HERCA
Heads of the European Radiological protection Competent Authorities

Western European
WENRA
Nuclear Regulators' Association

HERCA-WENRA Approach for a better cross-border coordination of protective actions during the early phase of a nuclear accident

Stockholm, 22 October 2014

The HERCA-WENRA Approach is an incentive approach that comprises the necessary mechanisms for countries to exchange adequate information and to achieve practical and operational solutions on a voluntary basis during an emergency leading to a uniform way of dealing with any serious radiological emergency situation, regardless of national border line, hence allowing for coherent and coordinated protective actions.

The HERCA-WENRA Approach has the potential to improve the coherence of the response in case of a nuclear accident with impact on territories of other countries and to be used as guidance to implement Article 99.1[1] and 99.2[2] of the Euratom-BSS. It also fulfils recommendation N°12.7.b of the so-known ENCO study and it further addresses some of the other recommendations.

[1] 1 Art. 99.1. Member States shall cooperate with other Member States and with third countries in addressing possible emergencies on its territory which may affect other Member States or third countries, in order to facilitate the organisation of radiological protection in those Member States or third countries.

[2] [2] Art 99.2. Each Member State shall, in the event of an emergency occurring on its territory or likely to have radiological consequences on its territory, promptly establish contact with all other Member States and with third countries which may be involved or are likely to be affected with a view to sharing the assessment of the exposure situation and coordinating protective measures and public information by using, as appropriate, bilateral or international information exchange and coordination systems. These coordination activities shall not prevent or delay any necessary actions to be taken on a national level.

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General Presentation of the HERCA-WENRA Approach for a better cross-border coordination of protective actions during the early phase of a nuclear accident

Stockholm, 22 October 2014

General presentation of the HERCA-WENRA Approach for a better cross-border coordination of protective actions during the early phase of a nuclear accident

The HERCA-WENRA Approach improves the response and cross-border coordination for all types of possible accident scenarios. It contains overarching principles based on radiation safety considerations and provides an incentive for joint actions between neighbouring countries. These principles need to be implemented at national level. Therefore additional conceptual work is needed, some of the principles need additional guidance, and other relevant stakeholders such as civil protection services need to be included.

HERCA and WENRA recognise that in European countries, efficient emergency preparedness and response (EP&R) arrangements have been established since many years and are tested and challenged regularly. They allow authorities to issue recommendations for effective public protective actions. In the development of such arrangements, each European state defines its own priorities and objectives in planning for nuclear emergencies directly affecting its own territory. The international and EU radiological protection frameworks leave large margins of freedom for setting national criteria for intervention. Emergency planning has evolved in all states over many years, mostly without giving great priority to cross-border issues. This has led to sometimes significant differences. Should a nuclear emergency occur in Europe, these differences can potentially have a significant effect, especially if the location of the emergency is close to a national border. Internationally, populations would feel unequally protected, depending on where they live. Agreeing or aligning protective actions along adjacent national borders is therefore highly desirable.

During the very early phase of any accident, the status of the reactor and the estimation of the amount of radioactivity released (the source term) are likely to be poorly understood. Thus, the uncertainties in terms of dose estimation and overall radiological impact are very large. The role of the decision-maker is to arrive at appropriate health protection measures possibly even without any dose estimation. This inevitably leaves room for flexibility in decisions, even where there is a rigid national framework. The HERCA-WENRA Approach makes use of this freedom for coordination between neighbouring countries in order to align early decisions across borders. As a result, the respective national arrangements do not necessarily need to be changed. Instead, the prevailing differences are respected and are taken into account, and the response is based on ‘compromise’ solutions which are understandable and explainable in each given situation.

HERCA and WENRA additionally consider that the possibility of a severe accident scenario (i.e. Fukushima-like) with no or insufficient information on the plant status cannot be completely ruled out. EP&R arrangements should therefore also cover such cases. However, in such cases, the recommendations of protective actions need to be formulated rapidly, leaving very limited time for cross border coordination during the first phase of the accident. Therefore, the HERCA-WENRA approach contains pre-defined simplified schemes for protective actions that may be applied in these cases, as improbable they might be.

The general mechanism of the HERCA-WENRA approach on EP&R for a better cross-border coordination of protective actions during the early phase of a nuclear accident is independent of the scenario of the accident.

The approach relies on the following principles: shared technical understanding, coordination and mutual trust. It does not propose a uniform cross border framework. The main strategy is to aim at an alignment of the response between neighbouring countries or neighbouring territories. This is supported by early information exchanges using existing dedicated bilateral and international arrangements as far as possible.

The HERCA-WENRA Approach is divided into 3 steps: the preparedness phase, the early phase and the later phase. The approach contains the main principles and leaves necessary margins of freedom for detailed implementation:

Step 1
In preparedness the aim is to achieve and maintain a shared understanding of the existing national emergency arrangements through the improvement of bilateral or multilateral arrangements, the testing of these arrangements and the implementation of improvements.

Step2
In the early phase of an accident, the proposed HERCA-WENRA Approach foresees rapid information exchanges by using existing dedicated bilateral and international arrangements, including the exchange of liaison officers as appropriate. If the response is thought consistent, the neighbouring countries can recommend to their governments to follow these recommendations, i.e. adopt the principle “We do the same as the accident country” in the first hours of the accident.

Step3
In the later phase a common situation report, accepted by all impacted countries, will further support coordinated protective actions.

The HERCA-WENRA Approach has been tested and validated against concrete and realistic accident scenarios in NPP’s that are close enough to national borders. A workshop in September 2013 showed that in case of a sufficient information exchange most countries would be able to recommend to their decision-makers that the advice of the accident country should be followed during the very early stages.

For the initial stage of a highly improbable severe accident (i.e. Fukushima-like), requiring rapid decisions for protective actions while very little is known about the situation, simplified schemes for protective actions are needed.

Fukushima has shown again that a severe nuclear accident anywhere in the world, including Europe, cannot be completely excluded. Considering the safety level of European nuclear power plants and their improvements resulting from the lessons learned from various events (including the Fukushima disaster), it is estimated that the probability of such a severe accident is very low. But, as improbable such an accident might be, EP&R arrangements must be prepared for such cases, too.

According to the current studies, international standards and methods used for emergency preparedness and response, an accident comparable to Fukushima would require protective actions such as evacuation to around 20 km and sheltering to around 100 km. These actions would be combined with the intake of stable iodine.

In this framework, HERCA and WENRA propose a methodology for a common European approach allowing to recommend urgent protective actions as well as a minimum common level of preparation for these actions.

HERCA and WENRA consider that in Europe:

- evacuation should be prepared up to 5 km around nuclear power plants, and sheltering and ITB up to 20 km;
- a general strategy should be defined in order to be able to extend evacuation up to 20 km, and sheltering and ITB up to 100 km;
- nuclear and radiation safety authorities in Europe should continue attempts to promote compatible response arrangements and protection strategies amongst the European countries.

The need for rapid decisions using the simplified schemes for protective actions will only apply during an initial phase. As soon as the accident country is in a position to present a more elaborate assessment of the plant status and the expected off-site impact, it shall take the necessary steps to align its decisions and cross-border coordination mechanisms accordingly.

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Part I.

HERCA-WENRA Approach for a better cross-border coordination of protective actions during the early phase of a nuclear accident.- General Mechanism

Stockholm, 22 October 2014

The HERCA-WENRA Approach (Part I) on emergencies was approved by the Board of HERCA on 12 June 2014 and later approved/endorsed by WENRA on 22 October 2014.

Content

Executive Summary

The Association of the Heads of the European Radiological protection Competent Authorities (HERCA) established its "Working Group on emergencies' (WGE) in June 2011. The mandate of the WGE covered all types of nuclear accidents. With regard to accidents originating from within the boundaries of the HERCA member countries the overall aim of the WGE was to come up with practical and operational solutions leading to a uniform way of dealing with any serious radiological emergency situation, regardless of national border lines. From December 2012 on, 42 experts (from 23 European countries) in nuclear safety, emergency preparedness and radiological protection of the WGE have worked aiming at fulfilling this mandate. As a result, they have proposed a response mechanism for the early phase of an accident for a better cross-border coordination of protective actions, called the "HERCA-Approach" which was approved by the Board of HERCA in June 2014. In developing the approach, the WGE started off by investigating what others had done or were doing, has taken advantage of this work and built on it. It has also acted in a complementary way to these activities, with the aim of reaching maximum mutual benefits. In this context, a representative of the European Commission has participated as observer in these activities and most recently an observer from the IAEA.

The HERCA-WENRA Approach recognises that in European countries, efficient emergency preparedness and response arrangements have been established for many years and are tested and challenged regularly. They allow authorities to issue recommendations for effective public protective actions. In the development of such arrangements, each European state defines its own priorities and objectives in planning for nuclear emergencies directly affecting its own territory, and the international and EU radiological protection frameworks leave large margins of freedom for setting national criteria for intervention. Emergency planning has evolved in all states over many years, mostly without giving great priority to cross-border issues. This has led to differences, sometimes significant. Should a nuclear emergency occur in Europe, these differences can potentially have a significant effect, especially if the location of the emergency is close to a national border. Internationally populations would feel unequally protected, depending on where they live. Aligning protective actions along adjacent national borders is therefore highly desirable.

In the early stages of an accident the uncertainties in terms of dose estimation and overall radiological impact are very large. The status of the reactor, the estimation of the amount and type of radioactivity released (the source term), and the dispersion conditions are very likely to be poorly understood in the first hours. The role of the decision-maker is to arrive at appropriate health protection measures taking into account these uncertainties. This inevitably leaves room for flexibility in decisions, even where there is a rigid national framework. The HERCA-WENRA Approach makes use of this freedom for coordination between neighbouring countries in order to align early decisions across borders. As a result, the respective national arrangements do not necessarily need to be changed. Instead, the prevailing differences are respected and are taken into account, and the response is based on 'compromise' solutions which are understandable and explainable in each given situation.

The HERCA-WENRA Approach on emergencies relies on the following principles: mutual understanding, coordination and mutual trust. It does not aim at proposing a uniform cross border framework to deal with such situations. The main strategy is to aim at an alignment of the response between neighbouring countries, or neighbouring territories. The HERCA-WENRA Approach comprises mechanisms of early information exchanges allowing neighbouring countries to align measures for protective actions by using as far as possible the existing dedicated bilateral and international arrangements. The HERCA-WENRA Approach is divided into 3 steps, the preparedness phase, the early phase and the later phase (development of a common situation report). The approach contains the main principles and leaves necessary margins of freedom for detailed implementation:

- In preparedness the aim is to achieve and maintain a shared understanding of the existing national emergency arrangements through the improvement of bilateral or multilateral arrangements, the testing of these arrangements and the implementation of improvements.
- In the early phase of an accident, the proposed HERCA-WENRA Approach foresees rapid information exchanges by using as far as possible the existing dedicated bilateral and international arrangements, including the exchange of liaison officers as appropriate. If the response is thought consistent, the neighbouring countries can recommend to their governments to follow these recommendations, i.e. adopt the principle that in the first hours, "we do the same as the accident country".
- In the later phase a common situation report, accepted by all impacted countries, will further support coordinated protective actions.

The HERCA-WENRA Approach has been tested and validated against concrete and realistic accident scenarios in NPP's that are close enough to national borders. Therefore a workshop was organized in September 2013. The workshop showed that in case of a sufficient information exchange most countries would be able to recommend to their decision-makers during the very early stages that the advice of the accident country should be followed. Other conclusions of the workshop will be taken into account when developing the guidelines for the implementation of the HERCA-WENRA Approach into the national arrangements.

The HERCA-WENRA Approach has the potential to improve the coherence of the response in case of a nuclear accident with impact on territories of other countries and to be used as guidance to implement Article 99.1[3] and 99.2[4] of the BSS Euratom. It also fulfils recommendation N°12.7.b of the ENCO study and it further addresses some of the other recommendations.

The HERCA-WENRA Approach is an incentive approach that comprises the necessary mechanisms for countries to exchange adequate information and to achieve compromise solutions on a voluntary basis during an emergency allowing for coherent and coordinated protective actions.

[3] Art. 99.1. Member States shall cooperate with other Member States and with third countries in addressing possible emergencies on its territory which may affect other Member States or third countries, in order to facilitate the organisation of radiological protection in those Member States or third countries.

[4] Art 99.2. Each Member State shall, in the event of an emergency occurring on its territory or likely to have radiological consequences on its territory, promptly establish contact with all other Member States and with third countries which may be involved or are likely to be affected with a view to sharing the assessment of the exposure situation and coordinating protective measures and public information by using, as appropriate, bilateral or international information exchange and coordination systems. These coordination activities shall not prevent or delay any necessary actions to be taken on a national level.

Part I. - HERCA-WENRA Approach for a better cross-border coordination of protective actions during the early phase of a nuclear accident - General Mechanism

1. Introduction

The Association of the Heads of the European Radiological protection Competent Authorities (HERCA) [1], identified as early as 2007 the need for an improved and harmonized cross-border approach in response to nuclear emergencies. A working group of HERCA was therefore established and issued a document on emergency preparedness "Practical Guidance – Practicability of Early Protective Actions" [2], which included the definition, aim and rationale of three early protective actions (sheltering, evacuation and thyroid prophylaxis), the planning phase, the intervention phase and the lifting of protective actions. Risk/benefit considerations and linked protective actions (e.g. food restrictions that need to be taken at the same time) were also discussed.

Subsequently the HERCA 'working group on emergencies' (WGE) concentrated its activities related to European nuclear emergency situations on mechanisms to improve the response to such an event. Key factors comprise the achieving of a more rapid exchange of information and the improvement of the coherence of national responses, including balancing radiation protection and social issues.

The present document deals with the development and testing of a response mechanism for the early phase of an accident, called the "HERCA-WENRA Approach". The testing of the approach during a dedicated workshop resulted in good progress, but also revealed several difficulties. The second part of this document presents and discusses those difficulties. Solutions for improvements are proposed, including concrete steps to be implemented through national, bilateral and multinational arrangements.

The HERCA-WENRA Approach on emergencies was approved by the Board of HERCA on 12 June 2014 and later approved/endorsed by WENRA on 22 October 2014.

2. Brief analyses of the given situation

Each European state defines its own priorities and objectives in planning for nuclear emergencies directly affecting its own territory, and the international and EU radiological protection frameworks leave large margins of freedom for setting national planning criteria for intervention. Emergency planning has evolved in all states over many years, mostly without giving great priority to cross-border issues. At the same time, the international framework for planning and response has changed.

This has led to differences, sometimes significant, in:

- Criteria for intervention levels for introducing protective actions (defined in terms of projected dose).
- Types of protective actions.
- Operational intervention levels (action levels based on measurements).
- Methods for assessing source terms.
- Methods for radiological impact assessment and dispersion modelling.
- Definitions of emergency planning zones.

In addition, there are differences between the concepts, e.g.:

- The implementation of protective actions can be based on assessments and calculations or triggers.
- The reference level and dose criteria are for planning purposes or also for response.
- The levels are legally binding or guidelines.
- There are national differences in the interpretation of international guidelines.

Should a nuclear emergency occur in Europe, these differences could potentially have a significant effect, especially if the location of the emergency is close to a national border. Figure 1 illustrates schematically how a particular protective action could be implemented when the decision is purely based on national considerations.

In each individual country, the decision is in line with the national plan and the legal framework, and it is well balanced and justified for the situation in the country given the national framework. However, internationally, populations would feel unequally protected, depending on where they live. An unbalanced cross-border implementation of one or more protective actions would lead to distrust in governmental decisions and potentially to panic. Attempts at explanation of the rational for such differences to the affected populations are not likely to be successful during the crisis. Aligning planning for protective actions along adjacent national borders is therefore highly desirable (see figure 1).

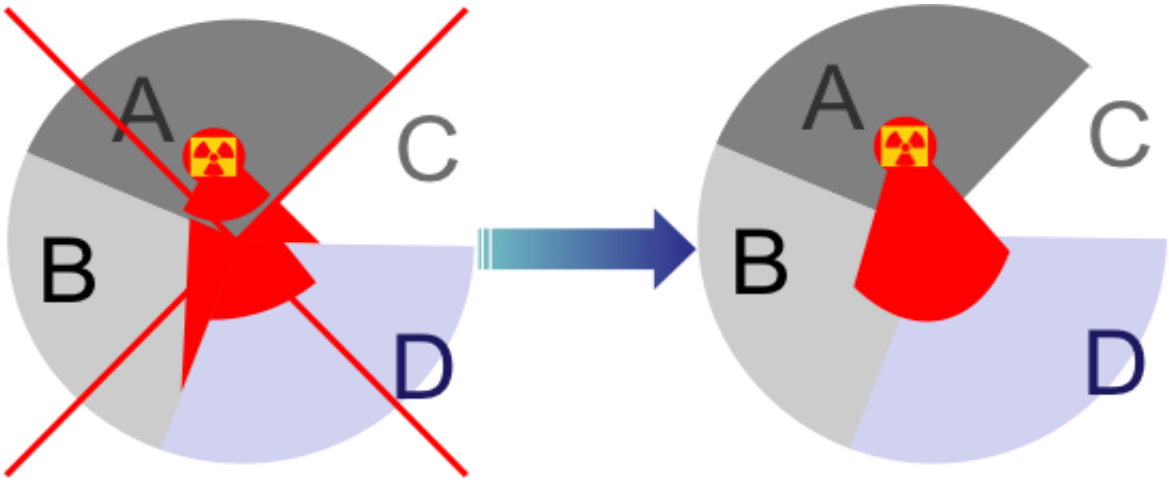

Figure 1: Country A has a nuclear emergency close to the borders of three others countries. All four countries are affected. Each country decides on a particular protective action individually. The protective action applies to the areas marked in red, for each country. The aim is to align protective actions.

3. The HERCA-WENRA Approach for the early phase

From December 2012, the WGE, in cooperation with members of WENRA, developed a new so-called "HERCA-Approach", relying on the following principles: mutual understanding, coordination, mutual trust and alignment of recommendations for decisions between neighbouring countries, or neighbouring territories, as the main strategy. The Board of HERCA had approved these principles on the occasion of its 10th meeting in Paris (30-31 October 2012). The basic aim is to develop mechanisms for implementing protective actions during an emergency in a consistent way along national borderlines but without – necessarily - changing the respective national arrangements. Instead, the prevailing differences are respected and are taken into account, and the response is based on 'compromise' solutions that are understandable and explainable in each given situation.

In the early stages of an accident the uncertainties in terms of the overall radiological impact are very large (see also figure 2).[5] The role of the decision-maker is to arrive at appropriate health protection measures despite this uncertainty. This inevitably leaves room for flexibility in decisions, even where a rigid national framework exists. The WGE believes that this freedom can be used for coordination between neighbouring countries in order to align early decisions across borders.

[5] WENRA and HERCA established the HERCA-WENRA taskforce that started in March 2014 to agree on common principles for advice in the early hours of a severe nuclear emergency. The difference between both approaches is that the general mechanism of the HERCA-WENRA Approach deals with accident scenarios with sufficient information for a technical assessment, whereas the HERCA-WENRA taskforce focuses on severe accidents where either no or not enough reliable information for a technical assessment is available or the rapid development of the accident does not leave sufficient time.

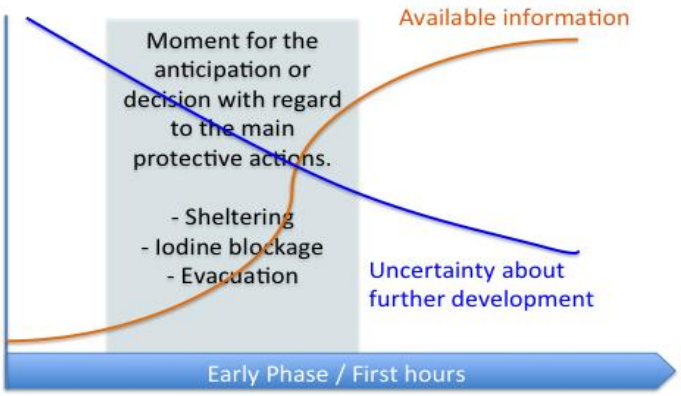

Figure 2: Factors influencing emergency decisions in the early phase of an accident.

For the early phase of an accident, the proposed HERCA- WENRA Approach comprises mechanisms of early information exchanges allowing neighbouring countries to align measures for protective actions by using as far as possible the existing dedicated bilateral and international arrangements.

This objective is in line with article 99 of EU-BSS calling for Member States to cooperate with other Member States and with third countries in addressing possible emergencies on their territory which may affect other Member States or third countries, in order to facilitate the organisation of radiological protection in those Member States or third countries.

The HERCA- WENRA Approach is divided into 3 steps, the preparedness phase, the early phase and the later phase (development of a common situation report). The approach contains the main principles and leaves necessary margins of freedom for detailed implementation. Compared to an earlier version, the approach below has been updated following the discussions at the workshop and the subsequent WGE meetings.

In preparedness

- Develop or improve already existing bilateral or multilateral arrangements, following a graded approach (i.e. the greatest priority is given to arrangements with the closest countries, and less urgent priority is given to countries at greater distances), with the goal of achieving and maintaining a shared understanding, taking into account the following:
    - National organizations:
        - General arrangements and information.
        - Stakeholders are involved in the emergency situations.
        - Facilities or reactors technologies.
    - National Emergency arrangements.
    - National strategies.
    - National expertise:
        - Assessment methods and tools (diagnosis, prognosis, environmental impact, etc.),
        - Information needed to understand correctly the products of national expertise (i.e. this may be available on restricted web pages – see below).
    - Arrangements regarding information exchange (what kind of information, ways to exchange it) during the accident and the deliverables (contents and frequency):

        - Forms, maps, technical and radiological data.
        - Information regarding countermeasures already implemented or planned to be.
        - Media information or press statements.
    - Trans border coordination mechanisms for protective measures in the response phase.
    - Communication policies to explain discrepancies in protection measures.
    - Joint public communication campaigns.
- Test arrangements and implement improvements.

Early phase / First hours

- The accident country should provide and update information required to the understanding of the situation and make available on-site and off-site assessments, using bilateral, multinational and international arrangements.
- Exchange of liaison officers and access to restricted websites may be arranged.
- Based on the information provided by the accident country and knowing the accident country's emergency arrangements, the neighbouring countries should be able to verify quickly if the response in the accident country is consistent with these arrangements.
- If the response is thought consistent, the neighbouring countries can recommend:
    - To their governments: if the accident country provides a recommendation for protective measures affecting part of the territory of the neighbouring country, to follow these recommendations i.e. adopt the principle that in the first hours, **"we do the same as the accident country".**
    - To their embassies: to protect their own nationals living in the accident country, by following the recommendations delivered by the authorities of the accident country.
- If the response is highly inconsistent, the neighbouring countries will urgently try to agree on an alternative position, which, together with their reasons, will be communicated to the accident country. The neighbouring countries should inform the competent authorities in the other European countries of their provisional position and the results of coordination.

Development of a common situation report

- The development of a common situation report is a major step towards more coordinated protective actions.
- Within the framework of the post-Fukushima action plan, the IAEA is currently developing mechanisms for an independent assessment and the production of a common situation report available for all Member States.
- The WGE will continue to analyse in more depth what has been proposed by the IAEA, and will then identify possible synergies and evaluate the potential for cooperation with the IAEA.

During its 12th meeting on 26-27 November 2013, the HERCA Board unanimously confirmed that the Approach fulfils the expectations of the Board in general terms.

4. Cologne WORKSHOP

4.1. Preparation of the workshop

As part of this work, the HERCA- WENRA Approach needs to be tested and validated against concrete examples, such as realistic accident scenarios in NPP's that are close enough to national borders. Therefore a first workshop was organized in September 2013. Some realistic accident scenarios in NPPs that are close to national borders were developed. The main goal was to explore whether the HERCA- WENRA Approach may potentially work, and also to identify difficulties.

Three scenarios with risks of considerable releases were prepared in advance, allowing participants some pre-preparation. The scenarios chosen were:

- NPP-Loviisa-1: The latest 8-countries exercise in Finland was used. STUK made its 15 situation reports available in English (USIE-format). The scenario was a real-time 12 hours exercise with 3 key moments, where decisions needed to be recommended or anticipated. In this scenario, no territory outside Finland was directly concerned with the main protective actions during the duration of the exercise. The main reason for providing this scenario for the Cologne workshop was to indicate how much information an accident country is able to provide in real time and in English.
- NPP Cattenom: IRSN had prepared a core melt scenario with risk of filtered venting. Detailed information was included in 5 IRSN and 3 ASN messages, the latter ones in the USIE format. The scenario contained two key moments, where decisions needed to be recommended or anticipated. In the earlier stage Germany and Luxembourg were concerned with protective sheltering and iodine blockage. The potentially large releases from a filtered venting threatened the territories of Luxembourg and Belgium where additionally evacuations needed to be considered.
- NPP Emsland: The BfS had prepared a short scenario concerning the NPP Emsland. It did not comprise elaborated technical details on the situation of the reactor, but contained key messages to be shared with the participants. The scenario was limited to the threat phase with a potential release along the border between Germany and the Netherlands (protective actions needed to be considered on both sides of the border). The two countries had agreed on the scenario beforehand.

4.2. Conduct of the workshop

The workshop took place on 24 September 2013 in Cologne at the GRS. 18 participants from 10 countries attended the workshop, during which participants responded to a predefined set of questions for each key moment of the 3 scenarios. The questions were:

1. Would we in reality have informed others that early?
2. Do we understand the information received from the accident country? If not, what is the issue?
3. Is the information consistent?
4. Is information missing? If yes, what?
5. As neighbouring country: Would we be able to align our recommendations with the protective action(s) as proposed by the accident country? If not what are the obstacles or concerns?

6. Would we be able to advice our citizens living in or visiting the accident country to follow the advice for protective actions of the accident country?
7. To those countries who are not a neighbouring country: If we were a very close neighbouring country (within the range of protective actions), would we be able to align our recommendations with the protective action(s) as proposed by the accident country?

Participants provided answers to those questions during the workshop as far as they were able to prepare themselves for the workshop and within the limits of a tight timescale. In particular WGE participants stressed the need for technical support from their national experts. Therefore, after the meeting, workshop participants and all other HERCA-WGE members had the opportunity to provide the missing answers in writing. In total, answers were received from 12 countries.

5. Main issues discussed at the workshop

The overall impression from all participants was very positive. The exercise of sitting together and having open and direct dialogues on concrete and relatively realistic accident scenarios was very useful. This gave raise to several interesting discussions.

Most participants thought that in the very early stages they would be able to recommend to their decision-makers that the advice of the accident country should be followed.

More discussion took place with regard to a possible alignment of recommendations for protective actions along national borders. However it has to be noted that the context of the discussion was somehow artificial. To imagine the coordination of protective actions between countries which do not share a common border is indeed difficult (see question 7). One key difficulty in such a discussion is clearly the missing knowledge of the arrangements in the accident country. Discussions concerned issues around the use of definitions and methodologies (for example, in dose calculations), the application of different decision criteria in the accident country and the extension of measures beyond EPZ's, to name only a few examples. Also societal particularities, such as the density of population, are potentially very different, for example between Nordic countries and West European countries.

The configuration of the workshop also permitted the accident country to provide missing information. With such additional explanations, most participants thought it would be possible to recommend to their own decision makers to 'do the same as the accident country'. This finding confirms the need for effective pre-emergency arrangements and shared understanding of these between all countries.

In a few countries, it seemed at the workshop, that the possibilities of adjusting recommendations during an emergency to favour coherent protective actions were very limited. These countries are obliged by law to do their own assessments and/or to recommend protective actions based on their own intervention levels. The workshop participants discussed several technical possibilities to overcome these difficulties. However no real solution emerged for these cases.

The WGE has undertaken more in-depth analyses of the workshop after having received all written answers. The main findings of this work are presented and discussed in the following chapter.

6. Main Findings of the workshop

6.1. Findings

The most important findings of the workshop were:

- Mutual knowledge of EPR arrangements is essential to make the HERCA-WENRA Approach work;
- Frequent updates by the accident country on the situation are essential for other countries to be able to verify the response in the accident country and are a pre-condition for them to be able to advise their decision-makers to follow the accident country;
- Most countries (not being neighbouring countries) were able to recommend their own citizens in the affected area to follow the advice given by the accident country based on the available information;
- The success of a harmonized approach between neighbouring countries is strongly influenced by bilateral agreements;
- Different values in decision criteria can result in a different advice than the one given by the accident country.

In the following paragraphs, the main elements of those findings are elaborated in more detail.

6.2. Information to be provided by the accident country through its first messages

A limited amount of information is available to be included in the first message. The type of information available for being included in the first message depends on the accident scenario. The present report does therefore not distinguish between the first message and the subsequent updates, but only refers to those in general terms as “Early Phase Messages (EPM)”. As a guiding principle, speed and accuracy are considered more important than quantity or completeness of information. Frequent updates are necessary.

Issue	Rational
(Conservative) evaluation of the potential hazard area.	Favours a common understanding and coherent communication internationally. Helps to give early assurance to populations outside this area.
Reports that contain maps, dispersion calculations and pictures.	Useful internationally for communication and similar purpose. Should be annexed to EMERCON forms.
Use of short message systems.	Essential to be used in case the situation changes rapidly (e.g.: update of emergency classification). It is recommended to the IEC to provide such a tool within USIE.
Include other operational measures, such as traffic restrictions, food restrictions, etc.	Important information for direct neighbouring countries (e.g.: hotlines). Helps deciding on travel advice. This possibility is included in the EMERCON forms, both for food and traffic. One may even add

Issue	Rational
	"other" measures
Clearly distinguish whether a protective action is, planned, recommended, decided (ordered) or implemented (taken).	The EMERCON form only asks to *"Describe protective actions that are planned, ordered, taken or withdrawn".* There is a need for clarity, in particular informing on recommendations for protective actions.
Prognosis for development, including a worsened case scenario (on a case by case basis).	This seems particularly useful in cases of a cliff edge effect (when consequences could dramatically worsen) or when failure of a further barrier is probable. In other situations such a scenario may be misleading and even favouring differences in decisions across national borders.
All responding countries enter information related to their decisions into USIE	This allows all countries, but in particularly the accident country, to reduce the burden on communication, i.e. the accident country may anticipate public discussions that may be stimulated by decisions taken elsewhere.

Table 1: Issues that are presently not considered by the EMERCON forms but that are worth exchanging through the EPM.

The WGE recommends that all countries should make full use of the USIE system and related EMERCON forms to inform the competent authorities of neighbouring countries and the international community. The workshop confirmed that the type of information foreseen to be exchanged by the EMERCON forms is vital in the early phase. In particular, the accident country should enter information on the classification of the emergency and its basis for declaration as early as available. For the provisional INES classification it should be borne in mind that the INES classification refers to the actual situation rather than to a possible degradation.

Besides, the workshop identified a couple of issues that are presently not considered by the EMERCON forms but that are worth for exchanging through the EPM. Those issues and their rational are given in Table 1.

Restricted websites exist in several countries with up-to-date information concerning the development of the accident. In some cases, authorities from neighbouring countries, the IEC and the EC have access to those sites during an emergency. In other countries, similar projects are under discussion. As a result of the workshop, it seems indeed a very good practice since the direct access to such a restricted website allows the technical expertise organizations in neighbouring countries to follow the situation in a timely manner as it develops. This permits anticipation and preparation for necessary developments and decisions. It also fosters a common understanding of the situation. As such, this finding confirms the HERCA-WENRA Approach as given in § 3.

A prerequisite for a successful implementation is a consistent mutual or bilateral agreement with the objective of co-ordinating activities in a wider area. A situation where neighbouring countries use the information provided to implement measures unilaterally has to be avoided. Finally, training will be needed before being able to understand the national expertise products.

6.3. Information to be exchanged in preparedness

The workshop demonstrated again how many differences in emergency preparedness arrangements actually exist. Harmonizing all those differences seems highly unrealistic. Therefore the aim of the HERCA-WENRA Approach to achieve from the beginning alignment of protective actions during the response, taking prevailing differences in preparedness into account, can be seen to be the correct approach.

As a minimum prerequisite, countries need to have sufficient knowledge of each other's arrangements. In this context, the workshop confirmed that good knowledge of the arrangements in the accident country helps to understand and to agree with decisions taken in that country. It further helps other countries in particular on the derivation of the accident country's recommendations for their own population. Indeed, neighbouring countries that, during the workshop, knew the arrangements in the accident country well enough could follow the HERCA-WENRA Approach more easily.

It also became clear that including this type of information in the first messages is not feasible, unless prepared and discussed beforehand. In that sense, although the HERCA- WENRA Approach is purely designed to improve coordination during response, pre-emergency arrangements are vital.

Otherwise the statements of the accident country will not be understood and will not be followed.

One possibility to effectively exchange this type of information would be the establishment of country factsheets. Those sheets should be short (approx. 2 pages), visual (to enable information to be found very quickly), factual and concise (i.e. key words rather than full sentences). The WGE should establish those factsheets and develop an appropriate solution for regular updates and dissemination.

6.4. Bilateral arrangements

The success of a harmonized approach between neighbouring countries is strongly influenced by bilateral arrangements (or multilateral if more than 1 country will be directly influenced by an accident within a certain NPP). This makes it easier to verify the assessment of the accident country and gives more understanding to the neighbouring countr(y)(ies). Understanding the response of the accident country is very important for advising decision-makers to harmonize their response with the accident country.

Additionally the arrangements shall contain provisions for coordinating the media response and for communicating well in advance about decisions and the reasoning behind those decisions, in particular in those cases when different decisions are unavoidable.

The WGE should develop guidelines for the establishment of these arrangements. Where an NPP is close to more than one other country, multilateral arrangements should be envisaged.

6.5. Key differences and potential obstacles for aligning recommendations for protective actions along national borderlines

Since emergency preparedness arrangements differ widely between European countries, it was to be expected that the verification of the HERCA-WENRA Approach against concrete accident scenarios would result in identifying situations where aligning recommendations for protective actions is not realistic. The workshop indeed revealed a few obstacles that may jeopardize the possible success of the HERCA-WENRA Approach. On the other hand, such obstacles cannot be generalized and depend largely on the situation and on the country concerned.

Table 2 gives an overview of the main difficulties that were identified. For most cases, it seems possible, nevertheless, to substantially reduce their impact through adapted solutions, as highlighted in the right column of the table.

Difficulties	Improvements to be implemented
Information not correctly understood (e.g.: definition, classification of the emergency different to IAEA, Basis for decisions, etc).	Increase knowledge of national arrangements and assumptions (country fact sheets, see § 6.3)
Information too late or too slow, not permitting other countries to prepare for necessary protective actions on the necessary timescale.	Improve quality of first messages (see § 6.1); Make use of single short messages to a specific subject or event between the regularly sent EMERCON forms; Grant access to restricted websites with the "national expertise product".
Different decision criteria, (e.g. action levels or triggers) used by the accident country, not used and/or not known by others.	Increase knowledge of national arrangements (country fact sheets, see § 6.3). The workshop has also shown that a good knowledge of the decision criteria used in the accident country helped most other countries to appreciate related decisions and to adapt their response, even if such criteria were otherwise not used.
Different values in decision criteria (e.g.: intervention levels). In a couple of countries intervention levels need to be used on a mandatory basis to trigger protective actions with only minor room for other considerations in issuing recommendations.	The new EU-BSS [3] has introduced the concept of "reference levels" for emergency and existing exposure situations. It allows for the protection of the individual as well as consideration of other societal criteria in the same way as dose limits and dose constraints for planned exposure situations. The obligation for the Member States to implement the new EU-BSS gives a unique chance for improved understanding and the implementation of adjustable criteria and the reduction of differences across Europe.
While appreciating different criteria, most authorities limit their considerations to their own territory. (the potential hazard	Need for systematic bilateral agreements that allow to look at the potential hazard area as a whole and to coordinate activities effectively during the

Difficulties	Improvements to be implemented
area is not regarded as a whole)	response between the involved bodies.
In a few countries, recommendations need by law to be based on own independent assessments following strict decision triggers.	There seem to be only a few countries concerned. However in those cases a successful implementation of the HERCA-WENRA Approach could be seriously jeopardized. The new EU-BSS may possibly help.
International requirements and recommendations are differently interpreted across Europe. This seems to be a major challenge.	More detailed work needed on listing the basis for each country, e.g. the use of reference levels, the legally binding criteria, the use of triggers. However, the new BSS present possibilities for further harmonisation, as above.
Extendibility of protective measures beyond EPZ's from an operational point of view.	Need for systematic bilateral agreements. It will be important to clearly define operational limitations (how far and how much can be extended) and how the responsibilities are assigned in each country. (In some countries the advisory body considers operational issues when issuing recommendations).
Advices on travel and traffic remain uncoordinated.	Implementation of the recommendations from the HERCA report "Practical proposals for further harmonisation of the reactions in European countries to any distant nuclear or radiological emergency" [4]

Table 2: Overview of the main difficulties that were identified.

7. Summary of the main findings

The workshop has enabled the WGE to clearly identify the following issues that need to be developed and implemented to allow best use of the HERCA-WENRA Approach:

- Implement nationally the guidelines included in chapter 6.1 for improving the effectiveness of the first messages.
- Development of country fact sheets;
- Development of a list of issues to be dealt with in bilateral or multilateral arrangements;
- Develop a common understanding of key elements of the new EU-BSS [3] and aim at reducing differences through a coordinated transposition and a better application of international recommendations. The EU-BSS does support such changes as they give the opportunity to review our basic principles of radiation protection in emergency situations.

Additionally, as a result from the workshop, the WGE makes the following recommendations:

- Make use of short message information exchange during the response;

- Countries should consider granting access to restricted websites and exchanging liaison officers;
- Always consider the whole affected area, independent of a national border, when making decisions.
- Aligning protective measures along borders should be a factor in decision-making.

8. Conclusions and further steps

The workshop has demonstrated that the HERCA-WENRA Approach has the potential to improve the coherence of the response in case of a nuclear accident with impact on territories of other countries. It was also shown that the approach allows for the assurance – sometimes deemed necessary - that things are done properly in the accident country. This permits in particular to recommend one's own citizens, who stay in the affected area, to follow the advice from the accident country.

A further positive result is the confirmation that the HERCA-WENRA Approach, as given in § 3, contains all necessary elements, ideas and principles needed.

While it may remain difficult to completely eliminate the occurrence of differences and inconsistencies in the response, the aim of the approach should be that this becomes the exception rather than the rule. In those cases where two countries take unavoidably different approaches, they shall coordinate their media response and communicate well in advance about their decisions and the reasoning behind those decisions. A systematic implementation of the findings of the present report (see summary in § 7) will certainly help to significantly improve towards the overall objective of the HERCA-WENRA Approach.

References

[1] HERCA the Association of the Heads of the European Radiological protection Competent Authorities; Radiation Regulator, Volume 1, Number 1.

[2] Emergency Preparedness. Practical Guidance – Practicability of Early Protective Actions; www.herca.org

[3] Council Directive 2013/59/EURATOM of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom.

[4] Practical proposals for further harmonisation of the reactions in European countries to any distant nuclear or radiological emergency; www.herca.org

Definitions

Accident country	The country where the nuclear or radiological emergency has taken place.
Affected countries	The countries that are not the accident country where protective actions need to be considered because of a transborder radiological contamination.
HERCA/WENRA countries	Each country represented through one or more authorities within HERCA/WENRA.
HERCA/WENRA members	Each authority who is a member of HERCA/WENRA.
Impacted countries	Countries that are not necessarily affected countries but which need to issue recommendations for their own citizens in the affected area, including travel arrangements.

List of acronyms

EMERCON: Emergency Convention

EP&R: Emergency Preparedness and Response

EPM: "Early Phase Messages" the first message and the subsequent updates distributed by the accident country in the early phase

EU-BSS: Council Directive 2013/59/EURATOM of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom.

HERCA: Association of the Heads of the European Radiological protection Competent Authorities

IAEA: International Atomic Energy Agency

IEC: Incident and Emergency Centre

MFA: Ministry of Foreign Affairs

NPP: Nuclear Power Plant

TSO: Technical Support Organisation

USIE: Unified System for Information Exchange on Incidents and Emergencies

WENRA: Western European Nuclear Regulators' Association

WGE: HERCA working group on emergencies

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The authors participated actively in the Working Group "Emergencies" (WGE) between December 2011 and May 2014. During this period, the WGE was chaired by Mr. Patrick Majerus (DRP, LU).

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ASN – Autorité de Sûreté Nucléaire; **BABS** - Bundesamt für Bevölkerungsschutz; **BfS** – Bundesamt für Strahlenschutz; **BMLFUW** - Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management; **BMU** – Bundesumweltministerium; **BNRA** – Nuclear Regulatory Agency; **CSN** - Consejo de Seguridad Nuclear; **DRP** – Division de la Radioprotection; **EC** – European Commission; **ENSI** - Swiss Federal Nuclear Safety Inspectorate; **FANC/AFCN** – Federal agency for nuclear control; **GR** - Icelandic Radiation Safety Authority; **GRS** – Gesellschaft für Reaktorsicherheit **ILT** - Inspectie Leefomgeving en Transport; **IRSN** - Institut de Radioprotection et de Sûreté Nucléaire; **Minez** - Ministerie van Economische Zaken; **NCRRP** - National Center of Radiobiology and Radiation Protection; **NRPA** – Norwegian Radiation Protection Authority; **OFSP** – Federal Office of Public Health; **ONR** - Office for Nuclear Regulation; **OSSKI** - National Research Institute for Radiobiology and Radiohygiene; **PHE** - Public Health England; **RPII** - Radiological Protection Institute of Ireland; **SNSA** - Slovenian Nuclear Safety Administration; **SSM** - Swedish Radiation Safety Authority; **STUK** - Radiation and Nuclear Safety Authority.

HERCA
Heads of the European Radiological protection Competent Authorities

Western European
WENRA
Nuclear Regulators' Association

Part II.-

HERCA-WENRA Approach in case of a Severe Accident requiring Rapid Decisions for Protective Actions, while very little is known about the Situation

Stockholm, 22 October 2014

The HERCA-WENRA Approach (Part II) on emergencies was approved by HERCA and WENRA on 22 October 2014.

Content

Executive summary

The HERCA-WENRA task force was established jointly by HERCA and WENRA. It included 21 experts in nuclear safety, emergency preparedness and radiological protection, belonging to 14 different countries. The HERCA-WENRA task force operated between March and September 2014. Its mission was to identify a common European approach addressing a severe accident affecting one or more nuclear power plant(s), and requiring rapid decisions for protective actions, while very little information is available. The HERCA-WENRA task force has built on existing European approaches, namely the NERDA, Nordic and HERCA approaches. IAEA developments and recommendations in emergency preparedness and response have also been considered.

HERCA and WENRA recognize that in European countries, efficient emergency preparedness and response arrangements have been established for many years and are tested and challenged regularly. They allow authorities to issue recommendations for effective public protective actions. In many cases, the current arrangements require exchange of a significant amount of information between the plant and the responsible authorities. However, past experience shows that the possibility of severe accidents without the information required by the current arrangements on the plant status in the initial stage cannot be completely ruled out. Such accidents could be as severe as the Fukushima one, affect more than one European country and require rapid protective actions in several of them.

HERCA and WENRA propose a general approach for dealing with the initial stage of such highly improbable cases. This approach, called the “HERCA-WENRA approach”, can serve as a basis to complement, when necessary, existing arrangements in the initial phase of an emergency situation and allow better coordination of protective actions between countries. The HERCA-WENRA approach proposes that, in case of a severe accident with great uncertainty about the situation, protective actions to be recommended to the decision makers be decided on the basis of the plant status and weather conditions. Three so-called Judgement Evaluation Factors (JEFs) are proposed: core melt risk, containment integrity and wind direction. The HERCA-WENRA approach assumes that a General Emergency (or an equivalent emergency class) is declared when a risk of core melt exists.

The JEFs have to be evaluated using expert judgement based on the nature of the event which has initiated the accident (e.g. earthquake, flooding, airplane crash), the information which can be obtained from the plant and the pre-existing knowledge of its behaviour under extreme conditions. As a first step of a general approach, HERCA and WENRA have only considered three direct protective actions: evacuation, sheltering and iodine thyroid blocking (ITB).

If the HERCA-WENRA approach has been initiated and core melt is judged possible, a precautionary approach is applied and the following actions shall be implemented: evacuation over a distance of 5 km, and sheltering and ITB over a distance of 20 km. However, if it is assessed that, additionally, containment integrity is lost, more serious actions would become necessary, such as evacuation up to 20 km, and sheltering and ITB up to 100 km. Depending upon the

prevailing and forecast wind conditions, protective actions are implemented either on a circular area around the plant or on a limited number of sectors of this circular area. The precise extension of the areas where protective actions are recommended is also adjusted as a function of demography, wind speed and stability.

It shall be noted that countries may have protection strategies more stringent than the conclusions of the HERCA-WENRA Task Force. Safety authorities in neighbouring countries should agree on consistent recommended protective actions.

Considering the safety level of European nuclear power plants and their improvements resulting from the lessons learned from the Fukushima disaster, HERCA and WENRA recognize that the probability of an accident comparable to Fukushima, which would require evacuation up to around 20 km and sheltering and ITB up to around 100 km, is very low.

Therefore, HERCA and WENRA consider that in Europe:

- **evacuation should be prepared up to 5 km around nuclear power plants, and sheltering and ITB up to 20 km;**
- **a general strategy should be defined in order to be able to extend evacuation up to 20 km and sheltering and ITB up to 100 km;**
- **nuclear and radiation safety authorities in Europe should continue attempts to promote compatible response arrangements and protection strategies amongst the European countries.**

Part II

HERCA-WENRA Approach in case of a Severe Accident requiring Rapid Decisions for Protective Actions, while very little is known about the Situation

1. Introduction

On January 15, 2014, a HERCA-WENRA extraordinary meeting held in Brussels established an Ad hoc High-Level Task force on emergencies. Its assigned task was to identify common European principles addressing nuclear emergency response decisions, in case of a severe accident affecting one or more nuclear power plant(s) and requiring rapid decisions for protective actions, while very little is known about the situation.

Between March and September 2014, the 21 high ranking members representing 14 countries met on four occasions. Coming from the fields of nuclear safety, emergency preparedness and radiological protection, they framed the HERCA-WENRA Approach, using the existing European approaches (NERDA, Nordic and HERCA) as a basis. IAEA developments and recommendations in emergency preparedness and response have also been considered. The following paper is the result of these discussions.

2. General Context

In European countries, emergency preparedness & response (EP&R) arrangements for nuclear power plants have been developed over many years. Nuclear and radiation safety authorities have established mechanisms with the nuclear power plants within their country to enable them, even under very difficult conditions, to have access to sufficient information and plant parameters for independently assessing the situation, both at the plant and concerning possible off-site consequences. This allows the authorities to issue recommendations for effective public protective actions, tailored to the possible or actual radiological exposure situation of the population. Drills are performed regularly through emergency exercises in order to train the teams and provide them with experience, which is in turn used to further improve the current arrangements.

However, in the case of the major nuclear accidents that have occurred in the past, namely Chernobyl and Fukushima, the situation was far less clear. Particularly for Fukushima, information was sparse during the early phase. At best only preliminary assumptions could be made on a

possible status of the plant, its evolution, and radiological consequences for the population and environment. In spite of the insufficient and unreliable information, it was necessary for the Japanese authorities to decide rapidly on protective actions for their population.

In Europe, both operators and authorities have sought to learn the main lessons from those accidents in order to strengthen their lines of defence. Should an accident occur, it is particularly vital to maintain functional communication channels between the plant(s) and the responsible authorities at all times, so that relevant and justified decisions can be made to attenuate the consequences of the situation.

Nevertheless, the possibility of a severe accident scenario with no or insufficient information on the plant status cannot be completely ruled out. Furthermore, the immediate effects of such a severe accident in Europe would most probably affect more than one country. This calls for the coordination of the approach to be followed in that case, to allow mutual understanding, consistent and fast decisions of countries affected by an extreme situation of this kind.

Independently of the root cause of the accident, several scenarios can be imagined where being able to use an assessment with projected doses to the populations as a basis for decision making is not realistic. This may be the case when:

- Little or no information from the plant is available (e.g. communication systems have failed such that nothing is known concerning the availability of any safety systems, the status of the reactor core and/or the primary circuit and/or the containment).
- The threat of a large/significant radiological release cannot be reliably estimated.

Since such a severe accident cannot be completely ruled out, the WENRA – HERCA extraordinary meeting of 15 January 2014 in Brussels decided to create an Ad hoc HERCA-WENRA High-Level European Task force in order to identify shared principles on how to address such an extreme situation.

In that context, the HERCA-WENRA Approach focuses explicitly on these extreme cases, producing a framework for European countries as guidance in formulating their detailed EP&R arrangements for an accident involving one or more nuclear power plant(s). Potentially affected countries would benefit from more detailed preparation specifically addressing the issues unique to these types of accidents.

Pre-existing agreement on the approach and actions to be taken in case of such extreme conditions would also significantly enhance the confidence of authorities in charge of protective actions. This is particularly the case for authorities of the countries neighbouring the country where the accident occurred.

It finally needs to be noted that past attempts to reduce differences between national EP&R arrangements were generally not very successful. Any success on agreeing upon common principles for these severe accident scenarios may improve mutual understanding and allow for better coordination of protective actions between countries, including coherence and consistency in early communications to the population across Europe.

Between March and September 2014, the HERCA-WENRA Task Force has developed a shared position for recommendations of generic protective actions for the early phase of those particular

nuclear emergency situations at nuclear power plants (NPPs) in operation when only information on the type of event, internal or external, the possibility of core melt and very little other information is available, including cases where the local operator no longer has the means to understand the situation or to communicate about the situation. At the present stage, the focus of the HERCA-WENRA Task Force lies on three direct protective actions: evacuation, sheltering and iodine thyroid blocking (ITB).

The present paper intends in no way to foreclose any national political decision as to whether or not to implement the proposed protective actions. The main intention is to give an outline on protective actions that may need to be considered. The aim of the HERCA-WENRA Task Force is to provide a common approach relevant to specific situations that can serve as a basis to complement, when necessary, existing arrangements in the initial phase of an emergency situation and allow better coordination of protective actions between countries.

It shall be noted that countries may have protection strategies more stringent than the conclusions of the HERCA-WENRA Task Force. Safety authorities in neighbouring countries should agree on consistent recommended protective actions.

3. Mechanisms for triggering decisions during an emergency situation

During the very early phase of any accident, the decision needs to be taken whether available information is sufficient to support a normal national assessment in a timely manner or whether the country faces an accident with great uncertainty about the situation. In the latter case, recommendations of protective actions have to be defined following a simplified scheme, hereafter referred to as the "HERCA-WENRA Approach". The normal national EP&R approach and the HERCA-WENRA Approach comprise as a whole the overall national approach. The different parts of the overall national approach, the normal approach and the HERCA-WENRA part, have to be compatible to ensure a smooth transition from one part to the other. The country where the accident occurs has the responsibility to judge which approach is appropriate and to organize if necessary the transition between the HERCA-WENRA Approach and the normal national approach.

It is therefore proposed that countries with operating nuclear power plants establish appropriate internal mechanisms, preferably within the competent regulatory authorities for nuclear safety and radiation protection (hereafter referred to as "safety authorities"), for triggering these decisions in a timely manner. The criteria to initiate the HERCA-WENRA Approach are any event, internal or external hazard, including a terrorist attack that might lead to large radioactive release in combination with a lack of the information necessary for applying the normal national EP&R arrangements.

Concerning the necessary decisions for protective actions in neighbouring countries, bilateral arrangements need to contain specific mechanisms for rapid exchange of relevant information between safety authorities. If the notification provided by the safety authority provides elements affecting parts of the territory of the neighbouring country, the neighbouring country should aim at doing the same as the "accident country"[6]. Such a mechanism would be in line with the principles of the general mechanism of HERCA-WENRA Approach.

[6] Country where the affected NPP is located

Generally, the need for simplified decisions using the HERCA-WENRA Approach will only apply during an initial phase. As soon as the accident country is in a position to present a more elaborate assessment of the plant status and the expected off-site impact, it shall take the necessary steps to align its decisions and cross-border coordination mechanisms accordingly.

It is finally emphasized that early information exchanges between neighbouring countries represent an essential element for a successful and coherent cross-border implementation of protective actions. The present paper shall nevertheless in no way provide a justification to neighbouring countries to unilaterally apply the HERCA-WENRA Approach.

4. Basic considerations of the HERCA-WENRA Approach

The HERCA-WENRA Approach is conceived as a general framework. It proposes a methodology for a common European approach allowing to recommend urgent protective actions as well as a minimum common level of preparation for these actions. Detailed implementation aspects will be provided in a second step, provided the methodology is accepted by HERCA and WENRA.

To initiate the HERCA-WENRA Approach (in case of any event, internal or external hazard, including a terrorist attack that might lead to a core melt and for which insufficient information is available to apply the national EP&R arrangements), the protective actions shall be based on the three so called Judgment Evaluation Factors (JEFs):

JEF	Description	Possible values of JEF		
1	Is there a risk of core melt?	Yes	No	Unknown
2	Is the containment integrity maintained?	Yes	No	Unknown
3	Is the wind direction:	Steady	Variable	Unknown

Table 1: Definition of JEFs

Note: If a General Emergency (or an equivalent emergency class) is declared, it is considered that a risk of core melt exists.

Initial containment integrity characterizes the overall structural state of the containment immediately after the initial event. Containment integrity could for example be considered lost after an airplane crash or if the initial event occurs while the containment is open. During the course of the accident, a small increase of containment leakage should not lead to an estimation of loss of containment integrity. However, if a drastic event like a violent internal explosion is expected, then containment integrity should be considered as lost (JEF 2 = No).

Wind direction should be considered, if known, in the period where large releases are expected.

5. Protective actions considered in the HERCA-WENRA Approach

The following protective actions have to be considered in the very early phase:

- **Evacuation**
  The rapid, temporary removal of people from an area to avoid or reduce short-term radiation exposure during emergency.

  It must be noted that there is a certain risk that evacuation will take place under the plume.

  The HERCA-WENRA position on this issue is detailed in § 8.4.

- **Sheltering**
  The use of a structure for protection from an airborne plume and/or deposited radionuclides.

- **Iodine Thyroid Blocking (ITB)**
  The administration of a compound of stable iodine to prevent or reduce the uptake of radioactive isotopes of iodine by the thyroid in the event of an accident involving radioactive iodine releases.

The protective action "Ban on harvesting and grazing" and actions like access control, which are part of the normal EP&R approach, are not considered by the HERCA-WENRA Approach at this stage.

Information to the public and the neighbouring countries as well as notification of and information to international organisations (IAEA and ECURIE) are of primary importance in any case.

6. Protective action zones considered in the HERCA-WENRA Approach

The protective actions should be planned up to distances of 5 km for evacuation and 20 km for sheltering and ITB. An extension to larger distances should also be considered for instance to take into account situations where containment integrity is lost (JEF 2 = No) (e.g. plane crash or large internal explosion) and large releases are expected.

It should be noted that existing planning zones such as the Precautionary Action Zone (PAZ) and the Urgent Protective Action Planning Zone (UPZ) should be used and adapted if already implemented in national emergency response plans. Local specificities (e.g. demographics and geography) should be taken into account to determine the exact shapes of the zones where the protective actions are implemented.

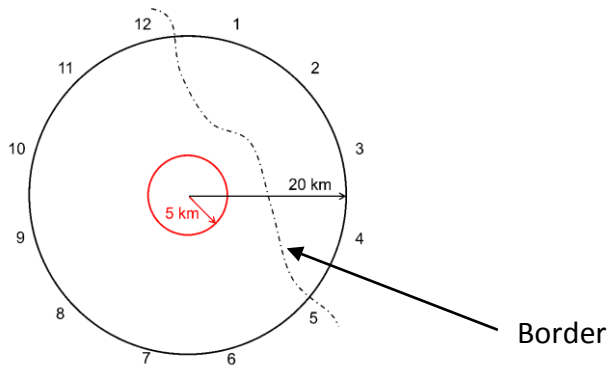

Figure 1: Distances where protective actions have to be planned.

7. Sectors considered in the HERCA-WENRA Approach

Depending on wind conditions forecast during the expected period of large release, these protective actions shall be implemented only in sectors potentially concerned rather than in the whole circular area. On the other hand, when complete circular areas are considered due to lack of wind, the extent of the area could be reduced to a shorter radius. HERCA and WENRA recommend the use of 30° sectors to cover the area concerned. However, other arrangements can also be used if already implemented in national emergency response plans (22.5° etc.). It should be noted that the variation of wind conditions might require adaptation with time of the sectors where protective actions are implemented. It has also been decided to always add an inner circle (keyhole approach) to the concerned sectors of at least 1 km (subject to adaptation to the local/field situation). Outside of the 20 km area, the radial sectors lead to large areas and therefore may not be appropriate and a more regional delimitation following municipality borders, rivers, etc. should be considered when more information on the radiological situation becomes available.

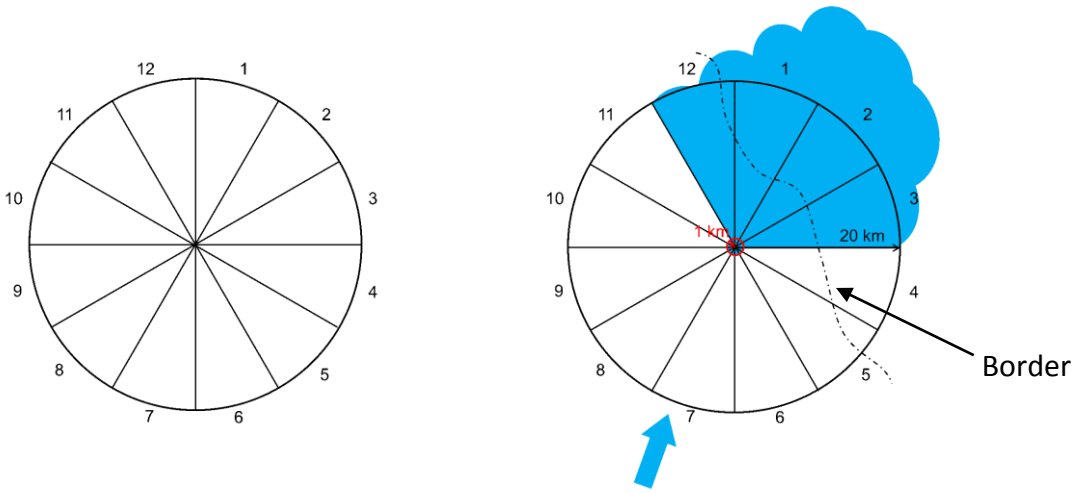

Figure 2: 30° sectors for the implementation of protective actions based on wind/weather conditions

8. Description of the HERCA-WENRA Approach

8.1. Estimation of time to release not available

Using the HERCA-WENRA Approach, a precautionary approach should be applied. Therefore, considering a situation that could lead to a core melt (JEF1 is Yes or unknown) and for which there is no indication of loss of containment integrity (JEF2 is Yes or unknown) and the time to radioactive release is not known, protective actions shall be implemented as follows:

Protective Action	Distance
Evacuation + ITB	up to 5 km
Sheltering + ITB	5 to 20 km

Table 2: Protective actions using the HERCA-WENRA Approach in case JEF1 is Yes or unknown, and for which there is no indication of loss of containment integrity (JEF2 is Yes or unknown) and time of release is unknown.

Note: If a General Emergency (or an equivalent emergency class) is declared it is considered that a risk of core melt exists.

8.2. Estimation of time to release available

Under the same situation and if the time to release ($t_{release}$) can be estimated, the evacuation of the population within a 5 km distance has to be evaluated on the basis of the time needed to evacuate (t_{evac}). If $t_{evac} > t_{release}$, sheltering is preferred over an evacuation under the plume.

The other protective actions are not considered critical because the implementation times for sheltering and ITB are comparably short if iodine tablets are already pre-distributed. Since sheltering cannot be implemented for a very long duration, it should be prepared immediately but only implemented a few hours before the time of release.

Protective Action	Distance	
	tevac > trelease	tevac < trelease
Evacuation + ITB	-	up to 5 km
Sheltering + ITB	up to 20 km	5 to 20 km

Table 3: Protective actions using the HERCA-WENRA Approach in the case JEF1 is yes or unknown, and for which there is no indication of loss of containment integrity (JEF2 is Yes or unknown) and time of release is known.

If containment integrity is lost due to the nature of the initiating event or the evolution of the accident (e.g., plane crash or large internal explosion) and core melt is expected, extended protective actions would become necessary, such as evacuation up to 20 km and sheltering and ITB up to 100 km. Additional ITB actions specific to children could also be necessary.

8.3. Weather Conditions

If the wind direction (JEF3) is known and steady, it can be used to determine in which adjacent basic (30°) sectors (cf. figure 2) protective actions are necessary. If the wind direction is unknown, protective actions have to be implemented in a zone of 360° around the installation and up to the specified distance.

8.4. Risk of evacuation under the plume

In the HERCA-WENRA Approach, sheltering and ITB are preferred to evacuation if it is predicted that the evacuation will actually occur under the plume. In all other cases, including unknown time to release, evacuation is preferred. Given the current state of knowledge, there are many uncertainties on this issue. Therefore, HERCA and WENRA recommend that additional studies be performed regarding the advantages and disadvantages of evacuating under a plume and considering a variety of factors including human behaviour, to provide a sound basis for such recommendations.

8.5. Organisation

The HERCA-WENRA Approach requires rapid assessment of the JEFs by experts, based on the available information. Timely interactions between the operator and the safety authorities will enhance the possibility to quickly assess the JEFs. Therefore, a national framework relying significantly, though not exclusively, on operators would facilitate the HERCA-WENRA Approach. Experts responsible for the necessary assessment should be designated. Robust communication

means should also be available between the key players involved in the evaluation of the situation and the production of recommendations for protective actions.

9. Harmonized preparation of protective actions in Europe

As shown by the Fukushima accident, a large nuclear catastrophe anywhere in the world, including in Europe, cannot be completely excluded. Emergency preparedness and response arrangements should therefore be prepared for such cases. According to the current studies, international standards and methods used for emergency preparedness and response, an accident comparable to the Fukushima one would require protective actions such as evacuation to around 20 km and sheltering to around 100 km. These actions would be combined with the intake of stable iodine.

However, considering the safety level of European nuclear power plants and their improvements resulting from the lessons learned from the Fukushima disaster, it is estimated that the probability of such a catastrophic accident is very low.

Therefore, HERCA and WENRA consider that in Europe:

- evacuation should be prepared up to 5 km around nuclear power plants, and sheltering and ITB up to 20 km;
- a general strategy should be defined in order to be able to extend evacuation up to 20 km and sheltering and ITB up to 100 km;
- nuclear and radiation safety authorities in Europe should continue attempts to promote compatible response arrangements and protection strategies amongst the European countries.

List of acronyms

EP&R: Emergency Preparedness & Response
HERCA: Heads of the European Radiation Protection Competent Authorities
ITB: iodine thyroid blocking
JEF: Judgment Evaluation Factor
WENRA: Western European Nuclear Regulators' Association

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ASN – Autorité de sûreté nucléaire; **BMU** – Bundesumweltministerium; **BNRA** – Nuclear Regulatory Agency; **Bel V** – FANC/AFCN TSO; **CSN** - Consejo de Seguridad Nuclear; **DRP** – Division de la Radioprotection; **EC** – European Commission; **ENSI** - Swiss Federal Nuclear Safety Inspectorate; **FANC/AFCN** – Federal agency for nuclear control; **FOCP** - Swiss Federal Office for Civil Protection ; **ILT** - Inspectie Leefomgeving en Transport ; **Minez** - Ministerie van Economische Zaken; **NCRRP** - National Center of Radiobiology and Radiation Protection; **NRPA** – Norwegian Radiation Protection Authority; **OFSP** – Federal Office of Public Health; **ONR** - Office for Nuclear Regulation; **OSSKI** - National Research Institute for Radiobiology and Radiohygiene; **PHE** - Public Health England; **RPII** - Radiological Protection Institute of Ireland; **SNSA** - Slovenian Nuclear Safety Administration; **SSM** - Swedish Radiation Safety Authority; **STUK** - Radiation and Nuclear Safety Authority; **SUJB** - State Office for Nuclear Safety ; **UJD SR** - Urad Jadroveho Dozoru Slovenskey Republiky;

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