement (6 or 35%). Six (35%) respondents also cited planning future policy strategy and four (24%) cited identifying safety trends and similarly, prioritizing other interventions.

Belgium has two systems with two different purposes. The Belgian Level of Protection Indicators (LOPI) system is aimed to evaluate individual operator performance while the Rapid Ranking Technique (RRT) system is intended for scheduling inspections. Moreover, the Belgian LOPI system, is also used for deciding on themes of future inspections, for evaluating effectiveness of the enforcement, for planning future policy strategy as well as for identifying safety performance trends. Similarly, the system of the Czech Republic and the International Water Risk Index (henceforth WRI) system are also used for more than one purpose (as indicated in Table 4 on the next page).

In some countries the system is also used for other purposes in addition to those cited explicitly above. For example, Poland also applies the system to carry out a multi-criteria analysis of environmental impacts and hazards posed by the establishment. The results eventually serve as a basis to determine the frequency of inspection and accordingly divide entities into five categories[6].

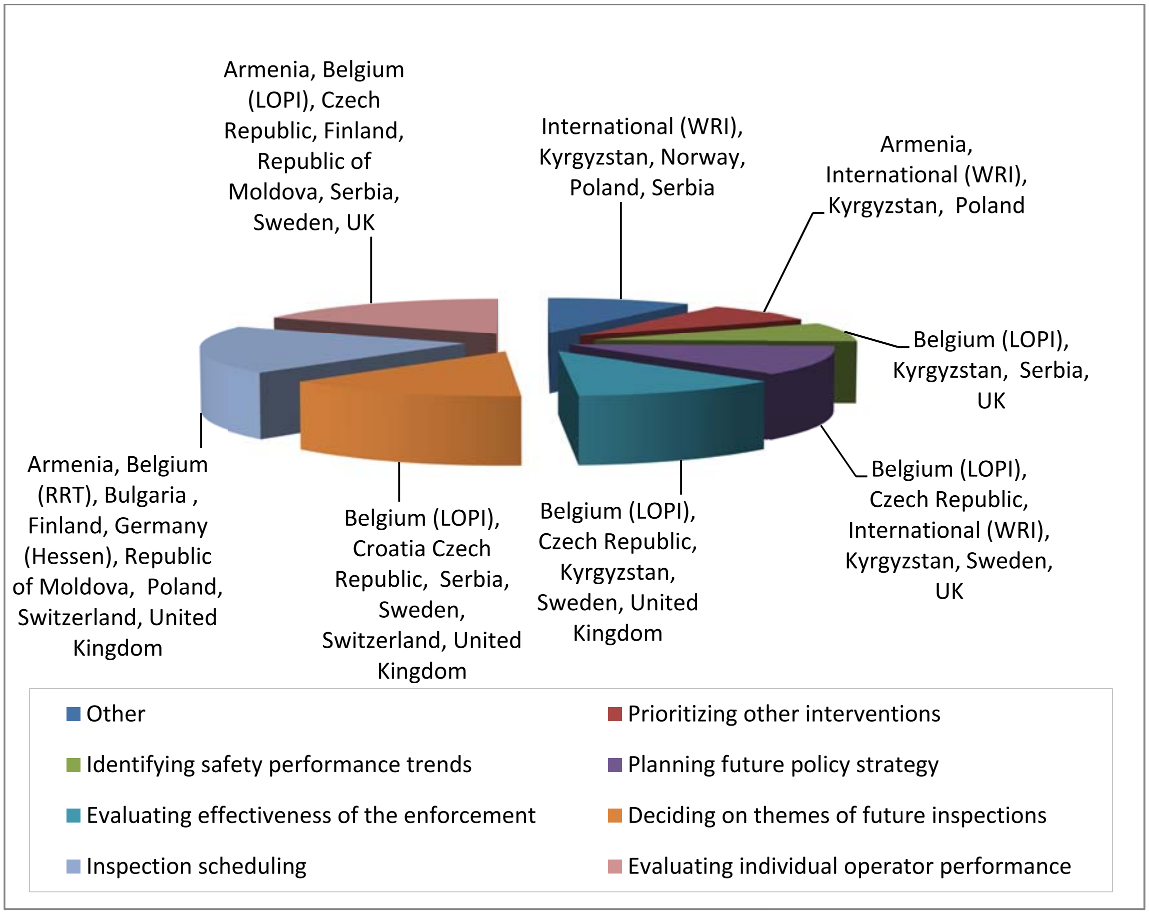

Figure 2: Different purposes indicated by various countries (N=17)

[6] Five categories:

Category I (highest risk): Annual inspection for the entities that must be inspected due to the legal requirements (e.g., upper-tier establishments etc.).

Category II (high risk): Biannual inspection for the entities that must be inspected due to the legal requirements (e.g., lower-tier establishments, activities classified as having always a significant impact on environment, entities that don't meet the environmental requirements etc.).

Category III (average risk): Inspection every three years or less often for the entities that pose a hazard of major accident (not classified as upper tier or lower tier establishment).

Category IV (low risk): Inspection every four years or less often other than category I, II and III, that are obliged to obtain environmental permits, selected as a result of multi-criteria risk assessment.

Category V: Inspection every five years Facilities that do not require environmental permits, not covered by annual planning, without allocated inspection frequency, inspection upon request for intervention.

In the case of the International WRI system, the system is used as to decide warning and alert thresholds in case of a water accident involving dangerous substances as well as for identifying accident risk spots at river basins. Serbia commented that its system may also be used for the purposes of emergency planning and land-use planning. Norway also commented that, to date, they do not have a hazard rating system in place, but the country has started a project looking into possible indicators for the development of risk level in and around Seveso establishments and expects to develop a system in future.

2.2.3. Scope of the hazard rating system or methodology

Similar to the purpose, the scope of the hazard rating system also varied considerably between countries. The survey uses the term 'scope' to mean the type or kind of the establishment that the system covers and also any legal requirements it supports. It is noted that the system of one particular country might cover various kind of establishments (i.e., upper and lower tier Seveso sites) while others may cover other legislative mandates. For this reason, the legal requirements governing a particular system may differ from one country to another. In the following section, the scope of hazard rating systems as exist in different countries is discussed.

2.2.3.1. Establishments covered

The hazard rating system of different countries is usually used in association with the particular legal status of an establishment within the country. Thus it can be understood that the establishments under the Seveso Directive are a point of particular interest for the Seveso-implementing countries. Several non-EU countries might also be working towards Seveso implementation with the expectation of joining the EU in future, and depending on what point they have reached, Seveso might also be their point of reference. Outside of this possibility, however, it can be assumed that a common legislative reference point for non-Seveso ECE countries could be establishments covered by the ECE Industrial Accidents Convention. It could also be that the system is applied only to specific economic activities (e.g., refineries) or to sites classified under other legislation apart from the Seveso Directive and ECE Industrial Accidents Convention.

It can be noted from Figure 3 (on the next page) that the majority of the Seveso implementing countries (10 out of 18 including the 2 Belgian systems) created their hazard rating system mainly for Seveso establishments. Notably, Bulgaria and Serbia identified only the upper tier Seveso sites as the scope of their systems (see Table 5 on the next page). Nonetheless, none of the Seveso countries indicated that the hazard ranking system was targeted to lower tier sites only. This situation can be

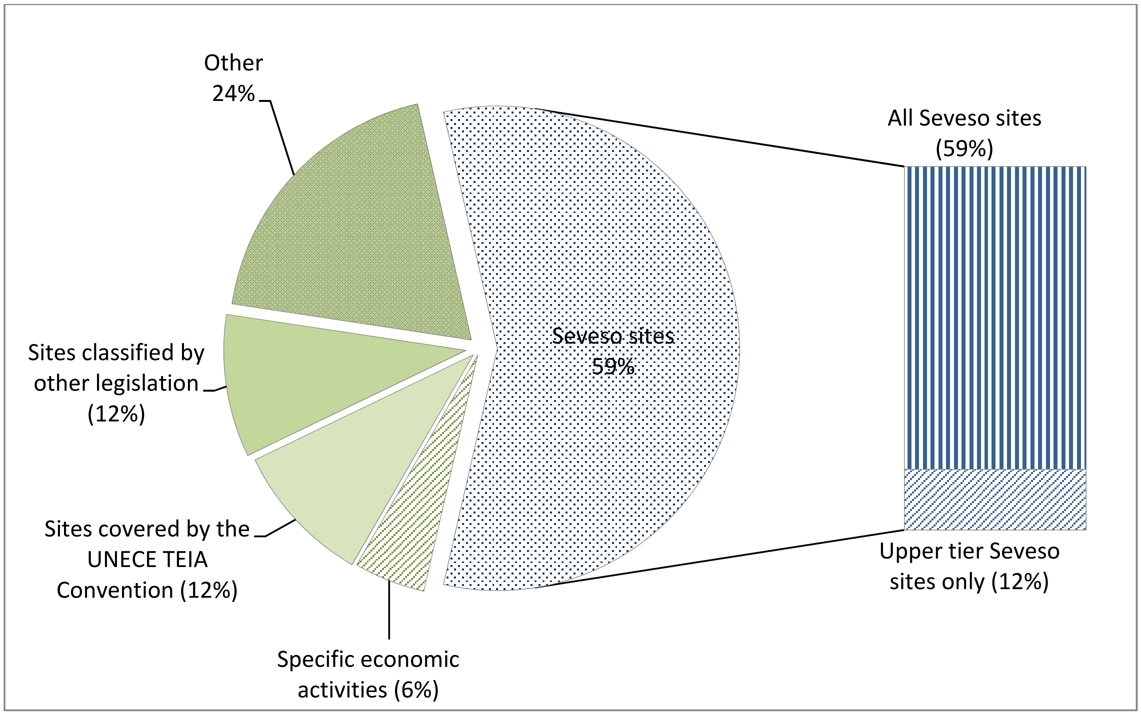

Figure 3: Kind of establishments covered by the hazard rating systems in percentage (N=17)

Table 4: Kind of establishments covered in countries

Establishments	Responses	Country
All Seveso sites	9	Belgium (RRT and LOPI), Bulgaria, Croatia, Czech Republic, Finland, Germany, Norway, Sweden, United Kingdom
Upper tier Seveso sites only	2	Bulgaria, Serbia
Sites classified by other legislation	2	Finland, Norway
Only sites covered by the ECE Industrial Accidents Convention	1	Kyrgyzstan, Ukraine
Specific economic activities	1	Republic of Moldova[7]
Lower tier Seveso sites only	0	None
Other	3	International (WRI), Poland, Switzerland

N=17

[7] All activities involving dangerous substances

attributed to the existence of a provision in the Seveso Directive allowing the authority to use a systematic appraisal system for planning inspections of upper tier sites if the authority prefers not to inspect each upper tier site every year on an automatic basis.

Some countries have also identified the establishments classified by other legislations as coming into the scope of their hazard rating system. For instance, in Finland, the establishments evaluated by the hazard rating system are covered by the Finnish National Legislation have a wider scope than the Seveso Directive (including also the establishments with volumes of substances below the Seveso lower tier thresholds).

In Poland, all establishments registered in the database of the Inspection of Environmental Protection (IEP), are also part of their system. The frequency of the inspection of the Seveso sites is fixed at once a year for upper tier sites and once in every two years for lower tier sites. Switzerland mentioned that it has lower thresholds quantities than the Seveso Directive and/or the ECE Industrial Accidents Convention. Therefore, the country has relatively more establishments falling in the scope of the hazard rating system used for inspection procedures. Besides, facilities representing water accident hazards are also considered as covered by the scope of the International WRI system.

Norway mentioned that, when its system is in effect, it could also be used for smaller sites whose quantities of dangerous substances are below Seveso thresholds.

2.2.3.2. Thematic scope (legal requirements) covered

Generally, the thematic coverage (or associated legal requirements) of a particular system varies in accordance with the political affiliation or legal status of the country. As shown in Table 4 (on the next page), the majority of EU Member States apply the hazard rating system in the context of the Seveso Directive. An analysis of the responses in this regard, highlights the fact that some of the existing systems (9 or 56%) associated with the implementation of the all operator requirements under the Seveso Directive. Some countries (2 or 12%) specifically apply (or applied, in the case of Kyrgyzstan) the hazard rating system in context of the implementation of the ECE Industrial Accidents Convention in addition to the Seveso Directive.

The Belgian LOPI system consists currently of the questions associated with 26 specific process safety measures. The intention of the rating system is to document whether such measures are in place or not for each company. The evaluation is based on inspection results as interpreted for each of the 26 measures; since the measures are very specific and are not exhaustive. Complying with the 26 measures or LOPI does not imply any particular level of compliance with the Seveso Directive, but

Table 5: Link of the rating system with legislative requirements in different countries

Requirements	Responses	Country
All operator requirements under the Seveso Directive	10	Belgium (RRT), Bulgaria, Croatia, Czech Republic, Finland, Germany, Serbia, Sweden, Switzerland, United Kingdom
All operator requirements under the ECE Industrial Accidents Convention	6	Bulgaria, Croatia, Czech Republic, Kyrgyztan, Serbia, Switzerland
Some operator requirements under the Seveso Directive	1	Belgium (LOPI)
Other themes in addition to the Seveso Directive and/or the ECE Industrial Accidents Convention requirements	5	Finland, International (WRI), Norway, Poland, Switzerland

N=16

it gives a good indication. The Seveso inspection authorities check many more measures than the 26 LOPIs but the LOPIs are evaluated and analysed statistically.

In response to other themes in addition to the Seveso Directive and/or the ECE Industrial Accidents Convention, the respondent representing the International WRI system mentioned that the classification of water accident risks, associated with legislation other than Seveso, also comes under the scope of their WRI system. In this regard, Finland pointed out that the rating system was also applied in the context of technical requirements based on the National Safety Decrees. In Poland, all establishments covered by the Control System of inspection that must be inspected are covered by the system. Republic of Moldova mentioned that the proposal of the system is intending to cover the requirements covered by both the Seveso Directive and the ECE Industrial Accidents Convention.

2.2.4. Development of the system

Hazard rating systems have been developed in a variety of ways in different countries. In some cases the system was subject to results of a specific research project or based on the existing system or methodology as developed by other authorities or countries. Some authorities developed their systems with the support of a special committee or a consultant.

The responses show (see Table 5 below and Figure 4 on the next page) that in the majority of countries (8 or 50%), the existing system was developed in collaboration with a special committee or task force. In contrast, in several other countries (5 or 31%), the existing system evolved based on an existing hazard rating system as conceptualised by another authority, or even another country. For

instance, in Poland, the hazard rating system was developed under the project entitled "Increasing effectiveness of the Environmental Inspection"; while in the Republic of Moldova the system developed for the Former Soviet countries is still operational. Similarly, the Belgian RRT system was developed by the TNO in the Netherlands based on the Dow Fire and Explosion Index[8]. In the Czech Republic, the system was developed based on the system of the UK Health and Safety Executive (HSE) and TNO methodology.

Norway also indicated that it is preparing its methodology based on inputs from other countries and being assisted by the Norwegian research institute, SINTEF. Norway has studied both the UK and Finnish systems in particular and it could be that its future methodology is a further development of both.

Furthermore, respondent representing the International River Commissions mentioned that the WRI hazard rating system was developed based on Annex VI of the Seveso Directive as adapted to river accidents. The system is based on the transposition of substances present that could lead to water pollution into WRC (in German language WGK) 3-equivalents (water risk classes). From the sum of the WRC 3- equivalents a so-called WRI (i.e., Water Risk Index) can be calculated logarithmically, analogous to the Richter scale in the case of earthquakes. On this basis, it is possible to analyse the potential accidental risk spots, i.e. in the Danube catchment area and assess their relative significance as well as to set threshold values for activating international Warning and Alert System.

Table 6: Various ways used to develop the system in respondent countries

Development	Responses (%)	Country
Supported by a special committee or task force	8	Belgium (LOPI), Bulgaria, Croatia, Germany, Serbia, Switzerland, Ukraine, United Kingdom
Based on an existing system of another authority or country	5	Belgium (RRT), Czech Republic, Republic of Moldova, Poland
Other	4	Finland, International (WRI), Norway, Sweden

N=16

[8] Published by the International Labour office (ILO) as Major Hazard Control, a practical manual (ISBN 92-2-106432-8),1988

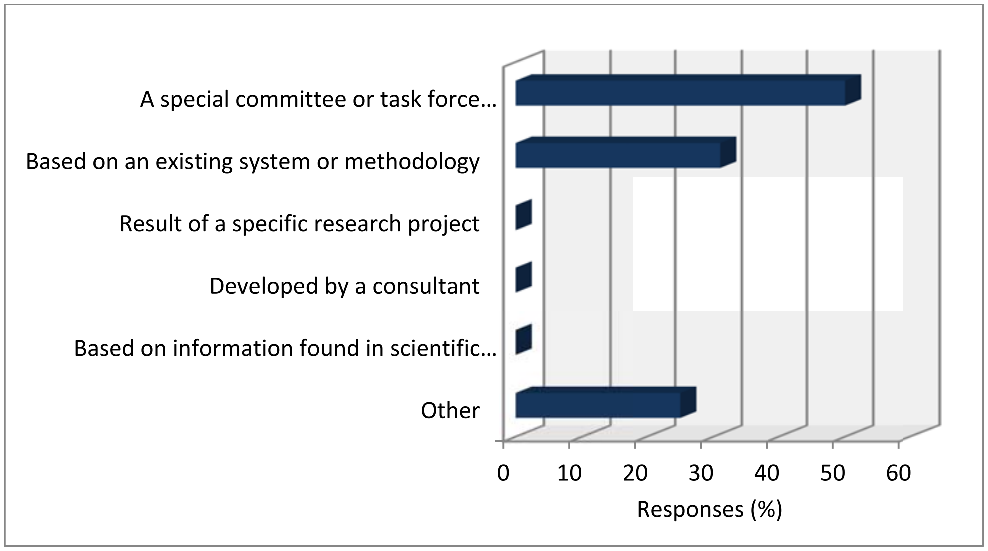

Figure 4: Various ways used to develop the system in respondent countries (N=16)

(N=16)

In Sweden the method was developed through various exchange of experience in workshops and conferences related to Seveso inspections. In Finland, the system began first as an indicator to assist in evaluating the influence of the authority's work as well as to associate a level of safety associated with the site based on inspectors' professional judgement.

Notably, no country has developed its system as a result of a specific research project or based on information found in scientific literature.

2.2.5. Users of the hazard rating methodologies

As indicated in Table 6 (opposite), national authorities were most often cited as the main user of the hazard rating system. In at least 3 countries, the main users were regional competent authorities. For one system, national and regional authorities were both cited as users and in another case the operator was also mentioned as a user. However, the international WRI system is used by the countries that belong to the International River Basin Convention.

Table 7: Users of the system

Country	Users
Belgium (LOPI)	The Seveso Inspection Authority of the Federal Public Service Employment, Labour and Social Dialogue (Department for the Supervision of Chemical Risks)
Belgium (RRT)	Federal Labour Inspectorate Competent for Seveso inspections; the resulting minimum inspection frequency is used for the inspection programme of all competent regional and federal Seveso inspection authorities
Bulgaria	Regional Inspectorates for Environment and Water
Croatia	Environmental Ministry Inspectorate
Czech Republic	Competent Authority, Operator
Finland	National Competent Authority - Finnish Safety and Chemicals Agency
Germany	The Hessian Competent Authority for Seveso inspections
International (WRI)	International River Commissions
Kyrgyzstan	The Competent Authority
Republic of Moldova	The Emergency Department is using the old system based on the number of the population exposed
Norway	National Competent Authority
Poland	Inspection for Environmental Protection (one of the national competent authorities)
Serbia	National Competent Authorities
Sweden	County Administrative Board (Regional level)
Switzerland	Cantonal Competent Authorities who are responsible for the enforcement of the Swiss Major Accident Ordinance (MAO) with chemical establishments.
Ukraine	The State Service for Mining Supervision and Industrial Safety
United Kingdom	National Competent Authority (i.e., regulatory body for COMAH Regulations 1999 which includes the Health and Safety Executive and respective Environment Agencies of England, Scotland and Wales).

N=17

2.2.6. Legal status of the hazard rating methodologies

According to the survey, half of those who responded (8 out of 16) said that the hazard rating system is formally part of national legislation. The remaining nine systems are not legally binding but in some cases a system has been adopted as official guidance (albeit voluntary). For example: the German Hessen system is adopted by an official committee of industry and authority representatives as guidance.

Also in the UK, the system is not mentioned in any legislation but developed as Competent Authority guidance and published on the HSE website. In Switzerland, the cantons can apply the instrument voluntarily. (There are some cantons that have other rating systems.) Implementation of a hazard rating system is legally required for the enforcement of the Swiss Major Accident Ordinance.

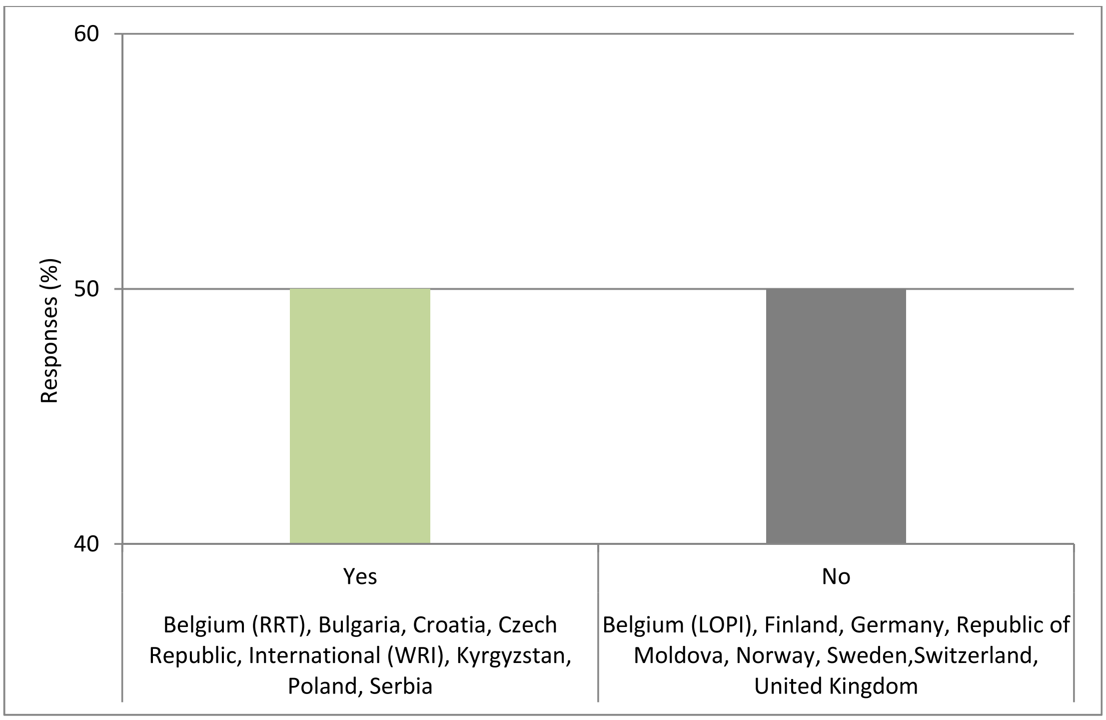

Figure 5: Status of formal adoption into legal requirements (N=16)

2.2.7. Age of the systems

It can be noted from Figure 6 and Table 7 (opposite) that, in various countries, the hazard rating system evolved in different time periods. Four countries have a long tradition (more than 20 years) of using this kind of system. On the other hand, a few countries have been using their system for less than 3 years. However, the majority of the countries (7 or 47%), have had a system in place from 3 to 10 years. Table 11 shows the number of years for which the system has been in operation in different countries. The Republic of Moldova[9] and Kyrgyzstan did not specify the age of the system but both mentioned that it is an old system. In one country, the system has not yet been applied.

[9] Used by Emergency Situations Department for forecasting the scale of the accident and calculate the human resources and capacities for the liquidation of the accident in case if it will happen.

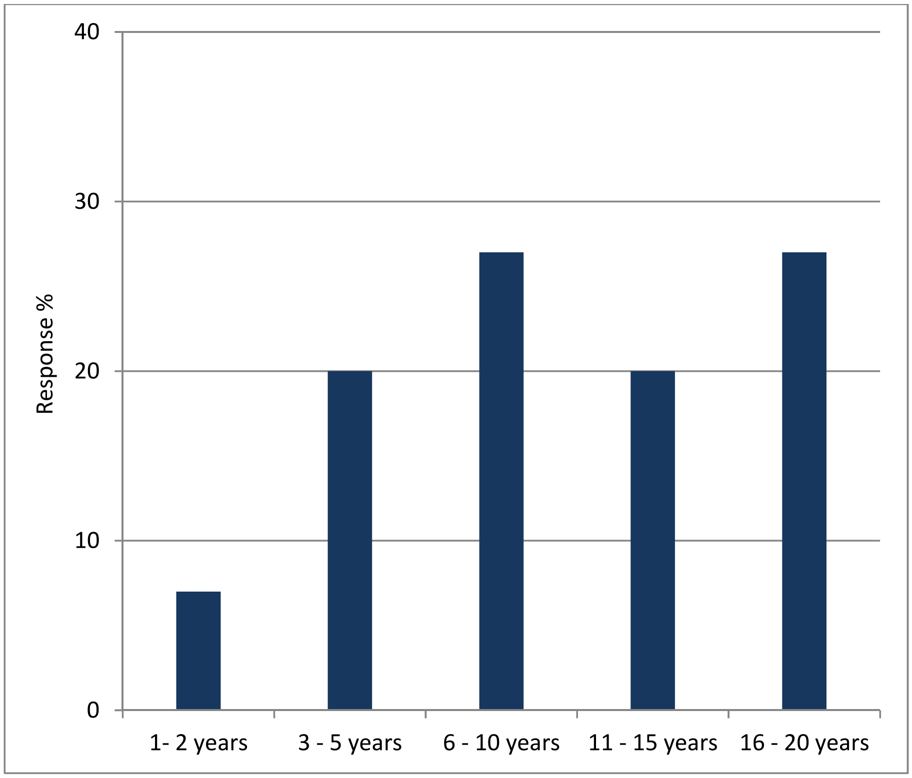

Figure 6: Number of systems distributed by different age groups (N=15)

Table 8: Age of the systems

Age (Years)	Country
1 to 2	Belgium (LOPI)
3 to 5	Poland, Serbia, United Kingdom
6 to 10	Bulgaria, Croatia, Finland, Germany
11 to 15	Czech Republic, Sweden, Ukraine
16 to 20	Armenia, Belgium (RRT), International (WRI), Switzerland[10]

N=15

In the UK, the current methodology was developed based on previous methodologies for rating and ranking intrinsic safety and updated to bring together consideration of environmental factors and site performance issue against a number of specific strategic major hazard inspection topics.

[10] In Switzerland the obligation to use a hazard rating system for organising inspections (the system described here or another system) has been in force for around 2 years.

2.2.8. Structure and outputs of the hazard rating systems

To understand the structure and the output pattern of the system, the respondents were asked which authority conducts as well as contributes to the rating exercise, how often the exercise is conducted, what the structural elements of the system are, how the data are evaluated, in which format the result of the system is available and which authority is provided with the result. In the following sections, each of these aspects is discussed explicitly.

2.2.8.1. Authority performing (conducting) the hazard rating exercise

The responses confirmed that the respondents' authority is not the only authority involved in performing the entire hazard rating exercise. As noted in Fig 7 (below) and Table 8 (opposite), for the majority of the systems (8 or 57%), the respondent's own authority lead the hazard rating exercise. Norway confirmed that their system would also adopt this approach once their system is in place. In contrast, in two countries (14%), other authorities, as opposed to the respondent's authority, perform the hazard rating exercise. In Sweden, it is the County Administrative Board. In Czech Republic, the authorities involved in the process can provide input but the regional competent authority is responsible for summarising these contributions.

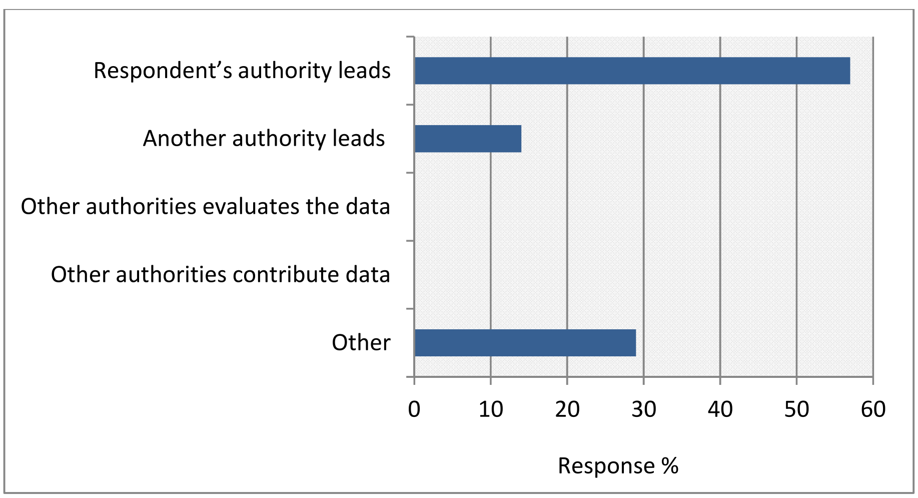

Figure 7: Authority conducting the hazard rating exercise (N=14)

Table 9: Authority conducting the hazard rating exercises in different countries

Authorities	Responses (%)	Country
Respondent's authority leads the hazard rating exercise	8	Belgium (RRT and LOPI), Bulgaria, Finland, Germany, Poland, Serbia, United Kingdom
Another authority leads the hazard rating exercise	2	Czech Republic, Sweden
Other authorities evaluate the data	0	None
Other authorities contribute the data	0	None
Other	4	International (WRI), Kyrgyzstan, Norway, Switzerland

N=14

The UK pointed out that the competent authority reviews the scores annually. And the overall ranking is shared and used in a combined competent authority planning exercise. Switzerland mentioned that the cantons conduct the inspections. With the supervision of the Major Accident Ordinance (MAO), Federal Office of the Environment verifies whether the hazard rating exercise has been carried out in a harmonised way. For the international WRI system it is the International River Commission. Ukraine mentioned that an economic actor that owns or operates at least one potentially hazardous facility or intends to launch the construction of such a facility may identify the performing authority.

2.2.8.2. Frequency of hazard rating exercise

Depending on the legal requirements as well as the purpose for which the system is used, the frequency at which the rating exercise is conducted varies. Consequently, some of the countries conduct the exercise annually whereas others only conduct the exercise after an inspection.

In terms of the frequency of the hazard rating exercise, for the majority of countries (6 or 35%) the exercise is conducted annually (Figure 8, on the next page). Five countries (29%) perform an analysis following inspections. In a number of other countries (3 or 18%), the exercise is not conducted at specific intervals but ratings are updated on an ongoing basis. Czech Republic indicated that the evaluation was conducted once every 5 years.

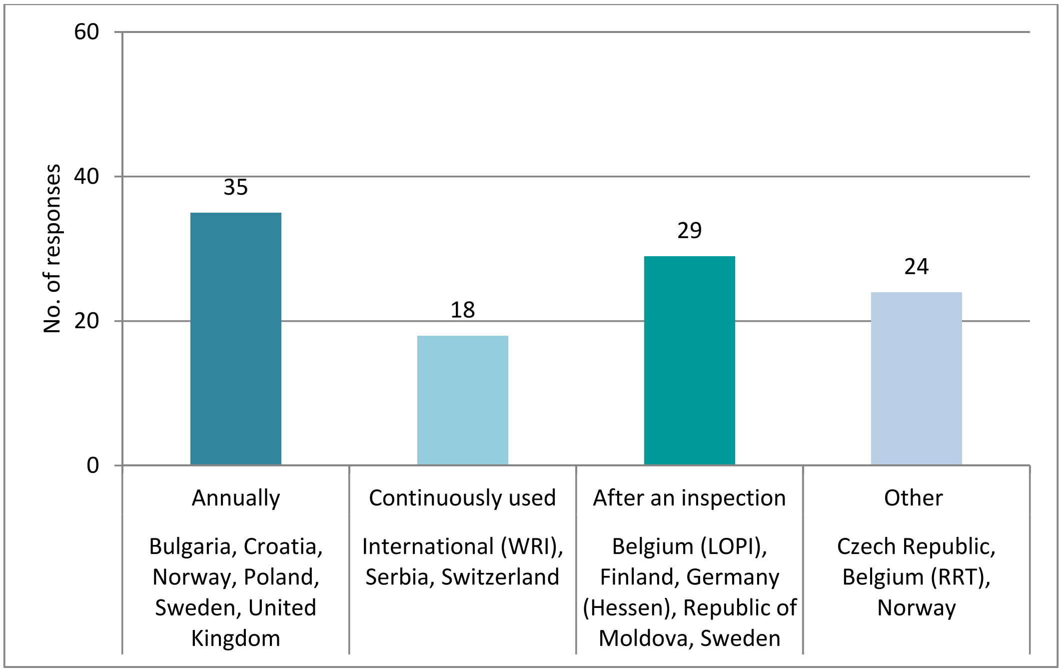

Figure 8: Frequency by which the hazard rating exercise is conducted (N=16)

Analysis of the individual responses reveals the following points:

- ✓ In Norway, the new system would be used for annual inspections. The inspectors can do an evaluation of recommended frequencies in between inspections.
- ✓ In the Czech Republic, the hazard rating exercise is being performed in every 5 years for evaluating of the Safety Reports.
- ✓ The Belgian RRT system for scheduling inspections purpose is applied when an establishment comes under the scope of the Seveso Directive. The exercise is also conducted if in case the establishment is modified, at which time the new rating uses information from the safety report.
- ✓ In Switzerland, because of limited personal resources in the cantons, they had the objectives to develop criteria which reflect inspection intervals depending on the hazard potential of the establishments and not a fix inspection rhythm.

2.2.8.3. Structural elements of the hazard rating systems

All of the 17 respondents answered this question. Figure 9 (below) compares the frequency that different types of inputs are used for hazard rating systems identified by respondents. Table 9 (on the next page) shows individual country responses associated with 14 systems. Fifteen systems (88%) use the type and quantity of hazardous substance as input to the ranking (and one country uses this element exclusively) and most of these systems (11 out of 17) also consider exposure (i.e., possible risk recipients) and production or process conditions. Many systems (anywhere from 4 to 9 out of the 17 responses) also include Seveso classification of the site, inspection records or compliance history, accident or near miss history, history of public complaints, installation design, safety culture elements, operator audits and assessments, enforcement records, or standardised hazard rating methodology.

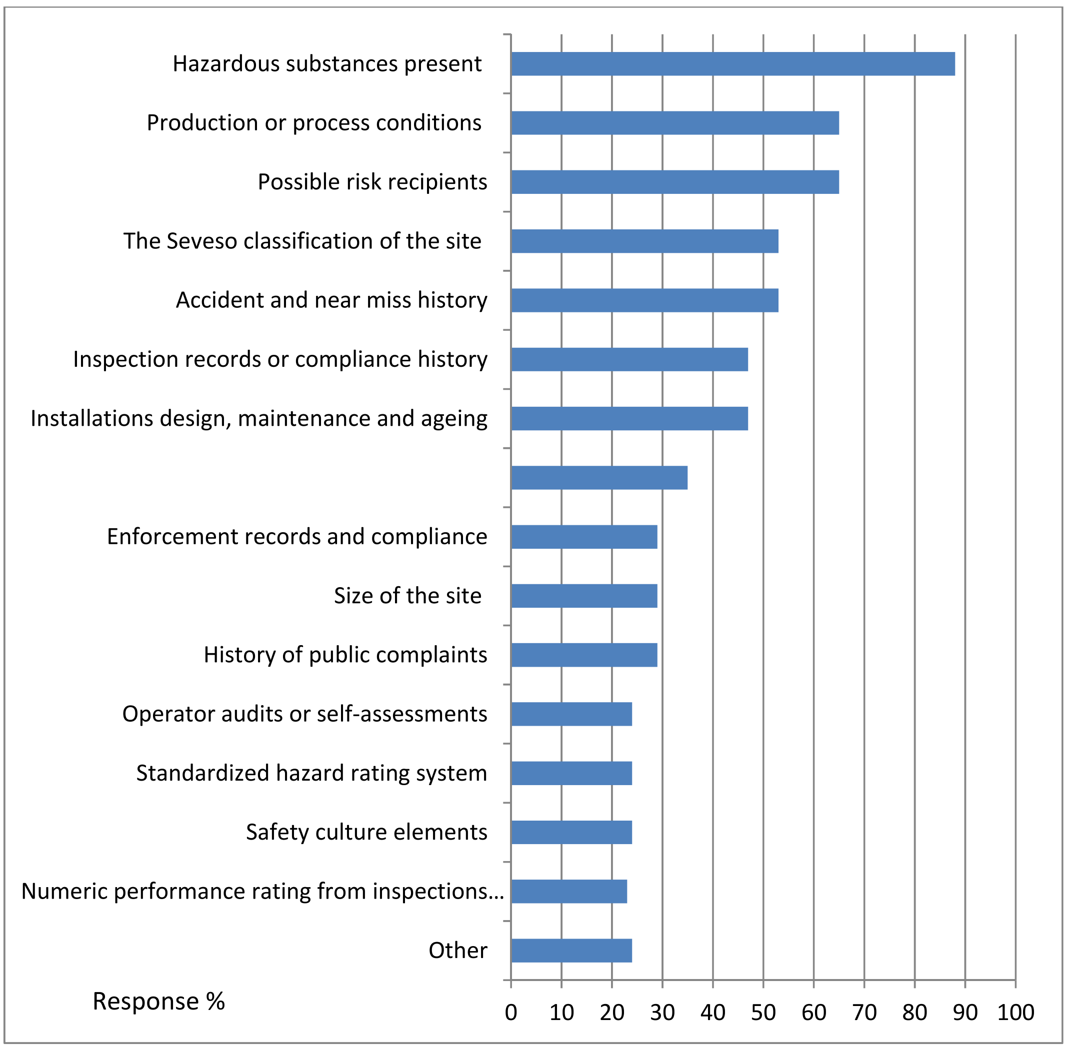

Figure 9: Structure elements of the hazard rating systems (N=17)

Table 10: Structure elements of the hazard rating systems

Elements	Responses	Country
Hazardous substances present	15	Belgium (RRT), Bulgaria, Croatia, Czech Republic, Finland, Germany, International (WRI), Kyrgyzstan, Norway, Poland, Serbia, Sweden, Switzerland, United Kingdom, Ukraine
Possible risk recipients	11	Bulgaria, Croatia, Czech Republic, Finland, Germany, Norway, Poland, Sweden, Switzerland, Serbia, United Kingdom
Production or process conditions	11	Belgium (RRT), Bulgaria, Croatia, Czech Republic, Finland, Germany, Norway, Poland, Serbia, Sweden, Switzerland, United Kingdom
Seveso classification of the site	9	Bulgaria, Croatia, Czech Republic, Finland, Germany, Norway, Poland, Serbia, Sweden
Accident and near miss history	9	Bulgaria, Croatia, Czech Republic, Finland, Norway, Poland, Serbia, Sweden, Switzerland
Enforcement records and compliance history	8	Bulgaria, Croatia, Finland, Norway, Poland, Serbia, Sweden, Switzerland
Inspection records or compliance history	8	Bulgaria, Croatia, Finland, Norway, Poland, Serbia, Sweden, Switzerland
Installations design, maintenance and ageing	7	Bulgaria, Finland, Poland, Serbia, Sweden, Switzerland, United Kingdom
Natural phenomena that could lead to an accident	6	Bulgaria, Czech Republic, Norway, Serbia, Sweden, United Kingdom
Size of the site	5	Bulgaria, Norway, Serbia, Sweden, United Kingdom
History of public complaints	5	Bulgaria, Croatia, Poland, Serbia, Sweden
Standardised hazard rating system or methodology	4	Belgium (RRT), Czech Republic, Poland, Switzerland
Operator audits or self-assessments	4	Bulgaria, Finland, Poland, Serbia
Safety culture elements	4	Bulgaria, Croatia, Finland, Switzerland
Numeric performance rating from inspections or other type of evaluation	2	Bulgaria, Sweden
Other	4	Belgium (LOPI), Republic of Moldova, Norway, Poland

N= 17

The Belgian LOPI system is qualitative and driven mainly by responses to specific questions based on specific information provided by the site. The Republic of Moldova indicated that all elements for rating exercise are at the discretion of the authorities. Poland mentioned equipment against the environmental pollution as another structural element of their system.

2.2.8.4. Data evaluation

Different techniques are generally used for evaluating the data, as shown in Table 10 (below). Most respondents (13 out of 15) assigned indicators to objective data. Four countries also used indicators or qualitative rankings developed either from qualitative analysis or from operator questionnaire, as data evaluation technique for their respective systems. In a few cases, data generated using proprietary or commercial software programme was also found to be used for the purpose of evaluation. Figure 10 (opposite) is a graphic depiction of the extent to which different methods are applied to generate evaluations across 15 different systems identified by respondents.

Table 11: Methods used for data evaluation

Evaluation techniques	Responses	Country
Indicators are assigned to objective data	13	Belgium (RRT), Bulgaria, Croatia, Czech Republic, Finland, Germany (Hessen), International (WRI), Kyrgyzstan, Serbia, Sweden, Switzerland, United Kingdom, Ukraine
Indicators or qualitative rankings developed from qualitative analysis	4	Bulgaria, Finland, Sweden, Switzerland
Indicators or qualitative rankings developed from operator questionnaire	4	Finland, Serbia, Sweden, Switzerland
Indexes used for interpretation	2	Belgium (RRT), Switzerland
Some data are generated using a proprietary software programme	2	Czech Republic, Sweden
The final result of the hazard rating is produced using a proprietary software programme	2	Belgium (RRT), Czech Republic
Some data are generated using a commercial software programme	1	Serbia
Other algorithms used for interpretation	2	Poland, Belgium (LOPI)

N=15

As another example, the Belgian LOPI system based its final result on observations (positive or negative ones) during inspection (and documented in inspection reports). The purpose is to make some of the written data in the reports usable for statistical analysis and producing overviews. The LOPI are a 'layer' on top of the inspection reports, but are by no means a replacement of them. They are not proactively communicated to the companies. In Poland, it is an excel-based application. In Serbia, the ALOHA software programme is used for evaluating releases of hazardous chemicals vapours, including toxic gas clouds, fires, and explosions.

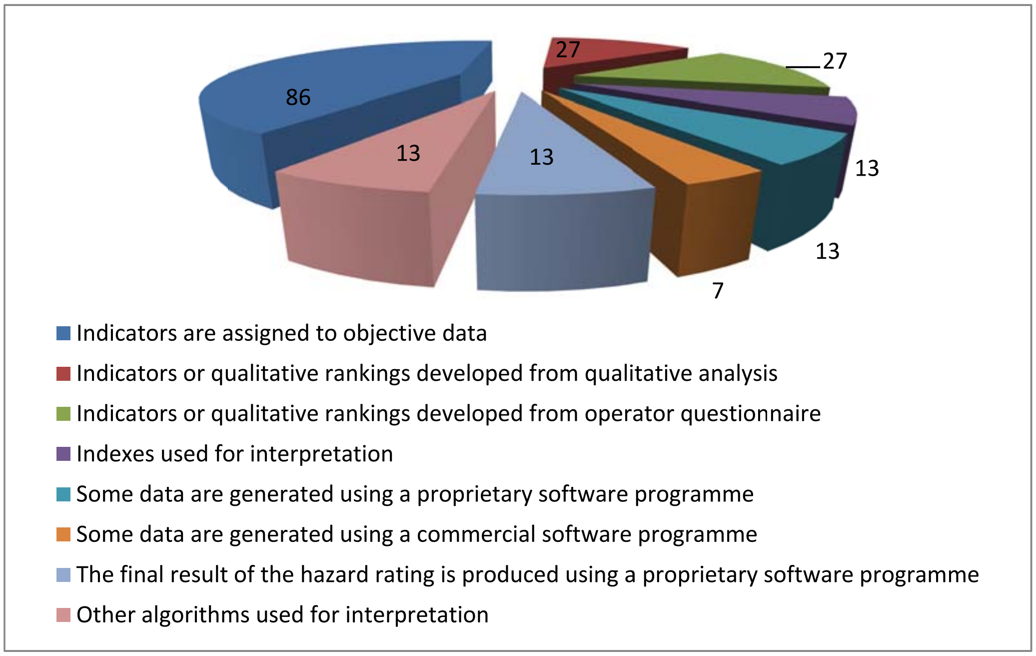

Figure 10: Methods used for data evaluation in percentage (N=15)

2.2.8.5. Type of output

As indicated in Figure 11 (on the next page), the final output of the system may be a set of numeric indicator(s) or alternatively, a qualitative classification. In addition, four countries also include specific recommendations for the site as an outcome. For over half of the systems (9 out of 16), the final output was at least composed of a numeric indicator or indicators. Also, over half (9 out of 16) applied a qualitative classification. The systems described by Bulgaria and Sweden are designed to produce all three types of output.

As an example, the Belgian RRT system output consists of three categories based on the numeric F&ET indicator. As another example, the Belgian LOPI system has at present 26 LOPI for each site. For each LOPI there are 5 possible outcomes and the default option 'not evaluated'. Although it is technically possible to combine these 26 qualitative indicators from a single site into a numerical score, but the authority has no intentions to do this. However, the authority can produce statistics

for each LOPI, e.g. how many sites test their safety instrumented functions periodically, and they have a (quick) overview of the LOPI for each site. This type of output seems currently to be more meaningful than a numeric score or a vague qualification of ‘bad’, 'good' etc. Also, in Switzerland, the result of the system is also a qualitative classification of the establishments with a recommended inspection frequency.

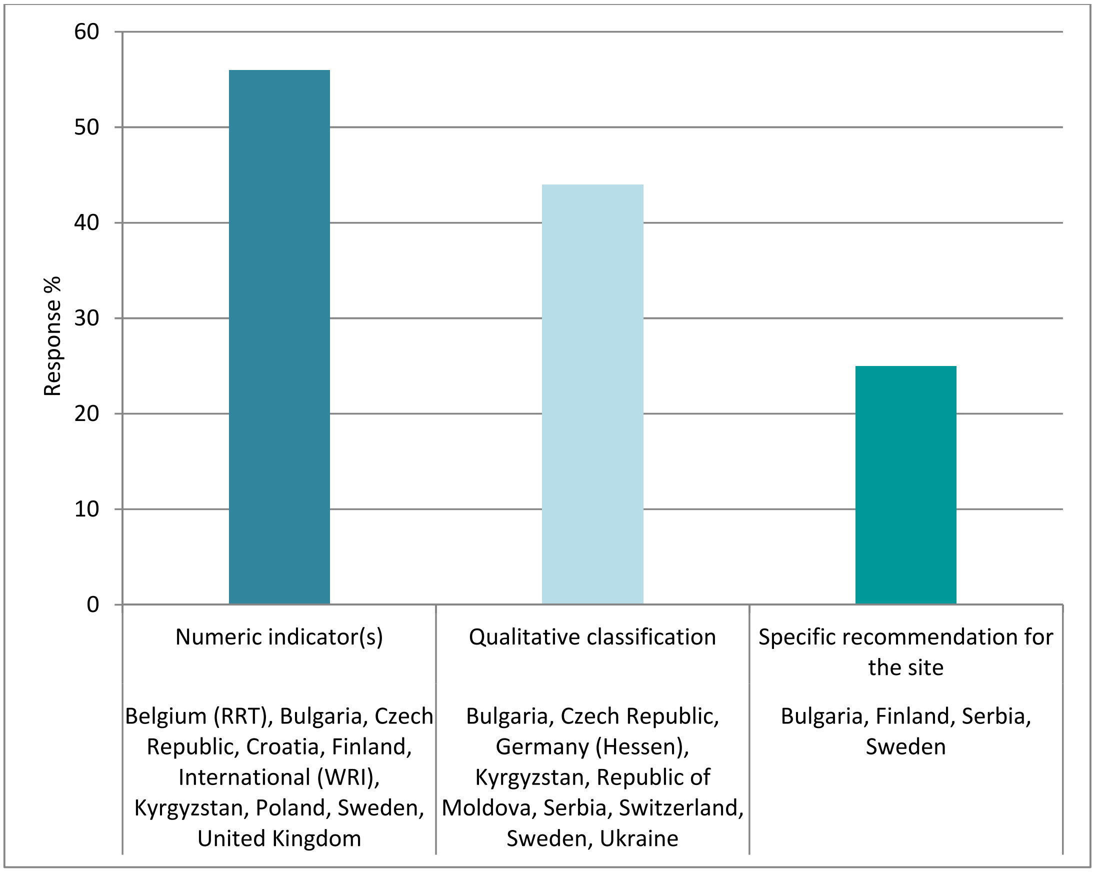

Figure 11: Output of the system (N=16)

2.2.8.6. Distribution of outputs of the rating system

According to the survey respondents, in the majority of cases (103 or 87%), the lead authority (i.e., the respondent’s authority) formally receives the results of the hazard rating exercise (Figure 12, opposite). In 8 countries (53%), other authorities as well as the operator also receive the result. In addition, results (or details of the results, if results are publicly online) are made available upon request in 8 countries (53%). Table 11 (on the next page) shows the distribution of responses across different systems.

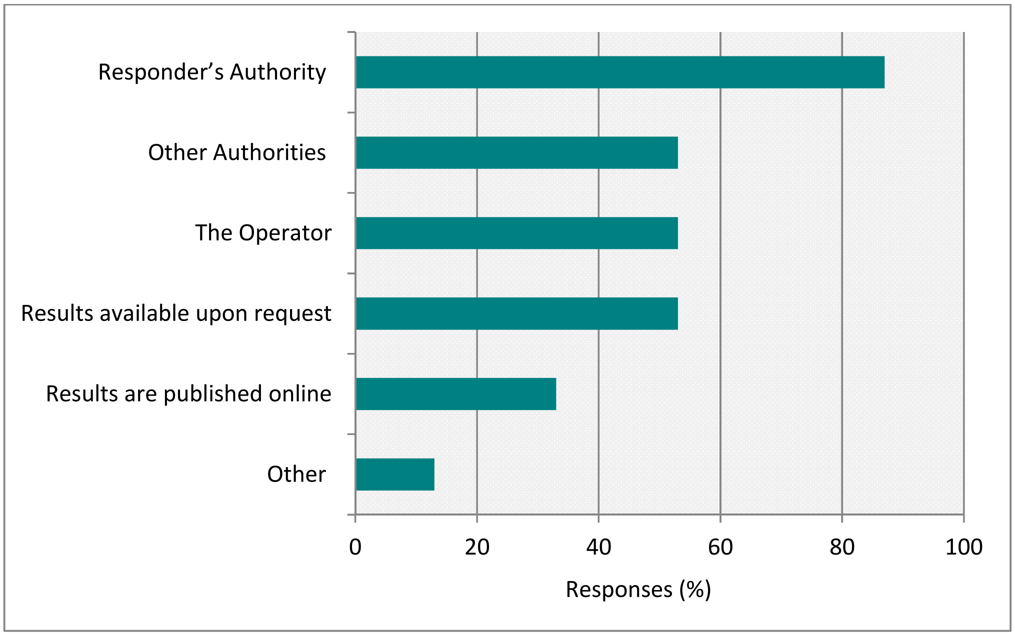

Figure 12: Recipients receiving a formal copy of results (N=15)

Table 12: Recipients receiving a formal copy of results

Recipients	Responses	Country
Respondent's Authority	13	Belgium (RRT and LOPI), Bulgaria, Croatia, Czech Republic, Finland, Kyrgyzstan, Poland, Serbia, Ukraine, Switzerland, United Kingdom
Other authorities	8	Belgium (RRT), Czech Republic, Germany (Hessen), International (WRI), Kyrgyzstan, Ukraine, Serbia, Sweden
The operator	8	Belgium (RRT), Croatia, Czech Republic, Finland, Germany, Kyrgyzstan, Ukraine, Switzerland, United Kingdom
Results are made available upon request	8	Belgium (RRT), Finland, International (WRI), Kyrgyzstan, Ukraine, Sweden
The public - Results are published online	5	Czech Republic, International (WRI), Serbia, United Kingdom, Ukraine
Other	2	Sweden, United Kingdom

N=15

An analysis of the individual responses (shown in Table 16 above) reveals the following points:

- ✓ The Belgian LOPI system - Communication of the results outside the respondent's authority is of course an open option, but at present they have no need for this. In addition, the system is in place since January 2012, so the data are not sufficiently mature for external use.

- ✓ Bulgaria - Priorities are set using the outcome of the risk assessment. The period between two site visits is based on a systematic appraisal of the environmental risks of the installations concerned and does not exceed 1 year for installations posing the highest risks and 2 years for installations posing the lowest risks. If an inspection has identified an important case of non-compliance with the permit conditions, an additional site visit is carried out in a short time.
- ✓ UK - Relevant site data is also shared with certain trade bodies to help them determine priorities and influence their relevant sector base/membership. The methodology is published on the HSE website (http://www.hse.gov.uk/comah/guidance/site-prioritisation-methodology.pdf)
- ✓ In Sweden it is the County Administrative Board who formally receives the result of the hazard rating system.

2.2.9. Accessibility of the methodologies of the hazard rating systems

Accessibility of the systems was evaluated in terms of availability to the hazard rating methodology to the public as well as to other ECE countries, the availability of IT and web-based tools and the language in which the system is available. In the following sections, the responses are analysed.

2.2.9.1. Availability of the hazard rating methodology to the public

It has been understood that some countries publish the methodology of their hazard rating system in order to make it available to the public, while other countries make it available upon written request only. From Figure 13 (on the next page), it can be interpreted that seven countries (53%) mentioned that their respective system is made available to the public only upon a written request or following the established legal process in regard to public access to information. In contrast, in 5 countries (33%) the system is published online for public. Norway also mentioned that their system will probably be published online. Table 12 (on the next page) shows the degree of availability for each rating system covered in the survey.

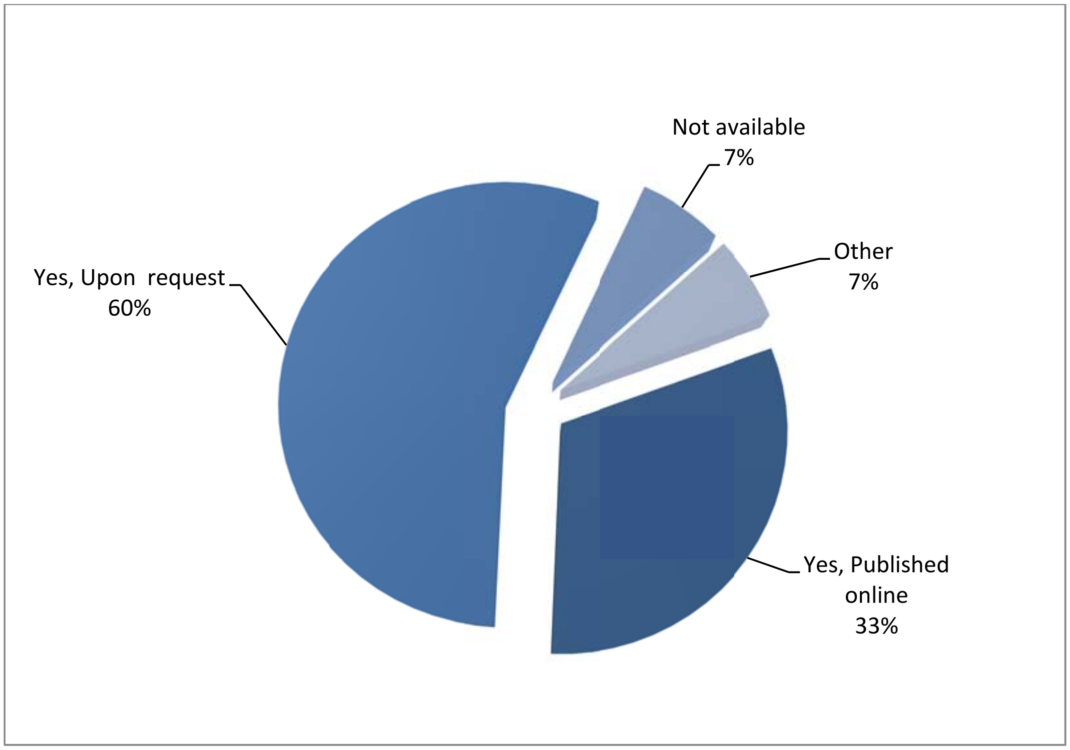

Figure 13: Availability to the public (N=15)

Table 13: Availability to the public

Availability	Responses	Country
Yes, Upon request	9	Belgium (RRT), Belgium (LOPI), Bulgaria, Germany (Hessen), Finland, Sweden, Switzerland, Ukraine
Yes, Published online	5	Czech Republic, International (WRI), Serbia, United Kingdom, Ukraine
No, Not available	1	Poland
Other	1	Norway

N= 15

2.2.9.2. Sharing the methodology with ECE member countries

To understand the degree of accessibility of the system, the respondents were also asked to express their willingness to share the details with other ECE member countries. Almost all the respondent countries agreed to share the details of their respective system (Figure 14, on the next page). Furthermore, Norway mentioned that when the system will be finished, it would be willing to share the details with ECE member countries, and confirmed that the project report would be available in the English language. Czech Republic mentioned the materials are available in Czech only.

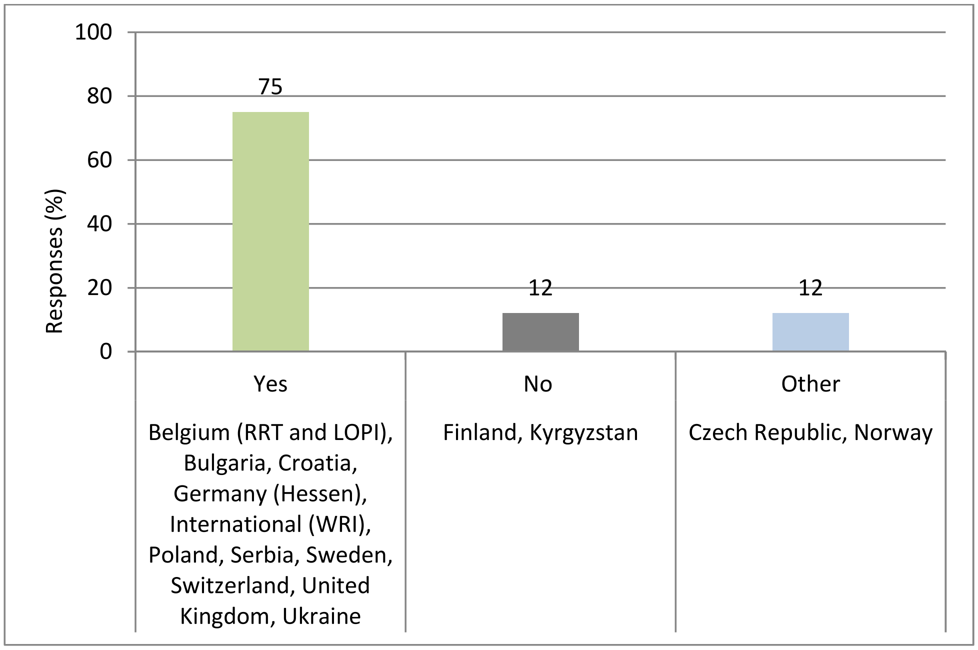

Figure 14: Willingness to share details with ECE countries (N=16)

2.2.9.3. Availability of IT or web-based tools

With regard to accessibility of the system to the public, availability of an IT or web-based tool based on the methodology of the system, would be an additional advantage. Hence the respondents were asked to mention the availability of any IT or web-based tools, based on the hazard rating system.

From Figure 15 (on the next page), it can be understood that most of the respondent countries, do not have an IT or web-based tool. Of the two Belgian systems, the RRT system has a web-based tool based on the hazard rating methodology whereas the LOPI system does not.

Belgium also commented that the LOPI are integrated into the database application used to manage all data on Seveso establishments, e.g., data on inspections, data on installations (such as the Rapid Ranking Technique (RTT) ranking), identification data etc. The database allows linking an evaluation (the evaluation of a specific LOPI for a specific company) with one or more 'observations' made during inspection (inspection reports are essentially a combination of 'observations').

At any time, the database software can generate an overview of the LOPI for an individual company, a group of establishments (e.g. upper tier, lower tier) or for all Seveso establishments. These evaluations are also possible for a certain point in time in order to show the change in LOPI over time. Since the evaluations are dated, the status of the LOPI can be produced for any moment in time since the start of the system.

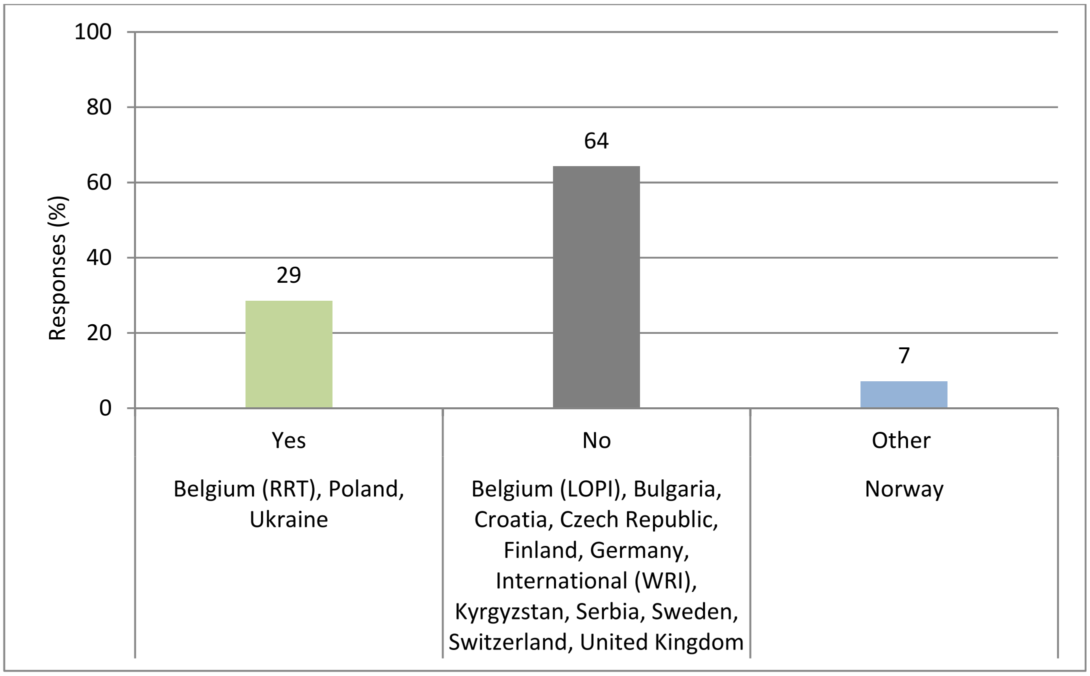

Figure 15: Availability status of IT or web-based tools (N=16)

Languages of the system or methodology

The language in which the system is available is an important aspect for assessing the accessibility of the methodology of the hazard rating system. Most of the hazards rating systems (12 or 80%) are available in the national language(s). As shown in Figure 16 (opposite), the systems of three countries are also available in English in addition to their respective national language. National languages of the respondent countries include: Czech (in Czech Republic), Dutch (in Belgium), English (in the UK), Finnish (in Finland), French (in Belgium and Switzerland), German (in Germany and Switzerland), Kyrgyz (in Kyrgyzstan), Norwegian (in Norway), Polish (in Poland), Swedish (in Sweden) and Ukrainian (in Ukraine), Bulgaria and Serbia did not mention the specific language. Kyrgyzstan mentioned that their system would also be available in the Russian language.

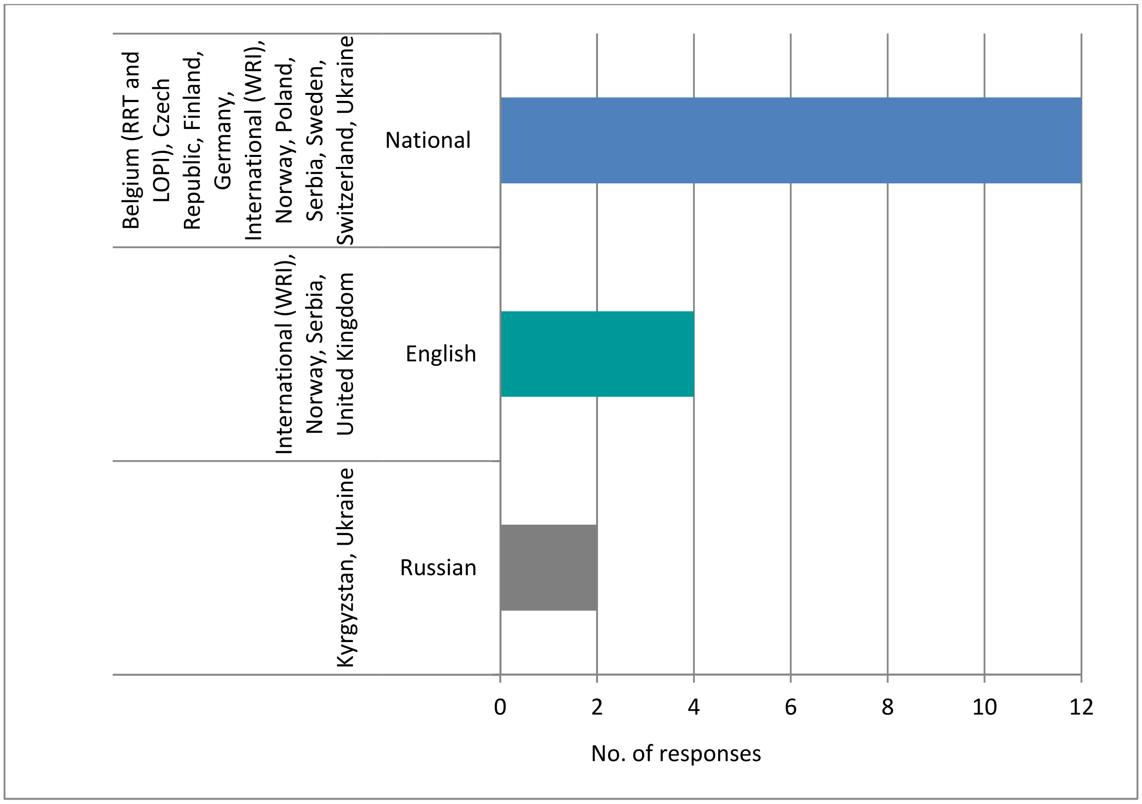

Figure 16: Language(s) of the hazard rating systems (N=15)

2.2.10. Strengths and weaknesses of the systems

In the previous section, the existing hazard rating systems were evaluated from different aspects including structure, outputs, availability to the public, language etc. These analysis highlighted many important aspects of the hazard rating systems that they have or have not. Nevertheless, in order to escalate any system profile, it is of utmost importance to evaluate its strengths and weaknesses of if any. Accordingly, respondents were asked to provide their viewpoint on certain aspects regarding the country's experience with the hazard rating system, including validation of the system (if any), history of modifications, effectiveness, transparency, and ease of application etc. These questions were asked in order to obtain a perspective on the perceived the strengths and weaknesses of the systems. In the following sections, each of these aspects were analysed individually.

2.2.10.1. System validation by independent external experts

In order to understand the capability of system as its strength, the respondents were asked to express their viewpoint by saying whether the system is ever validated independently by external experts or not. Fifty percent (N=8) of the responding countries confirmed that their systems had

been validated by external experts as did also 38% of respondents (6) who indicated that the system had never been validated by an external expert. The rest of the respondents (N= 2 or 12%) did not confirm this aspect.

In regard to validation of the system by independent experts, 4 respondent countries provided further detailed information (Figure 17, below). Czech Republic mentioned that their system was evaluated through the discussion with independent experts and scientific institutions. While in Poland, it was audited during the IMPEL review. Sweden mentioned that the Swedish Contingencies Agency evaluates the County Administrative Board regulatory programs through supervisory guidance. In Switzerland, validation of the system was conducted through an independent assessment of the methodology by a company that carries out ISO certifications. The Belgian RRT system was first developed by TNO in the Netherlands based on the Dow Fire & Explosion Index and published subsequently by the ILO (International Labour Office) in its Major Hazard Control - a practical manual (Geneva, 1988, ISBN 92-2-106432-8).

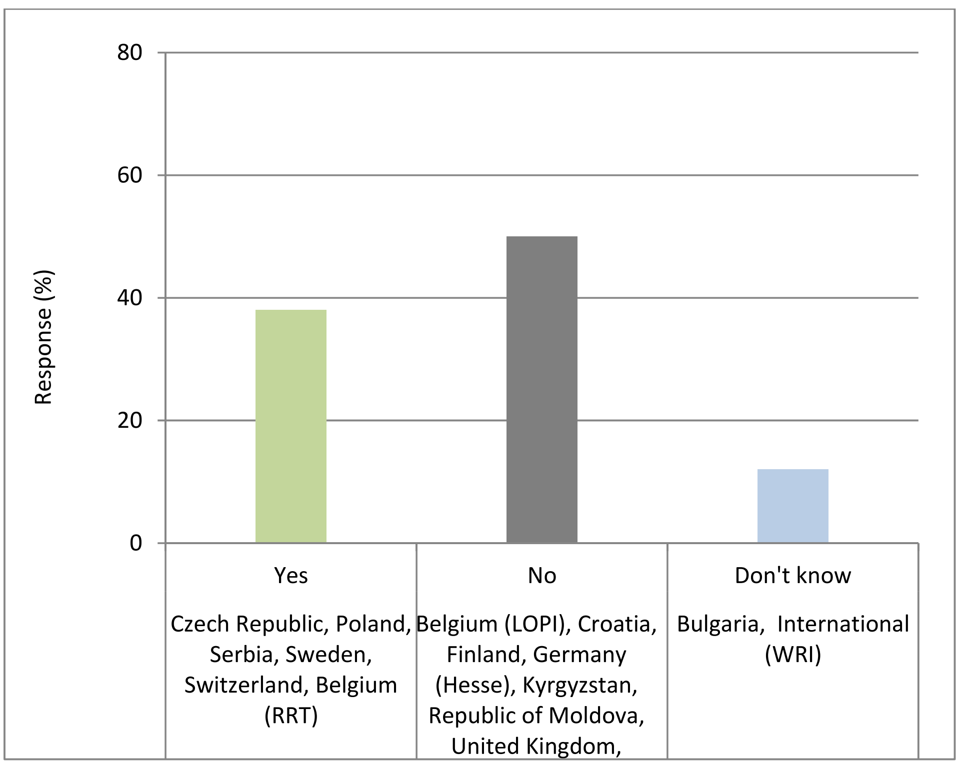

Figure 17: Independent validation of the system conducted (N=16)

2.2.10.2. Updates and modifications over time

Updating or modification of the system over time is considered to be another important issue for comprehending the strength of the system. The responses indicated that, in 8 countries (out of 15) there has been an effort to modify or update the system over time (Figure 18, below). In two countries, Switzerland and Serbia, the system has not yet been modified or updated, but since these systems have been in use for less than three years, this is not surprising. Two countries did not respond to the question. Figure 18 shows the update status of the systems in different countries.

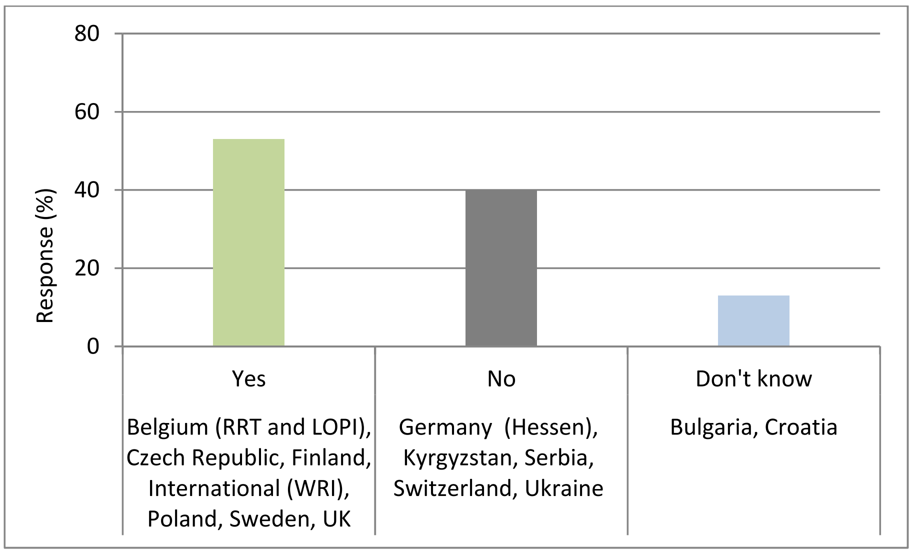

Figure 18: Update or modification conducted since initial system launch (N=15)

In Finland, the topics which are estimated have been changed slightly. The supporting example list of maters which may indicate particular number has been revised. The revision was based on inspector's opinions what could be better procedure and might reflect better situation in an establishment. The WRI system has also been modified for the heterogeneous mixtures potentially spilled into waters, like fire-prevention waters, slurry, suspended ashes, and not-specified oils. In Switzerland, the system developed in 2012. At the moment a revision is being conducted by the MAO with an aim to strengthen the inspection of the establishments. After the revised MAO is brought into force in 2015, and would like to make a guideline for the hazard rating for inspections based on the report attached to this survey. In UK, the system was modified in 2010 to include environmental hazards in the rating scheme for consideration alongside intrinsic safety hazard.

2.2.10.3. Effectiveness in achieving the purpose

Effectiveness, another parameter to evaluate the strength of the system, was evaluated in terms of how the system could be useful for pursuing or fulfilling the purpose for which the system was

developed. Accordingly respondents were asked to provide their opinion on the system according to the level of satisfaction with its performance in relation to its assigned objectives over time.

Figure 19 (below) shows that forty-two percent (5) of the respondents are 'satisfied' with their system's effectiveness. Three countries (25% of the total respondents) said that they were even 'very satisfied' with their system in its ability to achieve the intended purpose. However, four countries (33%) chose only the 'neutral' option. Nonetheless, no country expressed their dissatisfaction with its hazard rating system. Table 13 (below) shows the opinion of individual respondents in regard to their system.\\

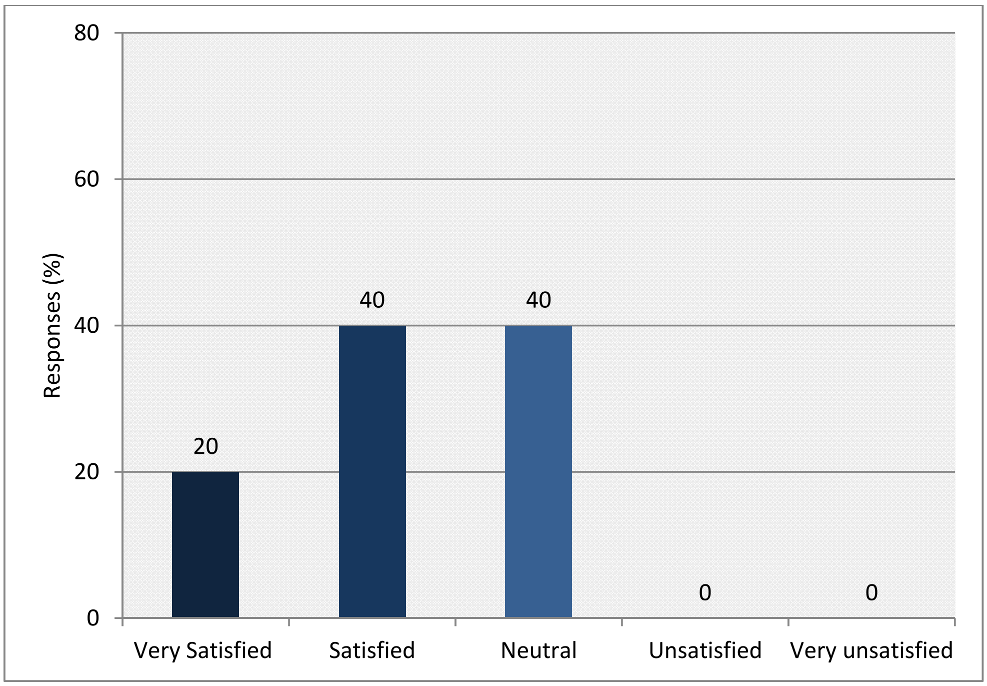

Figure 19: Opinion on effectiveness of the system (N=15)

Table 14: Opinion on effectiveness of the system

Opinion	Responses	Country[11]
Very Satisfied	3	International (WRI), Switzerland, United Kingdom
Satisfied	6	Belgium (RRT), Bulgaria, Finland, Germany (Hessen),Kyrgyzstan, Poland
Neutral	6	Belgium (LOPI), Czech Republic, Croatia, Serbia, Sweden, Ukraine
Unsatisfied	0	None
Very unsatisfied	0	None

N= 15

[11] Norway mentioned not applicable.

Amongst the two Belgian systems, the respondent reported being ‘satisfied’ with the RRT system since the system reflects the hazard potential of a site for fire/explosion and human toxicity very well (Table 24, above). However, the system does not include an evaluation of the hazard potential for the environment (eco-toxicity). The environmental inspectorates in Belgium are currently examining methodologies for the (separate) evaluation of the eco-toxic hazard, linked to the implementation of the Seveso III Directive. In contrast, satisfaction with the LOPI system was categorised as ‘neutral’, because the system was developed only in 2012 and actual implementation started in January 2013. Hence, it is too early to comment on the system’s effectiveness.

Other respondents also provided additional reflections beyond their opinion. The respondent from Germany mentioned that in case of their system it could possibly be improved with the addition of some criteria, such as operator performance, safety culture and effectiveness of maintenance practices, etc. However, it could be also that adding such criteria could make the rating system more complicated and not necessarily more effective. The UK respondent observed that their system provides a simple, objective but sensitive scheme for rating sites based on intrinsic safety and environmental factors. It is used across the competent authority to prioritise allocation of resource and provide assurance that regulator resource is properly targeted and proportionate to risk. It was also commented that the international WRI system has been established as an orientation scheme. For this reason, there was no need to adjust it over the last 20 years, thereby the respondent could indicate being ‘very satisfied’ with its effectiveness.

2.2.10.4. Ease of application

Ease of applying the system was taken into account as the fourth parameter to evaluate the system’s strength. Hence, the respondents were requested to rate the system in terms of ease of application using a scale of ‘extremely good’ to ‘extremely poor’. As can be noted from Figure 20 (on the next page), responses were evenly divided between “extremely good”, “somewhat good” and “neutral” in regard to the ease of application is ‘somewhat good’. Notably, no respondent gave a negative viewpoint about their system. Table 14 (on the next page) shows a graphic description of the results.

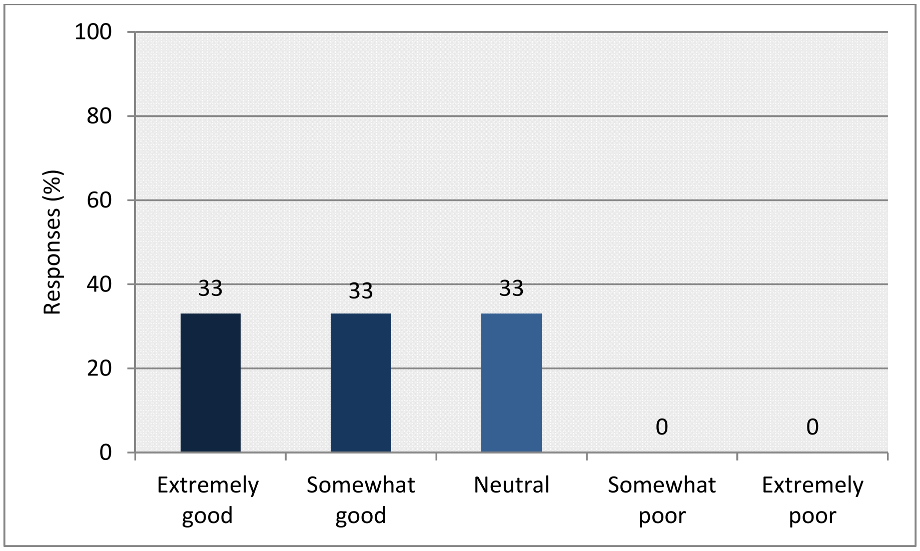

Figure 20: Opinion on ease of application (N=15)

Table 15: Opinion on ease of application

Opinion	Responses	Country[12]
Extremely good	5	Belgium (RRT), Bulgaria, International (WRI), Switzerland, United Kingdom
Somewhat good	5	Czech Republic, Germany (Hessen),Kyrgyzstan, Poland, Sweden
Neutral	5	Belgium (LOPI),Croatia, Finland, Serbia, Ukraine
Somewhat poor	0	None
Extremely poor	0	None

N= 15

In the case of the international WRI system, the ease of application was reported as 'extremely good' For this system, the applicant is expected to require the water risk class of the substance as available online and the quantity of the spilled substance in the case of an accident or just the capacity in the case of doing an inventory. Then the result would one number which makes it easy to compare it with other incidents.

Interestingly, two different assessments on ease of application were given for the Belgian systems. It was commented that the RRT system is an established methodology based on objective and easily accessible properties of dangerous substances and objective process parameters. However, the LOPI system requires an additional effort from the inspector in addition to writing reports and performing

[12] Norway mentioned not applicable.

other enforcement actions. The LOPI system requires also some discipline to update the LOPI continuously as new inspection reports become available. For this system to work it is essential to have a good database of inspection reports and the possibility to establish links in an easy way between the reports and the LOPI evaluations.

The Czech Republic mentioned that the use of the system requires the support of qualified experts. Switzerland pointed out two dimensions to the system in this regard. One dimension consists of quantitative aspects incorporated in the estimation of possible damage to the population or the environment based on a worst case scenario. In addition, there are soft criteria, for example, the operator's performance in managing site risks based on the opinion of the inspector.

2.2.10.5. Transparency of the results

Transparency of the system is essentially the level of interpretation that is required to understand the result. It may be that some systems require guidance to interpret results while others may not. Moreover, some systems may not only require a guided interpretation but also possibly some training in order to understand the result more clearly.

On the basis of a number of responses (as captured in Figure 21, on the next page), the systems of Bulgaria, Germany, Poland and Ukraine could be identified as 'very transparent system' since the correct interpretation of the system output does not require any further guidance. The systems including the Belgian RRT, Finland, Sweden, Switzerland as well as UK, can be labelled as 'medium transparent' as the interpretation of their results require some level of guidance; whereas the systems like Belgian LOPI, Czech republic, Republic of Moldova and Serbia as 'least transparent' since the correct interpretation requires a lot of guidance and training.

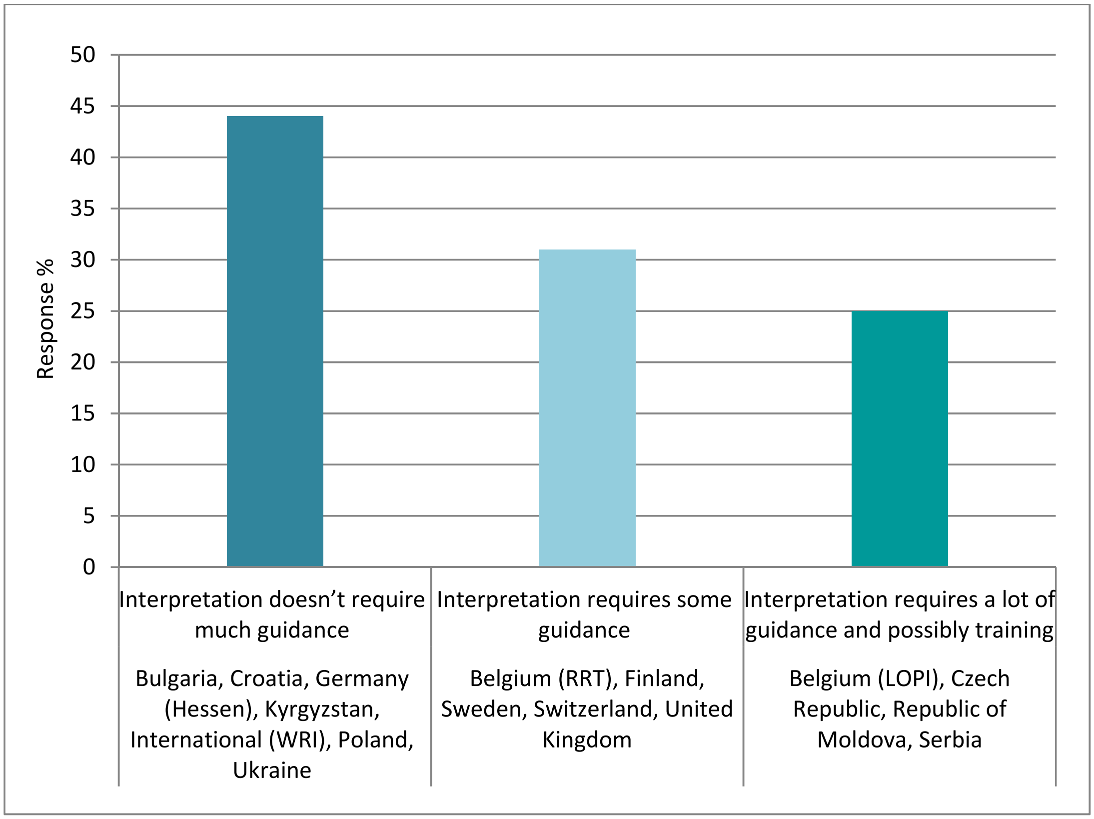

Figure 21: Transparency of the system results (N=16)

The respondent from the UK mentioned in this regard that there is difficulty in equating numerical values for intrinsic safety hazard with values for environmental hazard, i.e. can we compare the value of human safety and environmental safety on the same scale? The methodology obtains separate values for safety and environmental hazards which are presented as two separate components rather than incorporating them within one single linear rating scheme. The rating system is less sensitive to the variety of sites where environmental hazard is a dominant feature. These sites tend to be defined within site type 'other' for which the model and scoring system is not sufficiently sensitive to separate out variation in hazard across the full range.

2.2.11. Suitability of the results for risk communication to the public

The use of the results of the systems for communicating risk to the public may also serve as an indicator to evaluate the systems strengths or weaknesses. Some countries are using outputs as a basis for public communication, while some countries do not. In order to summarise this aspect, the responders were requested to express their views in terms of ‘agree’ or ‘disagree‘.

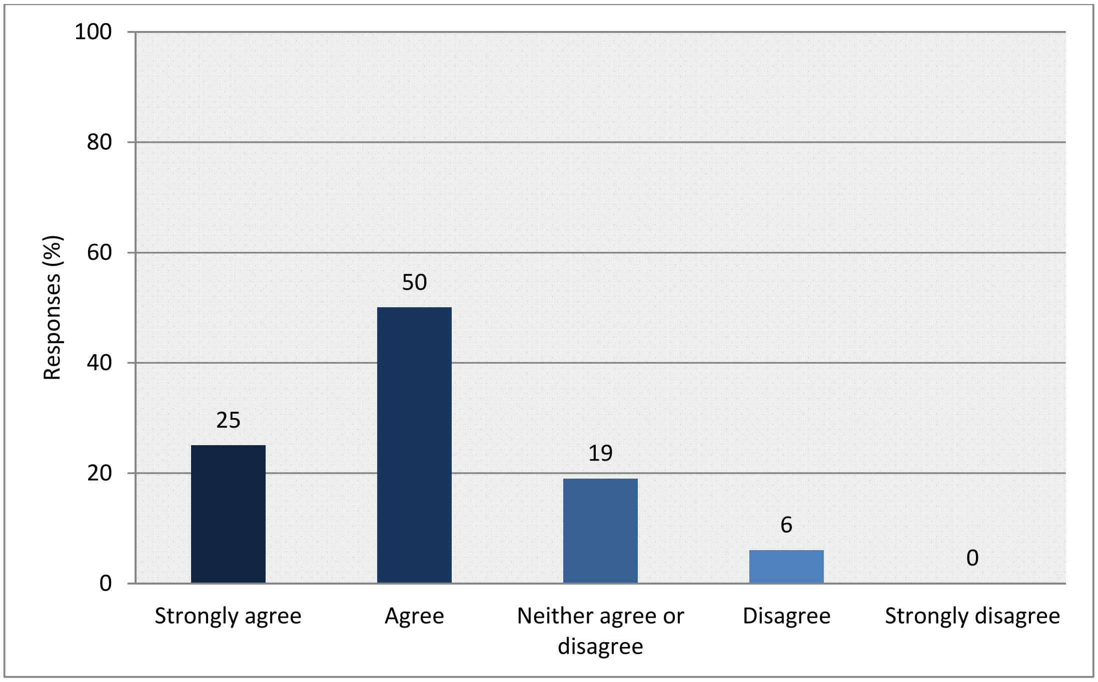

Figure 22: Suitability of output for risk communication (N=16)

Table 16: Use of output for risk communication

Opinion	Responses	Country
Strongly agree	3	International (WRI), Republic of Moldova, United Kingdom
Agree	9	Belgium (LOPI), Bulgaria, Croatia, Germany (Hessen), Kyrgyzstan, Serbia, Sweden, Switzerland, Ukraine
Neither agree or disagree	3	Belgium (RRT), Czech Republic, Poland
Disagree	1	Finland
Strongly disagree	0	None

N= 16

A majority of respondents (12 out of 16, or 75%) agreed or agreed strongly that the output could be used for risk communication to the public. However, it must be emphasised that the opinion was that of the individual respondent rather than the official view of their competent authority. In fact, the validity of this kind of use of the output has not been widely tested in practice. As indicated in Table 12 on p. 35, only 4 countries automatically publish the data online. Nonetheless, it is interesting to note that a good number of the experts who responded to the survey were favourable to the idea of using hazard ratings to help the public in forming their perceptions of risk in regard to individual major hazard sites.

3. Conclusions

The survey responses showed that hazard rating systems for major hazard sites are relatively common among European countries and their neighbours. Several countries have considerable experience with rating systems while other countries have only been operating their systems for a short time. A few countries also noted plans to introduce a new rating system or modify the current system. Also, one respondent reported on a system used to support international conventions (the Convention on the International Commission for the Protection of the Elbe and the Convention on the International Commission for the Protection of the Oder) that also offers relevant input to this study.

Not surprisingly, the EU/EEA countries were by far the most represented in the survey responses because of a legal option to use an appraisal system for scheduling Seveso Directive inspections. However, it was encouraging to note that several non-EU countries were also operating or planning to operate hazard rating systems for their major hazard sites and their comments generally reflected a considerable appreciation of the usefulness of such systems as a policy implementation instrument.

The survey responses also provided a rich source of information on different approaches to hazard rating systems. On the one hand, survey responses indicated a substantial commonality in terms of purpose and use, availability and design among the rating systems. On the other hand, individual systems also stood out for their differences. Two systems, in particular, the Belgian LOPI system and the system used by the International River Basin Commissions, were of a slightly different character than the others. Moreover, while respondents identified a number of strengths and weaknesses associated with their systems, in general it appeared that, in the opinion of respondents, the systems functioned adequately if not extremely well in meeting their various purposes. The following paragraphs summarise the main conclusions in this regard.

3.1. Purpose and use

In terms of purpose and use, the responses allowed for the following conclusions to be drawn:

- ✓ A sizeable proportion of countries have given a certain level of authority to their hazard rating methodologies, either as part of legislation or as official national guidance.
- ✓ The principal users are the competent authorities and of these, in particular the inspectorates, were by far the most important users.
- ✓ The systems are used mostly for evaluating operator performance and for scheduling inspections or other enforcement purposes.
- ✓ A few systems also used results from the rating for planning future policy strategy and identifying safety trends.

Notably, the international WRI system used by the International River Basin Authorities is the only system not associated with inspections and enforcement. It is primarily a system designed for prevention and preparedness interventions and policy development.

In addition, there was no particular commonality between the systems in terms of how the frequency for their application was defined. A little over a third generally applied the system to a site following an inspection. For the other systems, frequency was fairly evenly divided in terms of being either ongoing, continuous or based on other criteria.

3.2. Availability of hazard rating methodologies

From the point of view of transparency and co-operation, the responses regarding the availability of hazard rating methodologies were quite promising. Most of the hazard rating methodologies can be obtained from the relevant sources, either by virtue of publication on the internet or upon request. Nearly all the respondents specifically indicated their willingness to share the hazard rating methodologies with other ECE countries. However, it should be noted that the availability of methodologies in user-friendly IT or web-based form is often limited. Also, most methodologies are not available in English. Perhaps these obstacles present an opportunity for future mutual collaboration to reduce the barriers to countries in obtaining information on the methodologies and applying them, particular for those countries who seek to establish or improve their approaches.

3.3. Common design elements

The key design features of hazard rating systems are the criteria used for evaluation, the evaluation method, and the type of output. In this regard, the survey responses highlighted the following:

- Most hazard rating methodologies are developed by a task force and/or based on existing scientific knowledge. At minimum all hazard rating systems rely on measurable criteria and objective data (i.e., hazardous substances present, Seveso classification, process conditions and types, size of the site).
- The type and quantity of hazardous substances present was common to all systems in which information on criteria was provided by respondents. In addition, a number of hazard rating systems use qualitative rankings and indices, such as history of public complaints, performance rating following an inspection, etc.
- The final evaluation could be numeric (an indicator or indicators), a qualitative ranking, descriptive (i.e., recommendations), or a combination of these elements.
- To perform the evaluations, it appeared that there is not much reliance on proprietary software according to respondents.

3.4. Strengths and weaknesses

In general, most users of the hazard rating systems seem to be content with the performance of the system. Approximately, half of the hazard rating methodologies have been reviewed and updated after having been used for some years. It was also interesting to note that:

- Most users of the hazard rating methodologies rate them as relatively easy to use, although the interpretation of the results often requires some expertise and guidance.
- Most respondents considered that the outputs of their hazard rating methodologies could be suitable for risk communication to the public.

3.5. Final observations

The survey responses show that use of hazard rating systems is generally considered a value-added mechanism for implementation of major accident prevention and preparedness policy in many ECE countries. Countries remain satisfied to 'very satisfied' with the results provided by the system, suggesting that they are credible and have proven to be valid over time. For this reason, this document should be an encouraging input to countries who have not yet established their own rating systems but are considering it. Indeed, a number of countries are already in a phase of transition, that is, they are well along a path to establish a new system, either for the first time, or to replace an outdated one.

Based on the responses, all countries who responded are open to providing more detailed information on their system and experience with it to other ECE competent authorities. Contact information is listed in Annex 3 of this report [to be provided in the final version].

It is also known that a few countries (France, the Netherlands) who have established hazard rating systems were not able to respond to the survey in the given time frame due to the temporary unavailability of a competent expert in the system. However, based on exchanges with these countries, it is expected that they will also be interested to join and offer their knowledge and experience to other ECE countries should an opportunity arise in future.

Annex 1: Case studies for selected hazard rating systems

CASE STUDY 1: UNITED KINGDOM

SITE PRIORITISATION METHODOLOGY, INTRINSIC HAZARD (SAFETY AND ENVIRONMENT) AND PERFORMANCE

1. GENERAL DESCRIPTION

OWNER (S): National COMAH Competent Authority[13].

USERS: National COMAH Competent Authority. Relevant site data is also shared with certain trade bodies to help them determine priorities and influence their relevant sector base or membership.

LEGAL STATUS: Official guidance, but not incorporated in legislation.

GUIDANCE AVAILABLE: Yes

IT TOOL EXISTS: No

LANGUAGE(S): English

HOW TO OBTAIN A COPY OF THE METHODOLOGY:

Guidance available at http://www.hse.gov.uk/comah/guidance/site-prioritisation-methodology.pdf

2. OVERVIEW OF THE HAZARD RATING METHODOLOGY

SCOPE: All Seveso sites covered

PURPOSE(S): Inspection scheduling, evaluating individual operator performance, deciding on themes of future inspections, evaluating the effectiveness of enforcement, planning future policy strategy, identifying safety performance trends.

WHEN IS IT APPLIED: Annually

CRITERIA (INPUTS): Hazardous substances present, possible risk recipients, production or process conditions, installations design, maintenance and ageing

EVALUATION METHODOLOGY:

Prioritisation is based on the intrinsic site hazard and the performance of the site in managing major hazard risks. The hazard ranking methodology has two elements:

---

[13] The regulatory body for the Control of Major Accident Hazards Regulations 1999 includes the Health and Safety Executive (HSE) working jointly with the respective Environment Agencies of England, Scotland and Wales.

a. A simple safety ranking scheme assigns numbers to ‘unchanging’ features about the site and the surrounding area. The site is given a base score that describes the main activity/type of site, which is then multiplied by a factor that reflects the density of the local population. Where the site presents a high ‘societal’ risk another multiplying factor is applied.
b. The environmental rating system works in a very similar way: Numbers are attached to site type and multiplied by ‘pathway’ and ‘sensitivity’ factors to give the ‘environmental’ ranking score.

The safety and environmental scores are then combined to give an overall CA score/rank for the site. This remains relatively static, changing only when there are significant changes to inventories/ processes or the surrounding population/environment. All COMAH sites are thus assigned an intrinsic hazard score, ranked and assigned to one of four hazard bands which are used to influence regulatory activity, e.g., allocation of resources proportionate to the major accident risk, site complexity and regulatory history, consistent starting point for inspection planners, and assurance that resources are focused on priorities.

FINAL OUTPUT: Numeric

The intrinsic hazard ranking is the final output and is then used to classify each site into one of four hazard bands which is then considered alongside individual site performance data to determine level and depth of regulatory activity. (Separately from this system, operators are also scored against a number of specific strategic priority topics. The scoring system is published and individual scores shared with the relevant operator).

3. STRENGTHS AND WEAKNESSES

EFFECTIVENESS RATING: Very satisfied
EASE OF APPLICATION: Extremely good
TRANSPARENCY OF RESULTS: Correct interpretation requires some guidance

The system provides a simple and objective but rather sensitive scheme for rating sites based on intrinsic safety and environmental factors.

CASE STUDY 2: SWEDEN

SITE PRIORITISATION METHODOLOGY, INTRINSIC HAZARD (SAFETY AND ENVIRONMENT) AND PERFORMANCE

1. GENERAL DESCRIPTION

OWNER (S): Seveso competent authorities
USERS: County Administrative Board (at regional level)
LEGAL STATUS: No
GUIDANCE AVAILABLE: No
IT TOOL EXISTS: No
LANGUAGE(S): Swedish

HOW TO OBTAIN A COPY OF THE METHODOLOGY:
TBA during Member State review

2. OVERVIEW OF THE HAZARD RATING METHODOLOGY

SCOPE: All Seveso sites covered
PURPOSE(S): Evaluating individual operator performance, deciding on themes for future inspections, planning future policy strategy
WHEN IS IT APPLIED? Both annually and after an inspection
CRITERIA (INPUTS): Hazardous substances present, the Seveso classification of the site, size of the site, production/process conditions, installation design and maintenance possible risk recipients, inspection records/compliance history, numeric performance rating from inspection, accident or near miss history, history of public compliance, natural phenomena that could lead to an accident.

EVALUATION METHODOLOGY:
Indicators are assigned to objective data, qualitative rankings are developed either from quantitative analysis or from operator questionnaire and some data are generated using a proprietary software programme.
In general, all parameters are weighted together to produce an overall assessment. The County Administrative Board (CAB) and the Swedish Work Environment Authority discusses the result to get a common view. Swedish Civil Contingencies Agency then follows up the CAB estimates through supervisory guidance.

FINAL OUTPUT:	Numeric indicator, qualitative classification and specific recommendations made for the site.

3. STRENGTHS AND WEAKNESSES

EFFECTIVENESS RATING:	Neutral
EASE OF APPLICATION:	Somewhat good
TRANSPARENCY OF RESULTS:	Correct interpretation requires some guidance

CASE STUDY 3: BELGIUM - RRT

SITE PRIORITISATION METHODOLOGY, INTRINSIC HAZARD (SAFETY AND ENVIRONMENT) AND PERFORMANCE

1. GENERAL DESCRIPTION

OWNER (S): All competent regional and federal Seveso inspection authorities
USERS: All competent regional and federal Seveso inspection authorities
LEGAL STATUS: Yes
GUIDANCE AVAILABLE: Yes
IT TOOL EXISTS: Yes
LANGUAGE(S): Dutch and French

HOW TO OBTAIN A COPY OF THE METHODOLOGY:
TBA during Member State review

2. OVERVIEW OF THE HAZARD RATING METHODOLOGY

SCOPE: All Seveso sites covered
PURPOSE(S): Inspection scheduling
WHEN IS IT APPLIED? Calculation is done when an establishment comes under the scope of the Seveso Directive. It is also actualized in case of modifications of the establishments and is verified during the examination of the safety report.
CRITERIA (INPUTS): Hazardous substances present, production or process conditions, a standardised hazard rating system or methodology

EVALUATION METHODOLOGY:
Indicators are assigned to objective data and indexes (e.g., Mond Index, FE&I, etc.) used for interpretation purpose.

FINAL OUTPUT: Numeric indicators

The Rapid Ranking Technique (RRT) consists in the calculation of two indices: a Fire and Explosion Index, measuring the hazards related to fire and explosions and a Toxicity index, measuring the hazard related to toxicity. The calculation of these two indices takes account of the following:

- the energy release potential of the hazardous substances involved;
- the toxicity release potential of the hazardous substances involved;

- the general process hazards, related to the chemical reaction involved, handling of the chemicals; and
- some specific process hazards related to process temperature, pressure and other process conditions.

Based on the Fire & Explosion and Toxicity Index, establishments are categorised into three categories ranging from low hazardous to high hazardous. Each hazard category is linked to a minimum inspection frequency. For the lowest hazard potential category, the minimum inspection frequency is set at once every three years. For the highest hazard potential category, the minimum inspection frequency is set at once a year. For establishments only including simple processes such as storage activities and where no chemical reaction is involved, the minimum inspection frequency is decreased by one year (but never lower than once every three year).

3. STRENGTHS AND WEAKNESSES

EFFECTIVENESS RATING:	Satisfied
EASE OF APPLICATION:	Extremely good
TRANSPARENCY OF RESULTS:	Correct interpretation requires some guidance

CASE STUDY 4: BELGIUM - LOPI

SITE PRIORITISATION METHODOLOGY, INTRINSIC HAZARD (SAFETY AND ENVIRONMENT) AND PERFORMANCE

1. GENERAL DESCRIPTION

OWNER (S): The Seveso Inspection Authority of the Federal Public Service Employment, Labour and Social Dialogue

USERS: The Seveso inspection Authority of the Federal Public Service Employment, Labour and Social Dialogue

LEGAL STATUS: No

GUIDANCE AVAILABLE: Yes

IT TOOL EXISTS: Yes

LANGUAGE(S): Dutch and French

HOW TO OBTAIN A COPY OF THE METHODOLOGY: TBA during Member State review

2. OVERVIEW OF THE HAZARD RATING METHODOLOGY

SCOPE: All Seveso sites covered

PURPOSE(S): Evaluating the effectiveness of enforcement, evaluating individual operator performance, identifying safety performance trends, deciding on themes of future inspections, planning future policy strategy,

WHEN IS IT APPLIED? After an inspection

CRITERIA (INPUTS): 26 questions and observations whose findings are evaluated on a qualitative scale.

EVALUATION METHODOLOGY:

The 26 measures (or LOPI) are: - All safety instrumented functions (preventing major accidents) are identified and documented - For all safety instrumented functions the complete functionality is periodically tested - All pressure relief systems (on 'major hazard equipment') are properly sized - All safety valves are periodically maintained - Degradation of all envelopes (with 'major hazard potential') is being monitored - Periodic inspection of all secondary containment and draining systems - There is an explosion protection document (for the whole site) - For each installation there is a recent analysis of process upsets (e.g. HAZOP) (new LOPI since January 2014) - For each installation, the minimum staffing required to run the installation (safely) has been determined - The required initial formation is determined for all operational functions - For all operational manual actions written instructions are available - The company has identified the representative emergency scenarios and defined for each scenario the intervention strategy - The complete internal emergency plan is tested every 3 years - An emergency exercise with evacuation is held annually - All emergency

intervention equipment is inspected and maintained regularly - The minimum staffing of the internal emergency response team has been determined - All members of the internal emergency response team receive periodic training - Hot work is controlled by a work permit system - Works involving the opening of installations are controlled by a work permit system - Working in confined spaces is controlled by a work permit system - Checks are conducted on a regular basis to verify the correct application of the work permit system - Incidents and accidents process are internally reported and investigated - The actions resulting from the investigations of incidents and accidents are carried out - The actions resulting from the investigations of incidents and accidents are carried out - There is a reporting system that informs the manager about the functioning the process safety management system - All elements of the process safety management system are covered by an audit system Each LOPI is evaluated by the inspector responsible for the Seveso site.

The evaluation is based on findings documented in one or more inspection report. The possible options for the evaluation of a LOPI are:

- Investigated and no deficiencies observed
- Not applicable
- Unknown (not enough inspection findings available to make an evaluation)
- Shortcomings have been identified - actions in execution
- Shortcomings - no actions (this of course an unwanted situation requiring further enforcement).

Communication of the results outside the respondent's authority is of course an open option, but at present they have no need for this. In addition, the system is in place since January 2012, so the data are not sufficiently mature for external use.

The LOPIs are evaluated on the basis of observations (positive and negative ones) during inspections (and documented in inspection reports). The idea of the system is to make some of the written data in the reports usable for statistical analysis and producing overviews. The LOPIs are a 'layer' on top of the inspection reports, but by no means a replacement of them. They are just not proactively communicated.

In terms of an IT interface, the LOPI are integrated into the database application used to manage all data on Seveso etablishments companies, e.g., data on inspections, data on installations (such as the RTT), identification data etc. The database allows linking an evaluation (the evaluation of a specific LOPI for a specific company) with one or more 'observations' made during inspection (inspection reports are essentially a combination of 'observations').

At any time, the database software can generate an overview of the LOPI for an individual company, a group of companies (e.g. upper tier, lower tier) or for all Seveso companies. These evaluations are also possible for a certain point in time in order to show the change in LOPI over time (since the

evaluations are dated, the status of the LOPI can be produced for any moment in time (since the start of the system)). This database also contains the RTT-ratings for each company.

FINAL OUTPUT: Qualitative indicator (LOPI)

3. STRENGTHS AND WEAKNESSES

EFFECTIVENESS RATING:	Neutral
EASE OF APPLICATION:	Neutral
TRANSPARENCY OF RESULTS:	Correct interpretation requires a lot of guidance and possibly training

Annex 2: Copy of the survey

Respondent's details:

1. Name of respondent
2. Job Title
3. Name and contact information of the organization
4. Country

Summary description of the hazard rating system or methodology:

5. If your hazard rating system or methodology has a name, then kindly provide it in the space below. (If it is an acronym, it should be spelled out).
   ………

6. What is the purpose of using the system? (Check all that apply)
   - For inspections scheduling only
   - For evaluating effectiveness of enforcement
   - For evaluating individual operator performance
   - For identifying safety performance trends
   - For deciding on themes of future inspections
   - For prioritizing other interventions (not inspections)
   - For planning future policy strategy
   - Other (Please specify)

7. If you ticked in the before-mentioned question the reply "for prioritizing other interventions (not inspections)", then please specify below your reply. Should you not have ticked this reply, please proceed with the other questions.

8. How was the hazard rating system or methodology developed? (Check one answer only)
   - A special committee or task force collaborated on its development
   - The system or methodology is the result of a specific research project

- The system or methodology is all or partly based on an existing system or methodology of another authority or country
- The system or methodology (or part of it) was developed by a consultant
- The system or methodology was all or partly based on information found in scientific literature
- Other (Please specify

9. If you ticked in the before-mentioned question the reply "based on an existing system or methodology of another authority or country", then please explain below your reply. Should you not have ticked this reply, please proceed with the other questions.

10. What kind of establishments does the hazard rating system or methodology evaluate? (Check all that apply)
    - All Seveso sites
    - Upper tier Seveso sites only
    - Lower tier Seveso sites only
    - Specific economic activities (i.e. refineries)
    - Only sites covered by the ECE Industrial Accidents Convention
    - Sites classified by other legislation
    - Other (Please specify)

11. If you ticked in the before-mentioned question the reply either "specific economic activities (i.e. refineries)" or "sites classified by other legislation", then please explain below your reply. Should you not have ticked either of this reply, please proceed with the other questions.

12. What is the scope of the hazard rating system or methodology? (Check all that apply)
    - o All operator requirements under the Seveso Directive
    - o All operator requirements under the Industrial Accidents Convention
    - o Some operator requirements under the Seveso Directive (Please list in the 'comments' section below)
    - o Some operator requirements under the Industrial Accidents Convention (Please list in the 'comments' section below)
    - o Other themes in addition to the Seveso Directive and/or the Industrial Accidents Convention requirements (Please list in the 'comments' section below)

    Comments:

13. Who is the principal user (e.g., national competent authority) of the results of the hazard rating system or methodology?

14. Has the hazard rating system or methodology been formally adopted (e.g., in a legal act or guidance)? (Check one answer only)
    - o Yes
    - o No
    - o Other (Please specify)

15. How long has this hazard rating system or methodology been in use?

16. Please give us any other 'additional information' that you think would be helpful to describe your hazard rating system or methodology more clearly.

Structure and outputs of hazard rating system or methodology

17. How often do you conduct the hazard rating? (Check one answer only)
    - Annually
    - It is continuously used
    - After an inspection
    - Other (Please specify)

18. Which authority (es) conducts or contributes to in the hazard rating exercise? (Check one answer only)
    - My authority leads the hazard rating exercise
    - Another authority leads the hazard rating exercise
    - Other authorities contribute data
    - Other authorities participate in evaluation of the data
    - Other (Please specify)

19. If you ticked in the before-mentioned question the reply "another authority leads the hazard rating exercise", or "other authorities contribute data" or "other authorities participate in evaluation of the data", then please specify below your reply. Should you not have ticked this reply, please proceed with other questions.

20. What structural elements are used as a basis for the hazard rating system or methodology? (Check all that apply)
    - Hazardous substances present (e.g., quantities, properties, etc.)
    - The Seveso classification of the site (upper or lower tier)
    - Size of the site (e.g., number of employee, production volume, etc.)
    - Production/process conditions (e.g., high pressures, high temperatures, number of loading/unloading operations, batch/continuous processes, etc.)

- A standardised hazard rating system or methodology (e.g., MOND Index, Dow FE&I, etc.)
- Installations design, maintenance and ageing
- Possible risk recipients (e.g., residential areas, public facilities, vulnerable nature sites, surface and ground water sources, agricultural land use, historical and cultural assets, etc.)
- Natural phenomena that could lead to an accident (e.g., earthquakes, landslides, climate induced events, etc.)
- Inspection records/compliance history (e.g., ratings, number of minor and major deficiencies etc.)
- Enforcement records and compliance history (e.g., ratings, number of minor and major deficiencies, penalties and other legal interventions,)
- Numeric performance rating from inspections or other type of evaluation (You may wish to explain this in the 'additional comments' at the end of this section)
- Accident and near miss history
- History of public complaints
- Operator audits or self-assessments
- Safety culture elements (e.g., indicators of management commitment, results of safety culture assessment)
- Other (please specify)

21. How are the data evaluated? (Check all that apply)
    - Indicators are assigned to objective data (e.g., type and quantity of hazardous substance, size of site, etc.)
    - Indicators or qualitative rankings (e.g., excellent, fair, poor) developed from qualitative analysis (e.g., of inspection reports, questionnaires completed by the operator, operator interviews etc.)
    - Indicators or qualitative rankings developed from operator questionnaire (e.g., questions posed to the operator during a site visit or on paper/electronically)
    - Indexes (e.g., MOND, FEI) used for interpretation
    - Some data are generated using a proprietary software programme
    - Some data are generated using a commercial software programme (Please specify in the 'comments' section below)
    - The final result of the hazard rating is produced using a proprietary software programme.
    - Other algorithms used for interpretation (Please specify in the 'comments' section below)

Comments:

22. Please explain briefly how the components mentioned in Q20 and Q21 are combined to produce an overall result.

23. The result of the hazard rating exercise for each site is which of the following? (Check all that apply)
    - o A numeric indicator or indicators (If more than one indicator, please indicate in the 'comments' section below at what value each indicator is intended to represent)
    - o A qualitative classification (e.g., excellent, fair, poor) (Please indicate in the 'comments' section below about how the classification works and how many classifications you use
    - o Specific recommendations for the site (e.g., enforcement actions, safety improvements)

Comments:

24. Who is formally provided with the results of the hazard rating? (Check all that apply)
    - o My authority
    - o Other authorities (You may wish to explain this in the 'additional comments' at the end of this section)
    - o The operator
    - o The results are published online
    - o The results are available to the public upon request
    - o Other (Please specify)

25. Please give us any other information that you think would be helpful to describe the structure and outputs of your hazard rating system or methodology.

<u>Availability and access of the hazard rating system or methodology</u>

26. Is the hazard rating system or methodology available for the public? (Check one answer only)
    - o Yes, it is published online.
    - o Yes, upon written request.
    - o No, it is not available.
    - o Other (Please specify)

27. Can the details of the hazard rating system or methodology be shared with another ECE country if requested? (Check one answer only)
    - o Yes
    - o No
    - o Other (Please specify)

28. Are there any IT/interactive/web tools available that are based on the hazard rating system or methodology? (Check one answer only)
    - o Yes
    - o No
    - o Other (Please specify)

29. In which language(s) is the hazard rating system or methodology available? (Check all the apply)
    - o National languages(s) (Please specify in the 'comments' section below)
    - o English
    - o Russian

    Comments:

30. Please give us any other information that you think would be helpful to understand the availability and access of your hazard rating system or methodology.

Strengths and weaknesses of the hazard rating system or methodology

Please note that some of these questions may require you to use your own expert judgement. It would be very helpful if you could explain each answer briefly in the 'comments' section.

31. Has the hazard rating system or methodology ever been modified over time? (Check one answer only)
    - o Yes (If so, please explain in the 'comments' section below about how and why it was modified)
    - o No
    - o I don't know

    Comments:

32. Has the hazard rating system or methodology ever been independently validated by an external expert(s) or audited? (Check one answer only)
    - o Yes (If yes, please explain briefly in the 'comments' section below about how the validation was conducted)
    - o No
    - o I don't know

Comments:

33. How would you rate the hazard rating system or methodology in terms of effectiveness in achieving the purpose identified in Section 3 describing the hazard rating system or methodology? (Check one answer only)
    - Very satisfied
    - Satisfied
    - Neutral
    - Unsatisfied
    - Very Unsatisfied

    Please explain your choice:

34. How would you rate the hazard rating system or methodology in terms of ease of application (how easy is it to use and gather data)? (Check one answer only)
    - Extremely good
    - Somewhat good
    - Neutral
    - Somewhat poor
    - Extremely poor

    Please explain your choice:

35. How would you rate the hazard rating system or methodology in terms of transparency of results/user friendliness/need for specialised training? (Check one answer only)
    - Correct interpretation does not require much guidance
    - Correct interpretation requires some guidance
    - Correct interpretation requires a lot of guidance and possibly training

36. Could the results of the hazard ranking be used effectively for risk communication to the public? (Check one answer only)
    - o Strongly Agree
    - o Agree
    - o Neither agree nor disagree
    - o Disagree
    - o Strongly Disagree

37. Please give us any other information that you think would be helpful to understand the strengths and weaknesses of your hazard rating system or methodology.

Background materials

38. It would be helpful to have some materials describing the hazard rating system or methodology and its results. Please check below if you are providing the following with this survey.
    - o A copy of the description of the hazard rating system or methodology (regardless of the language in which it is available)
    - o An example of results of the hazard ranking exercise

As the materials cannot be attached to the survey, we would kindly ask EU / EFTA / EEA (i.e. Seveso) countries to send them to Ms. Anandita Sengupta (anandita.sengupta@jrc.ec.europa.eu) and non-EU ECE countries to Ms. Claudia Kamke (claudia.kamke@unece.org).

39. There may be interest in preparing a more detailed case study of a few hazard rating system or methodologies from the responses to the survey. (Check all that apply)
    - o If your system or methodology was found to be of interest, would you be willing to clarify some details and answer some further question from MAHB or ECE (e.g. by conference call)?
    - o Would you be willing to make a short presentation on your hazard rating system or methodology in the ECE workshop or webinar if requested?

40. If you have any other comments, please provide them here.

European Commission
EUR xxxxx XX – Joint Research Centre – Institute for the Protection and Security of the Citizen

Title: An Overview of Methodologies for Hazard Rating of Industrial Sites
A joint publication of the European Commission's Joint Research Cetre and the United Nations Economic Commission for Europe

Author(s): Anandita SENGUPTA and Maureen Heraty WOOD (European Commission)
Claudia KAMKE and Nikolay SAVOV (UN Economic Commission for Europe)

Luxembourg: Publications Office of the European Union

2014 – 68 pp. – 21.0 x 29.7 cm

EUR – Scientific and Technical Research series – ISSN xxxx-xxxx (print), ISSN xxxx-xxxx (online)

ISBN xxx-xx-xx-xxxxx-x (print)
ISBN xxx-xx-xx-xxxxx-x (PDF)

doi:xx.xxxx/xxxxx

Catalog Number

JRC Mission

As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new methods, tools and standards, and sharing its know-how with the Member States, the scientific community and international partners.

Publications Office

doi:xx.xxxx/xxxxx

ISBN xxx-xx-xx-xxxxx-x