Ref. Ares(2020)1700390 - 23/03/2020

EUROPEAN JOINT PROGRAMME FOR THE INTEGRATION OF RADIATION PROTECTION RESEARCH CONCERT

This project has received funding from the Euratom research and training programme 2014-2018 under grant agreement No 662287.

Confidence
Coping with uncertainty for improved modelling and decision making in nuclear emergencies

EJP-CONCERT

European Joint Programme for the Integration of Radiation Protection Research

H2020 – 662287

D 9.22 – Compilation of national stakeholders panels reports

Lead Author(s):

Milagros Montero; Cristina Trueba; Roser Sala (CIEMAT)

With contributions from:

Partners of CONFIDENCE-WP4

Reviewer(s): CONFIDENCE Coordinator and CONCERT coordination team

Work package / Task	**WP 9**	**T 9.1**
Deliverable nature:	**Report**	
Dissemination level: (Confidentiality)	**Public**	
Contractual delivery date:	**Month 25 (CONCERT M44)**	
Actual delivery date:	**Month 26 (CONCERT M45) Updated CONCERT M58**	
Version:	**v2.0 Final**	
Total number of pages:	**169**	
Keywords:	Emergency preparedness; transition phase to long-term management; post-accident recovery; decision-making process; stakeholder engagement; scenario-based analysis	
Approved by the coordinator:	**Month 58**	
Submitted to EC by the coordinator:	**Month 58**	

Abstract

This document contains the version 2.0 of the deliverable D9.22 on "Stakeholder engagement through scenario-based discussions panels. Compilation of national stakeholders panel reports" of the work package WP4 "Transition to long-term recovery, involving stakeholders in decision-making processes" of the CONFIDENCE Project (HORIZON 2020 EJP-CONCERT, EC GA 662287). It includes the reports with the results and conclusions from the Norwegian and Portuguese panels, which at the moment of the issue of the first version had not yet held their meetings. Also, it presents the update report of the Spanish panel, including the results from its second session that it was also conducted after delivering the first issue.

This project has received funding from the EURATOM research and training programme 2014-2018 under grant agreement No 662287.

Coping with uncertainty for improved modelling and decision making in nuclear emergencies

Stakeholder engagement through scenario-based discussions panels.

Compilation of national stakeholder panels reports

Final

Version 2.0

CONFIDENCE-WP4. Transition to long-term recovery, involving stakeholders in decision-making processes

Document Number: CONFIDENCE-WP4/D4.5

Montero, M.; Trueba, C; Sala, R. (CIEMAT)

Document Information

Project acronym:	CONFIDENCE		
Project full title:	COping with uNcertainties For Improved modelling and DEcision making in Nuclear emergenCiEs		
Project type:	Research and innovation actions (RIA)		
Funding Instrument:	EJP CONCERT_JTC2016	**EC Grant Agreement no.:**	662287
Topic:	Reducing uncertainties in human and ecosystem radiological risk assessment and management in nuclear emergencies and existing exposure situations, including NORM		
Start date of project:	1 January 2017	**Duration:**	36 months
Project URL:	https://portal.iket.kit.edu/CONFIDENCE/index.php		

Work Package:	WP4	Transition to long-term recovery, involving stakeholders in decision-making processes (TRANSHESS)	
Task	T4.2	Involvement of stakeholders in decisions to recover acceptable living conditions	
Subtask	T4.2.1	Stakeholders panels	
Document type:	Deliverable	**No**	D 9.22
Document reference No:	CONFIDENCE-WP4/D4.5	**Version /Status**	2.0 Final
Deliverable lead partner:	CIEMAT		
Contractual delivery date:	Month 25	**Issue date:**	11 March 2020
Dissemination level:	Public / Restricted		

Abstract:	This document contains the version 2.0 of the deliverable D9.22 on "Stakeholder engagement through scenario-based discussions panels. Compilation of national stakeholders panel reports" of the work package WP4 "Transition to long-term recovery, involving stakeholders in decision-making processes" of the CONFIDENCE Project (HORIZON 2020 EJP-CONCERT, EC GA 662287). It includes the reports with the results and conclusions from the Norwegian and Portuguese panels, which at the moment of the issue of the first version had not yet held their meetings. Also, it presents the update report of the Spanish panel, including the results from its second session that it was also conducted after delivering the first issue.
Keywords:	Emergency preparedness; transition phase to long-term management; post-accident recovery; decision-making process; stakeholder engagement; scenario-based analysis
Cited as:	Montero, M; Trueba, C.; Sala, R.; (2020). Stakeholder engagement through scenario-based discussions panels. Compilation of national stakeholder's panel reports. Technical deliverable D9.22 of the HORIZON 2020 EJP-CONCERT, EC GA 662287. CONFIDENCE-WP4/D4.5 v2.0 Final, CIEMAT, Madrid, Spain
Document URL:	

Issue Date	Revision No	Author / Reviewer	Reason for Change	Status[1]
24-01-2019	0.1	M. Montero	First version	Draft
30-01-2019	0.2	M. Montero	Second version	Draft
08-02-2019	1.0	M. Montero C. Trueba; R. Sala	First final version	Released
11-03-2020	2.0	M. Montero	Second final version, including the final reports from Norway, Portugal and Spain	Released

1 Status = "Draft"; "In Review"; "Released".

Executive Summary

This document contains an update of the deliverable D9.22 on “Stakeholder engagement through scenario-based discussions panels. Compilation of national stakeholders panel reports”, of the work package WP4 “Transition to long-term recovery, involving stakeholders in decision-making processes”, of the CONFIDENCE Project (HORIZON 2020 EJP-CONCERT, EC GA 662287), including the final reports from the countries that, at the time of the first issue, had not yet held or completed the sessions of their national panels.

Stakeholders’ discussion panels were set up in the nine countries Belgium, France, Greece, The Netherlands, Ireland, Norway, Portugal, Slovakia and Spain. The discussion panels are introduced to establish and assess the processes for a national dialogue with stakeholders during the transition to the recovery phase, based on representative contamination scenarios.

The main objective of the panels is to facilitate stakeholders’ involvement by incorporating their views in the governance of the exposure situation. The panels should provide an opportunity to identify the way of establishing a comprehensive adapted system to deal with this type of exposure situations, providing guidance and tools.

The discussions have been focussed on what to do and how to proceed in such contamination scenarios and how to evaluate the potential consequences of decisions and their impacts on achieving acceptable living conditions. Additionally, the uncertainties that have been arisen regarding the process of preparedness for the recovery, on the involvement of the stakeholders and the decisions taken during the transition phase have been identified and categorised according to their impact on the future success of the recovery plan.

This document presents, in the first part, a general overview of the common methodology, the generic scenarios and organisation of the panels. The second part compiles the respective national reports, summarising the main findings and conclusions reached in each one.

Table of Contents

Introduction

1 Background

In the framework of the European project CONFIDENCE[2] , the work package WP4 (*Transition to long-term recovery, involving stakeholders in decision-making processes*) is devoted to improve the preparedness and response during the transition phase after a nuclear accident, identifying and trying to reduce the uncertainties in the subsequent management of the long-term exposure situation, reflecting the requirements of the new European Basic Safety Standards (BSS) [1].

For that purpose, a framework of structured collaboration involving the technical experts (partners) and stakeholders in a sequential process has been established. Three tasks have been distinguished to accomplish the work [2]:

1. Establishment and optimisation of remediation strategies in generic scenarios. (**Recovery scenarios planning**)
2. Involvement of stakeholders in decisions to recover acceptable living conditions (**Scenario-based stakeholder engagement**).
3. Elaboration of guidelines and recommendations to address the planning and decision-making during the transition phase. (**Guidelines and recommendations**)

The work of the first task has been able to achieve results contributing to the following objectives:

- to identify and assess the criteria and factors (including the spatial and temporal influence in the establishment of the reference levels and the evaluation of the uncertainties in the optimisation process), that improve/affect the selection, efficiency and ending of remediation strategies, in both urban/inhabited and agricultural areas through modelling and literature review. [3], [4]
- to agree on scenarios and identify remediation strategies as well as the questions and issues to be addressed by national stakeholder panels through a structured brainstorming process, concluding with a dedicated workshop. [5]

The second task has been approached on a structured process of participation that combines the scientific-technical development with the points of view and interests of the interested parties. This approach is part of the preparation process for consequence management and post-accident recovery and for this purpose, a stakeholder participation exercise has been designed in decision-making processes, based on a generic action scenario with the following phases:

1. **Scenario analysis**: to establish generic contaminated scenarios. Its main objective is to clarify the context of the decision, collecting important ideas and elements to construct generic scenarios that can be adapted to the specific needs of each national stakeholder panel. An initial questionnaire was launched among experts and interested parties to assist in this purpose. Based on these results and taking advantage of the results obtained in task 1, to some generic scenario with the issues that will be used for discussion purposes in the panel have been approached[3].

[2] CONFIDENCE: COping with uNcertainties For Improved modelling and DEcision making in Nuclear emergenCiEs. HORIZON 2020 EJP-CONCERT, EC GA 662287. https://portal.iket.kit.edu/CONFIDENCE/index.php

[3] Different scenarios, prepared by the partners for the purposes of their panels were presented and discussed in the WP4 Meeting with motive of the NERIS Workshop 2018 in Dublin

2. **Stakeholder Discussions Panels**: organized to test and evaluate the national dialogue process with stakeholders during the transition to recovery in the previously defined generic contamination scenarios. The objective of the discussions will focus on what to do and how to proceed in a contaminated scenario and assess the potential impacts of their decisions in the course of the actions to be taken to recover acceptable living conditions. Specific consideration will be given to the uncertainties that arise from the different decision criteria and the possible recovery actions planned during this phase. One or two sessions by panel are foreseen.
3. **Delphi Study**: a series of three structured surveys are being carried out in parallel with the panels. The first one was launched in view of preparing questions and issues to be used as a basis for the panel discussions. The other will allow to select and prioritize the most relevant preferences and criteria of the different panels so that they can be used by the decision-making tools that are being developed in other work packages of the project. The joint results and conclusions from this Delphi study will be the subject of the next deliverable (CONFIDENCE D4.6 / CONCERT D9.23).

Once the generic scenarios were established, the stakeholders' discussion panels were set up in the nine countries hosting them (Belgium, France, Greece, The Netherlands, Ireland, Norway, Portugal, Slovakia and Spain).

This document compiles the respective national reports, summarising the main findings in a preliminary analysis of results. As follows, an overview of the common methodology, the generic scenarios and organisation of the panels are also included.

2 Scope and objectives

The transition phase is set between the early phase and before the start of the recovery phase, that is, from an emergency exposure situation after an accident to an existing exposure situation. It is a broad and diffuse phase, during which efforts are made to withdraw the emergency response, establishing specific plans to begin the late phase recovery and rehabilitation of the affected areas. The aim is to return, as far as possible, to normal social and economic activity.

These recovery plans need to be developed through a process of national dialogue with stakeholders, taking into account the inherent uncertainties on:

- the knowledge of the real consequences of an accident,
- the strategies to be implemented, and
- the potential socioeconomic impact on the affected population.

The success of the recovery plan will be measured by the ability of the recovery actions to meet the stakeholders' main concerns and to be implemented promptly. It depends on:

- How is the problem addressed?
- What concerns are considered: health, environmental, social, economic, …?
- What are the objectives, the things that matter, in the context of the decision under consideration?
- What options are possible?

The discussion panels are introduced to establish and assess the processes for a national dialogue with stakeholders during the transition to the recovery phase, based on representative contamination scenarios. The discussions have been focussed on what to do and how to proceed in

such contamination scenarios and how to evaluate the potential consequences of decisions and their impacts on achieving acceptable living conditions.

The main objective of the panels is to facilitate stakeholders' involvement by incorporating their views in the governance of the exposure situation. The panels should provide an opportunity to identify the way of establishing a comprehensive adapted system to deal with this type of exposure situations, providing guidance and tools.

Part A. Summary and Conclusions from the Stakeholder's Discussions Panels

3 Global organisation of the panel methodology established in each country

3.1 National panels involved in the study

Nine countries have organised national panels (see Figure 1): Belgium, France, Greece, Ireland, Norway, Portugal, Slovakia, Spain and The Netherlands. Each of them has defined their main concerns and issues of interest, the type and role of potential stakeholders attending and the connection and coordination with other panels, as foreseen mainly in WP5 and WP6.

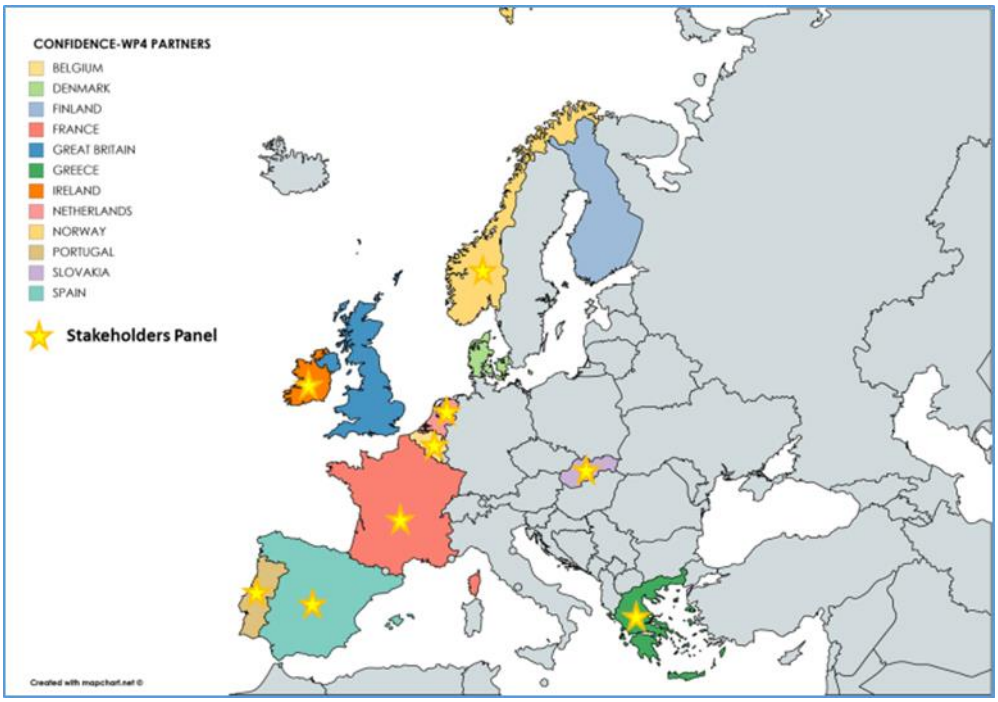


Figure 1 Countries where Stakeholders Panels will be established

Most panels dealt with decisions taken in the transition phase to recover food production in agricultural environments and urban decontamination issues, but also the consumption/marketing management and the impact of evacuation and relocation have been treated. Additionally, the panels in France and Ireland have also dealt with issues related to the emergency and acute phase. A summary is shown in Table 1.

Table 1 Summary of the National Panels involved in the WP4 of CONFIDENCE project

No	Country	Partners	Type	Emergency Phases	Scenarios	Relationships with other
1	Belgium	SCK.CEN	Nuclear	**Transition** phase	**Urban** contamination	
2	France	IRSN/CEPN	Nuclear	**Early** and **transition** phases	**Evacuation/relocation** of population and **ban/restriction** of the local consumption and trade	Additional scenario from WP1
3	Greece	EEAE	Non-Nuclear	Emergency response and **transition** phase	Contamination in **food** derived from an accidental release occurring in a neighbouring country	
4	Ireland	EPA	Non-Nuclear	**Early** emergency response and **transition** to recovery.	Contamination of **food** and **animal feedstuffs** in the aftermath of a nuclear accident abroad.	WP5
5	The Netherlands	RIVM/RIKILT	Nuclear	**Transition** phase	**Urban** and **agricultural** contaminated scenarios	WP6
6	Norway	DSA	Non-Nuclear	**Transition** phase and **long-term recovery**	**Agricultural** scenario following an accident at a floating Russian nuclear power plant along the Norwegian coast	Including in national exercises. Scenarios from WP1
7	Portugal	APA/IST	Non-Nuclear	**Transition** phase and **long-term recovery**	**Urban** and **agricultural** contaminated areas from an accidental release from the nearby NPP in Spain.	WP5
8	Slovakia	VUJE	Nuclear	**Transition** phase	Impact of **evacuation/relocation** of population and **urban** area recovery	WP5 & WP6
9	Spain	CIEMAT	Nuclear	**Transition** phase	Contaminated **inhabited** and **agricultural** areas	

The panels have been composed of experts and representatives of stakeholders groups, covering the three broad categories defined as:

- Stakeholders directly involved in the post-emergency planning and management of the transition phase: representatives of Government institutions, agencies or companies directly involved in the management of the transition phase,
- Others affected but not involved in such management: representatives of the population, producers, industries, marketers, directly affected,
- Others unaffected but interested: experts with a high level of knowledge related to the subject or activity, but not directly affected by this type of situation

3.2 Methodology used

A document was prepared to guide the organisation and discussions of the national panels [6].

The general approach to engage the stakeholders in the national panels has been as follows:

- A "question-driven" tabletop exercise to be conducted individually by each participating country (national panel).
- Simulating an intervention scenario from an accidental release in a Nuclear Power Plant (NPP), based in the contamination pattern monitored after the source term has been controlled and all the contamination has been deposited.
- Focussed in the consequence management and the post-emergency preparedness for the long term recovery to carry on during the transition phase.

One or two sessions per panel were foreseen. The updated schedule of the panels is shown in Table 2

Table 2. Schedule of the WP4 panels´ meetings.

Country	1st session	2nd session
France	Jun-18	Oct-18
Spain	Jun-18	Feb-19
Ireland	Nov-17	Oct-18
Greece	Jul-18	
The Netherlands	Jun-18	Nov-18
Norway		Apr-19
Belgium	Dec-18	
Slovakia	Dec-18	
Portugal	Mar 19	

Among the objectives pursued are the next:

- Understand the transition phase, timeline and challenges in the decision-making process, including the decisions taken in the early phase of the emergency
- Identify the critical aspects in the preparedness and response for the recovery during the transition phase
- Approach to dealing with the uncertainties arisen in the transition phase, to prepare plans for subsequent recovery
- Explore how and at what level to engage the stakeholders in the decision-making process.
- Contribute to obtain and prioritise the preferences of the stakeholders that could be incorporated in a multi-criteria decision-making analysis (MCDA) by WP6.

The non-nuclear countries (except Ireland) have opted for one session, in addition to Belgium. The other countries, in the majority, have taken advantage to coordinate the purposes of the WP4 with the interest of others, as WP5 or WP6.

3.3 Scenarios and topics for discussion (including the uncertainties to be addressed

Scenarios are narrative descriptions of potential futures that focus attention on relationships between events and decisions that have to be taken. The basic concept for the scenario has been the focus on the preparedness to long-term recovery and decisions to be taken during the transition phase: Identify action alternatives, development of action strategies, implications of actual situation and decisions for the future, structure and roles of decision-makers, stakeholder preferences and their engagement in the plans.

The scenario-construction process, in general, includes the next elements:

1. Radiological characterisation:

- Initial situation of the contaminated area and exposure impact estimated or measured.
- Zoning of the contaminated territories, based in dose criteria after deposition, the level of deposition or in Euratom Food Intervention Levels CFILS
- Estimation of radiological impact in the long-term through the relevant pathways.

2. Socio-economic and environmental characterization:

- Structure into elemental units, as a function of the parameters and attributes that affect the behaviour of the radionuclides but also the response and applicability of the remediation actions. (Weather, land use, food-chain, etc.).
- Estimation of the population affected
- Social and economic structures that could be affected and/or can influence the course of the actions to take.
- Economic consequences and potential direct and indirect costs from the implementation of the recovery actions.

3. Spatial-temporal evolution of the scenario

Taking into account these elements, the majority of the scenarios have explored:

- the different recovery alternatives in each one of these components
- an estimation and measure of the consequences of the implementation of such planned strategies

- an approach to assess the practicability and optimisation of the strategies assuring the sustainability of the recovery and rehabilitation in terms of social, economic, political, environmental and/or ethical factors
- the uncertainties that arise during the transition phase, associated with the preparedness of the recovery strategies, the decision-making process and the involvement of the stakeholders.

A list of topics of concern and the possible uncertainties to deal in the discussions have been presented in the document of guidelines [6]

4 Results and national panel's lessons

The nine panels organized in Europe, under the WP4, have allowed obtaining a very broad and complete vision of all aspects of interest, and the preferences of stakeholders associated with decision-making and the preparation of plans for the post-accident recovery, during the transition phase of an emergency. The impact of the measures implemented during the urgent and early phase over the decisions to be taken in the post-emergency, (when and how to review or lift such measures), or how to manage the consequences of contamination during the transition phase and how to select and evaluate the best strategies to consider in future recovery plans, have been discussed. The main uncertainties of the process have been identified and categorized. Urban and agricultural/farming environments have been considered, in both nuclear countries, directly affected and in surrounding non-nuclear countries. Qualitative and quantitative assessments (using the MCDA) of preferences and decision criteria have been conducted.

The participation of various stakeholder in the national panels was perceived as fruitful by the panellists themselves and conveyed their willingness to continue being involved, reporting the usefulness of the meetings in terms of knowing each other, better identification of roles and coordination and preparedness improvement.

The results and main findings of the national panels are presented in the next part B.

Part B. Overview of each national panel. Compilation of the national reports

B-01. Report of Belgian National panel

Authors: Abelhausen, B.; Turcanu, C.; Olyslaegers, G., Gueibe, C. (SCK•CEN)

Ref. Report: CONFIDENCE-WP4/T4.2.1-R02; CONCERT D 9.22 Part B-01. v1.0 Final

Summary

A stakeholder panel has been organised in Belgium in the framework of the European project CONFIDENCE, in order to exchange views, experiences and opinions related to scientific and social uncertainties in the transition phase. Participants included representatives of nuclear safety authorities, research institutions, authorities responsible for local emergency planning around Belgian NPP's, first responders, local community representative and the army. The stakeholders identified the following uncertainties in the transition phase: people/stakeholders needed to address both the emergency and the transitions phase (the inclusion of these stakeholders in the preparedness phase), find a balance concerning the timing of decisions, an equilibrium between economic, social and ethical aspects, difference between communication and stakeholder involvement, waste (type of waste, the storage of waste), willingness of people to take action, amount of knowledge needed to take decisions, willingness to return, acceptable level of contamination, lay uncertainties (who will pay me as compensations, how will I survive with my family if I cannot go in that area, I don't have my house), stress, trust, willingness to participate in preparedness, willingness to work in the contaminated areas.

The stakeholder panel provided the insight that societal uncertainties can and should be addressed in the preparedness phase to eliminate or reduce these uncertainties in the transition phase. Setting-up a stakeholder network via a campaign, paying specific attention to mental health issues, is seen as the best strategy to achieve this.

Table of Contents

1 Objectives and Scope

Within the framework of the European project CONFIDENCE, SCK•CEN researchers organized a workshop with Belgian stakeholders addressing the transition phase after a nuclear accident. The scenario used in the workshop focused on issues related to urban contamination and covered a hypothetical accident at the Nuclear Power Plant in Doel, causing the need for countermeasures in a (limited) part of the city of Antwerp.

The main objective of the panel was to exchange views and experiences related to the scientific and societal uncertainties in the transition phase between a nuclear emergency situation and the recovery phase. The topics proposed for discussion included issues such as the objectives of the transition phase, the need for decontamination, the recovery strategy, the management of resulting waste, and the lessons learned from past events. The aim was to identify and analyse how decisions are taken, what issues are at stake, and how societal and scientific uncertainties influence decision-making. Scientific uncertainties relate for instance to the reliability of model calculations or the effectiveness of recovery options to reduce external dose to the population, whereas societal uncertainties stem from broader issues such as balancing the social and technical factors when taking decisions about recovery options.

2 Methodology

The Belgian stakeholder panel was organized by SCK•CEN researchers, taking into account the CONFIDENCE general guidelines for the organization of stakeholder panels (Montero and Trueba, 2018). Several preparatory meetings were held between the authors of this report in October, November and December 2018 in addition to the WP4 general meetings. The scenario for the panel was developed by Christophe Gueibe and presented by Geert Olyslaegers.

The format of the panel meeting included presentations and moderated discussions. Participants reacted both during the presentations and during the discussion sessions. Permission was asked and received from participants to record the discussions for further analysis. Additionally, one SCK•CEN researcher took notes.

Prior to the workshop, a questionnaire was sent together with the invitations. The questionnaire consisted of five sections covering influence on decision-making, concerns and issues of importance for future recovery, objectives for future recovery, and challenges for future recovery. The first section included questions about the stakeholders' actual and desired level of influence on decision-making processes in the preparedness phase and in post-accident management. The questions were assessed using a 5-point Likert scale ranging from low (1), over medium (3) to high (5). The questions were:

- 'How do you evaluate the actual level of influence of your organisation on decisions concerning preparedness for recovery after a nuclear accident?'
- 'What would be the desired level of influence for your organisation on decisions concerning preparedness for recovery after a nuclear accident?'
- 'How do you evaluate the expected level of influence of your organisation on decisions concerning recovery after a nuclear accident?'

- 'What would be the desired level of influence for your organisation on decisions concerning recovery after a nuclear accident?'
- 'To what extent you consider your organisation (or its members) as having a stake in the preparedness and/or management of post-nuclear emergencies?'

The second section queried about the first concern the stakeholders would have in case of an emergency. One open question was asked for this section: 'what would be your first concern?'. The third section related to questions on the importance of issues to be addressed for future recovery in the transition phase of an emergency. The issues were rated on a 7-point Likert scale ranging from 1 being "not important" to 7 being "very important". The issues included were: food control, other goods control, relocation of people, health monitoring and health care, application of countermeasures, decontamination, waste management, radioactivity surveillance/monitoring programs, radiological characterization of the contaminated areas, classification of zones/management of land use, dialogue with national and local stakeholders, public trust in experts and authorities, information dissemination and risk communication to the population, and other issues not included. The fourth section included questions on the importance of various objectives and challenges for future recovery, with respondents being asked to score all objectives according to a 7-point Likert scale ("not important" (1) – "very important" (7)). The objectives included were: minimise the radiological impact, minimise the impact in the population, improve/increase the public confidence, minimise the economic costs, minimise the environmental impacts, and other issues not included. The challenges were evaluated on a 7-point Likert scale ("not important" (1) – "very important" (7)). The challenges included were: engagement of stakeholders, communication with the affected population, common goals and interests among different actors in the decision-making, acceptability of the recovery actions by the population (e.g. food restrictions), allocation of adequate resources (availability of equipment, skilled workers, etc.), public distrust and stigmatisation, roles and coordination of those involved, legislation issues, capacity for monitoring and certification of food and feed; resumption of agricultural exports, compensation for affected persons, and other issues not included. For the purpose of the stakeholder panels, a selection of the results were presented to the stakeholder panel as inspiration for discussion.

2.1 Scenario and timeframe of interest

The scenario was developed for an emergency at the Nuclear Power plant in Doel allowing for a discussion on the transition phase in an urban scenario, i.e. Antwerp and surrounding areas. Information concerning the objectives of the transition phase were discussed with the information on the radiological effectiveness and various other characteristics of a number of countermeasures provided to the stakeholder panel based on Charnock et al (2018) and the European Handbook for the management of inhabited areas.

2.1.1 Objectives of transition phase

The scenario was presented during the stakeholder panel by Geert Olyslaegers. In a first presentation (**Fig. 1**), an overview of part of the emergency plan was provided. He summarized the objectives of the transition phase, on the basis of the Belgian nuclear and radiological emergency plan. The presentation reminded that the actions, in the transition phase, target the termination of the emergency phase (either return to the pre-crisis situation or management of the new exposure situation due to contamination in the environment) and the preparation of the post-accident management. Concretely, this requires:

- Complete evaluation of the radiological situation
- Complete evaluation of the expected consequences

- Adaptation/ revision of countermeasures
- Decision on the management strategy (i.e. considering socio-economic impact, remediation, communication)
- Consultation with stakeholders

The main objective of the transition phase is the return, as soon as possible, to normal living conditions for the population. This may involve total or partial lifting of emergency countermeasures, or their revision (lifting of sheltering, eventually with return of evacuated population, lifting of ban on production and distribution of foodstuff). In some cases, non-urgent actions (e.g. recommendations on plant crops, advice on radiation protection behaviours) can be integrated in the daily life of the affected population.

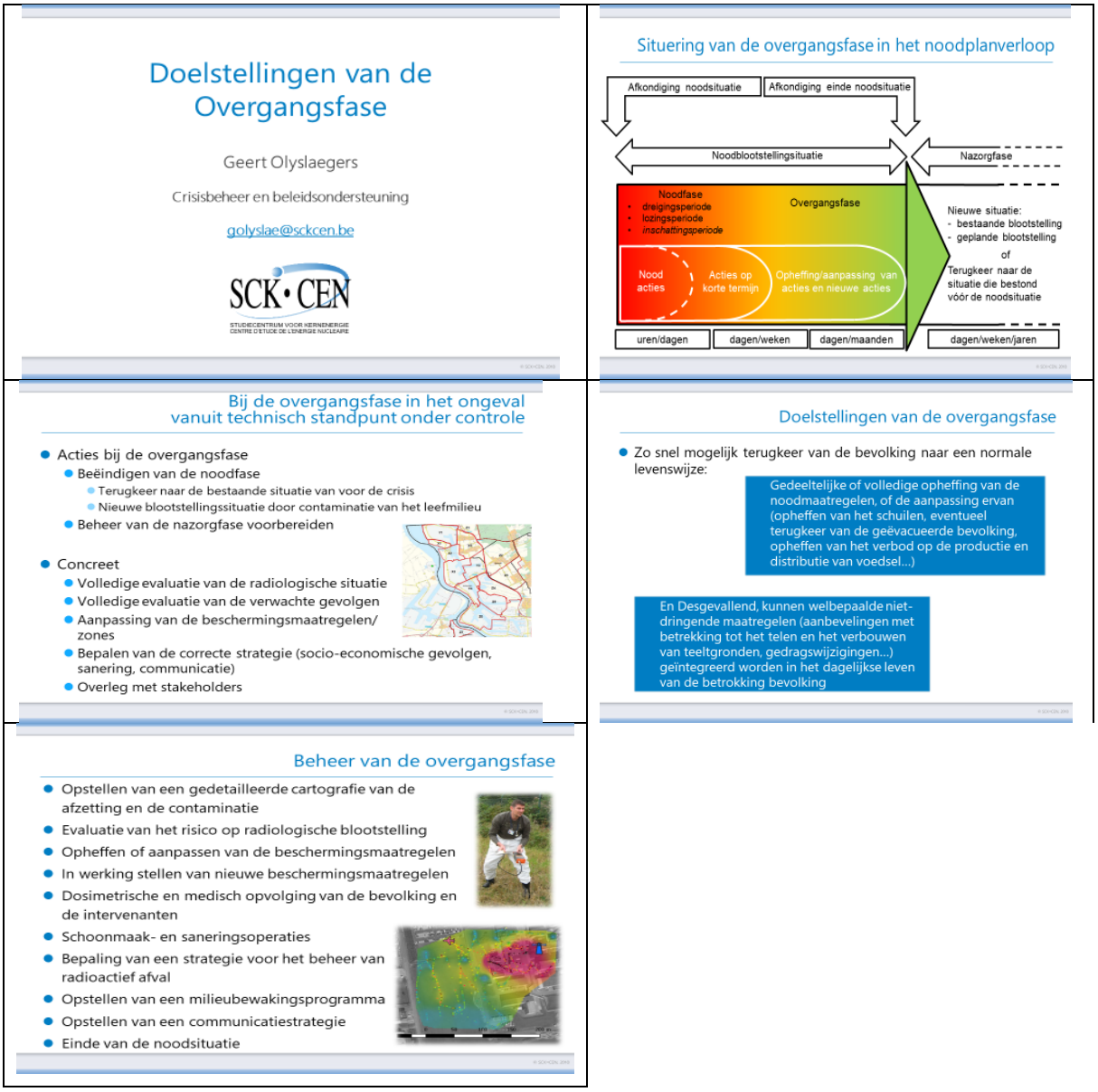


Fig. 1. Belgian stakeholder panel - Objectives of the transition phase (Dutch)

2.1.1.1 Reaction by stakeholders

After the presentation on the objectives of the transition phase, the participants provided some initial reactions. They indicated that socio-economic and psycho-social aspects are very important

and addressing these aspects should be considered as a separate objective. This observation is based on experiences from Fukushima where the role of doctors showed to be significant. Medical follow-up should therefore not only include physical but also psychological health. Additionally, the topic of stigmatizations was discussed. The following concerns/examples were raised: “in the plan we assume that people will not be received in a big shelter, but relocated to other houses: but who will receive these people?”, “children from Chernobyl were received in Belgium; families (not those hosting, but neighbours) asked if it is safe for their children to play with those children”.

The issue of preparedness was also addressed: “it is important to prepare in advance, not start at that moment; we know it will be first chaos, then comes emergency aid”, “also in the decree it is written that a strategy for communication should be prepared now, even if the content of communication is decided at that moment”. The example of a communication campaign on the distribution of iodine tablets, and the strengths and weakness of this strategy, was discussed and raised the issue of trust. “Communication for the distribution of iodine pills in Belgium was a disaster because the trust of people is low”. As a response to this, the suggestion is made to also address fake news: as “people get information from all sides we have to be neutral and give the best information”.

2.1.2 Scenario Belgian Stakeholder panel

After the presentation on the objectives of the transition phase, the scenario was presented by Geert Olyslaegers. The scenario was explained and a summary of countermeasures, for inhabited areas, was provided. During and after this presentation, participants discussed the land use of the area and the optimization and implementation of decontamination options. A respondent debated whether bringing the exposure down till the natural radioactivity background in a radon prone area elsewhere in Belgium might be considered enough (i.e. acceptable).

2.1.2.1 Urban countermeasures – Doel

2.1.2.1.1 Source term

The source term used is based on standard scenario n°33 for Doel 3. This scenario corresponds to a leak in the primary water circuit with a core melt. The inventory released in this scenario is summarized in

Table 1 - Released inventory in standard scenario n°33.

RADIONUCLIDE CATEGORY	RELEASED INVENTORY [BQ]
NOBLE GASES	$7.98\ 10^{16}$
IODINE	$2.80\ 10^{17}$
AEROSOLS	$8.27\ 10^{15}$

The duration of the release is here assumed to be 12 hours. For sake of simplicity, it is assumed that only I-133, Cs-137 and Xe-133 were released.

2.1.2.1.2 Meteorological conditions

The meteorological conditions are based on the meteorological conditions on 01-04-2018 (derived from numerical weather prediction data from the Global Forecast System). The corresponding data at the location of the Doel Nuclear Power Plant (NPP) were retrieved and were adapted for the purpose of this scenario. The weather conditions were assumed to be homogeneous on the calculation domain (*i.e.* 40 km around the site). The wind direction, wind speed, precipitation rate and stability category during the calculation period are shown in **Fig. 2**.

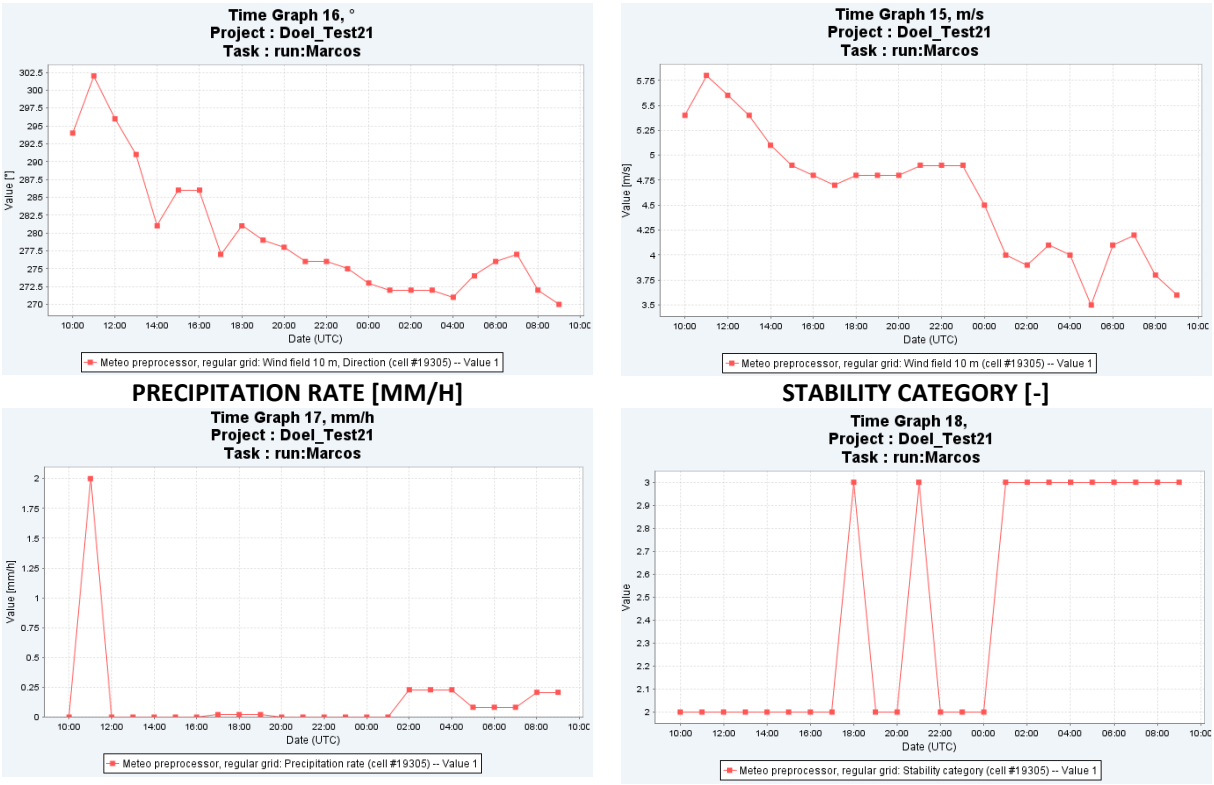


Fig. 2 – Wind direction, wind speed, precipitation rate and atmospheric stability class during the calculation period.

2.1.2.1.3 CORINE Land Cover 2012

For illustration of the contamination issue in different environments, the EU CORINE land cover dataset was used. The dataset was used to shown the different types of land cover in the region of the Doel NPP. The land cover was categorized into 5 categories as shown in **Table 2**.

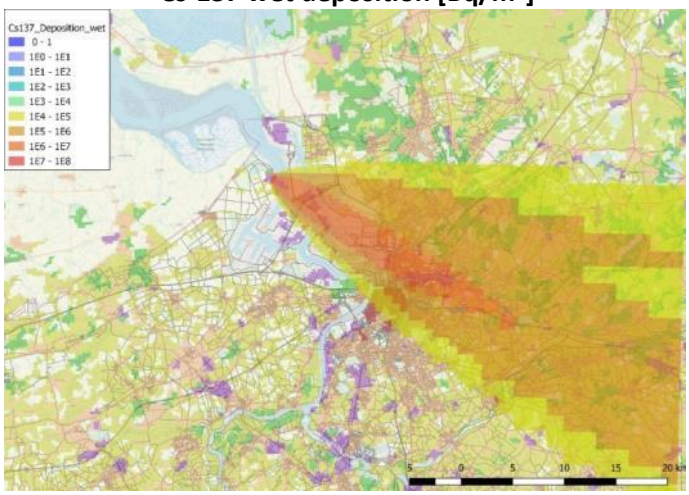
Table 2 - Land cover categories derived from the EU CORINE land cover 2012 dataset.

Category	Colour
Continuous urban fabric	
Discontinuous urban fabric	
Industrial or commercial units	
Agriculture	
Forest	

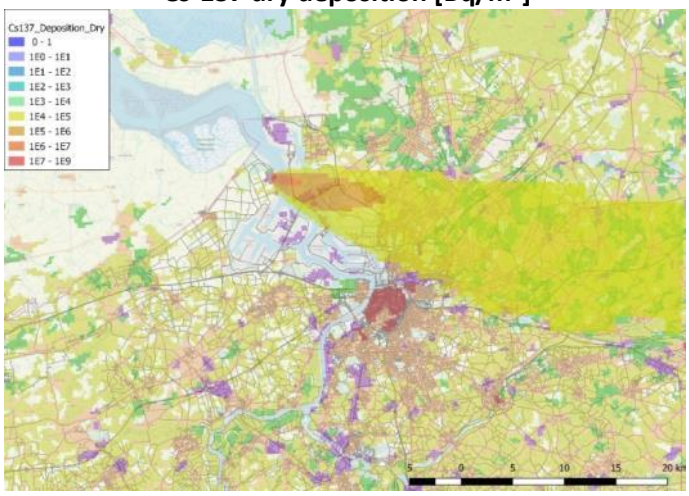
2.1.2.1.4 Cs-137 deposition maps

The wet, dry and total deposition maps for Cs-137, after the release has been fully dispersed over the calculation domain, are shown in **Fig. 3**.

Cs-137 wet deposition [Bq/m²]



Cs-137 dry deposition [Bq/m²]



Cs-137 total deposition [Bq/m²]

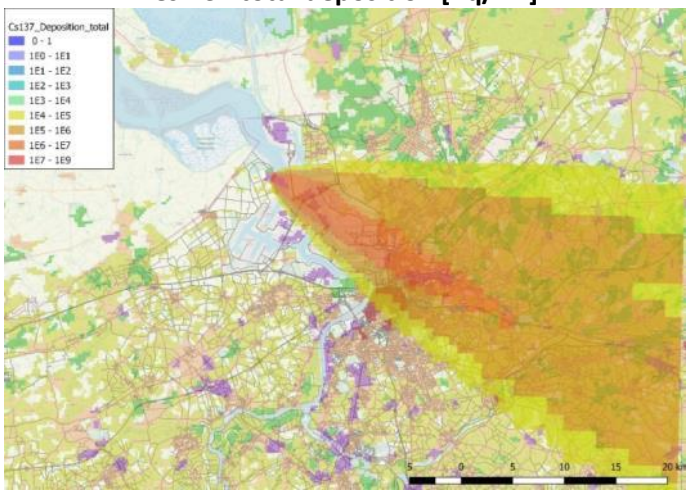
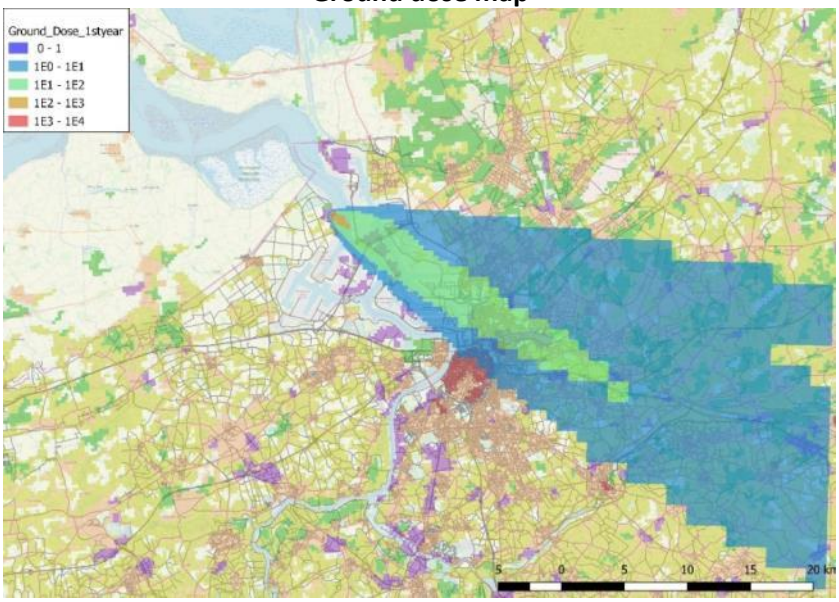


Fig. 3 - Cs-137 wet, dry and total deposition maps.

2.1.2.1.5 First year ground dose

The first year ground dose map as well as the 10 and 20 mSv isolines resulting from the Cs-137 ground contamination are shown in **Fig. 4**.

Ground dose map



10 and 20 mSv ground dose isolines

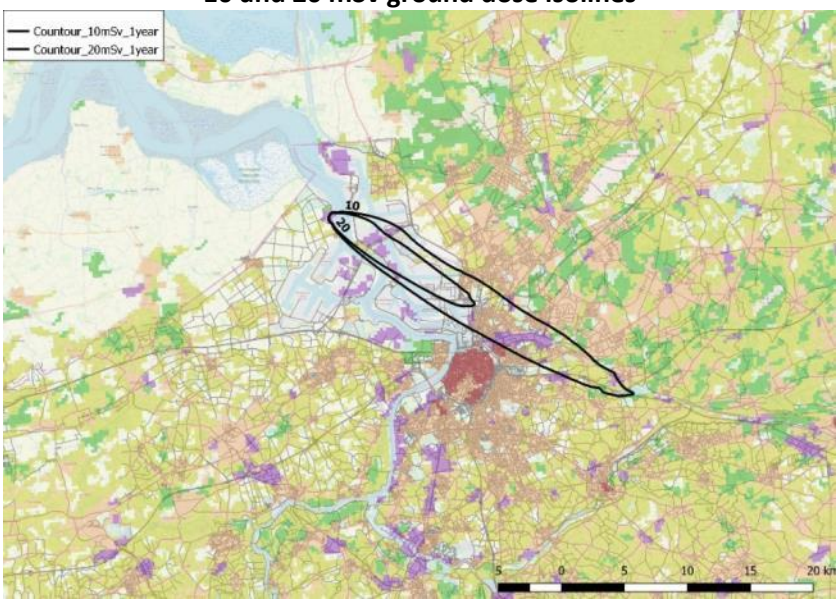
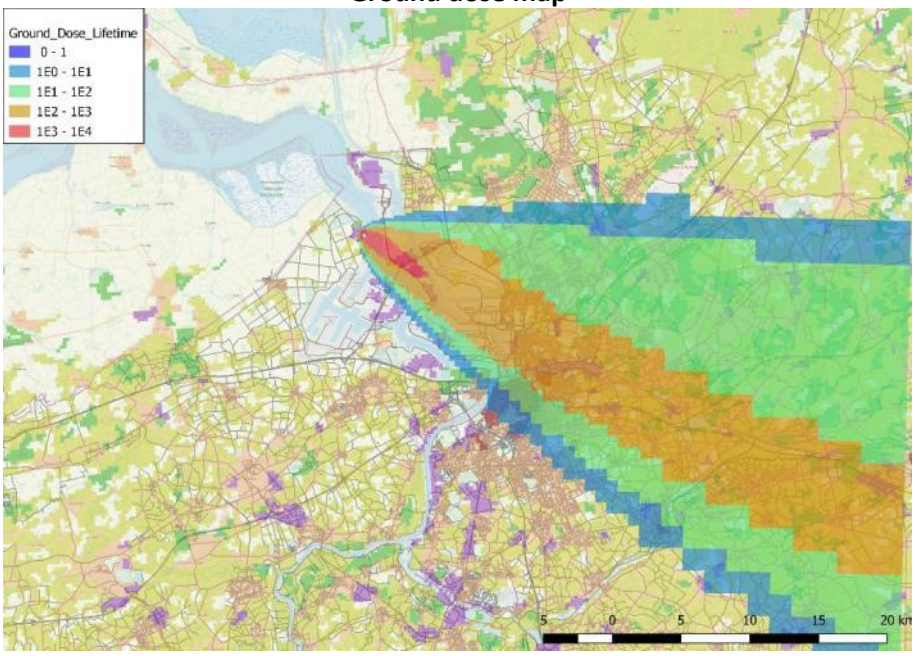


Fig. 4 – First year ground dose map and first year 10 and 20 mSv ground dose isolines.

2.1.2.1.6 Lifetime ground dose

The lifetime ground dose map as well as the 1 and 10 mSv isolines resulting from the Cs-137 ground contamination are shown in **Fig. 5**.

Ground dose map



10 and 20 mSv ground dose isolines

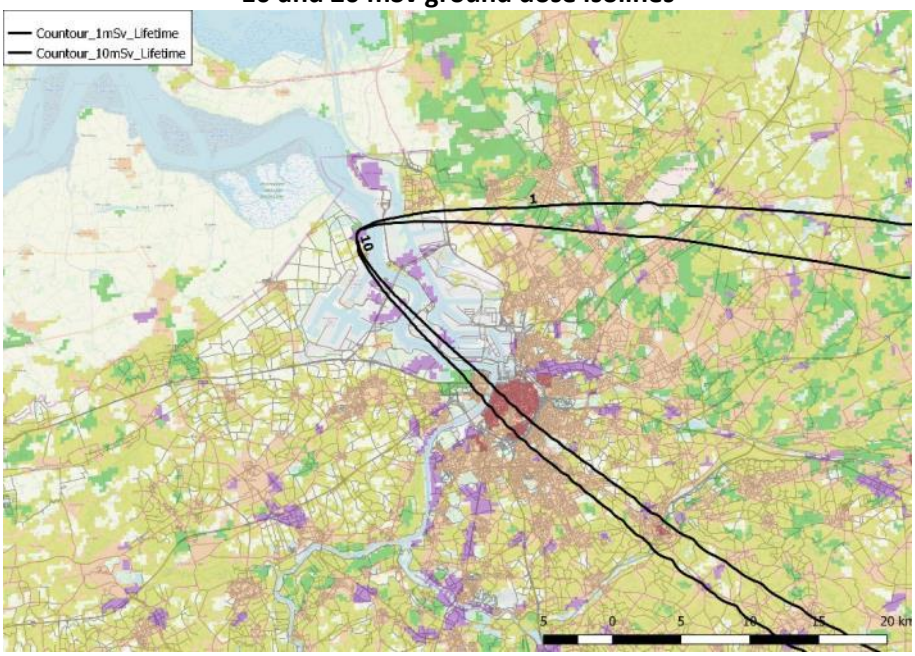


Fig. 5 – Lifetime ground dose map and first year 1 and 10 mSv ground dose isolines

Apart from the technical scenario, a summary was given of different countermeasures for inhabited areas (see Fig. 6).

2.1.2.2 Presentation scenario

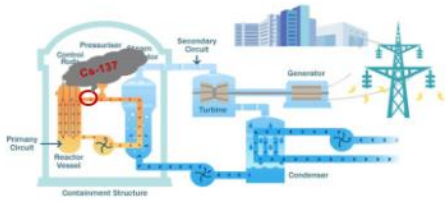
Urban contaminated areas – Example of Antwerpen

Christophe Gueibe and Geert Olyslaegers

SCK•CEN
STUDIECENTRUM VOOR KERNENERGIE
CENTRE D'ETUDE DE L'ENERGIE NUCLEAIRE

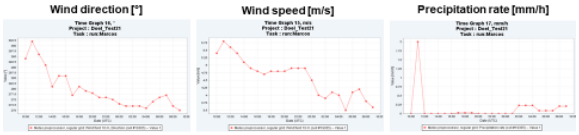
Source and source term

- Doel 3
  - Use of a standard scenario (within set of predefined scenarios)
  - Core melt with a leak in the primary water circuit
  - Release of 8.27 10^{15} Bq of Cs-137 over 12 hours



Meteorological conditions

- Based on meteorological conditions on 01-04-2018
  - Slightly adapted for the purpose of the scenario (shift in wind direction and adding precipitations)
  - Meteorological conditions are assumed to be homogeneous on the calculation domain (i.e. 40 km around the Doel site)

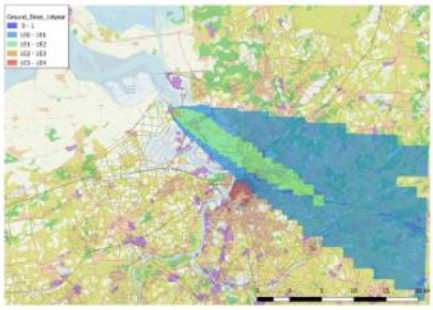


Land cover in the region

- Data extracted from the CORINE Land Cover dataset 2012

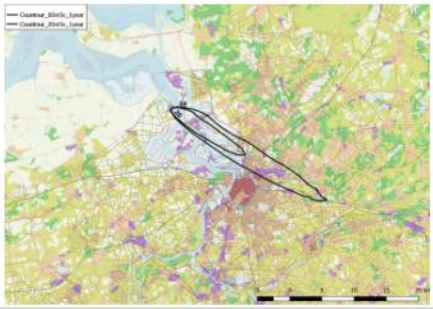
Category	Color
Continuous urban fabric	
Discontinuous urban fabric	
Industrial or commercial units	
Agriculture	
Forest	

First year ground dose (mSv) (1/2)

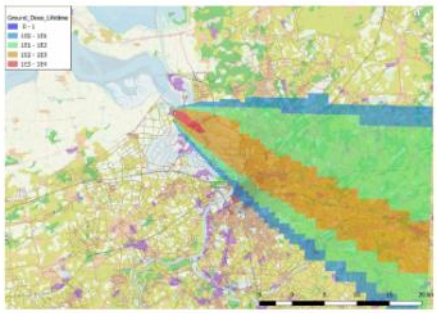


First year ground dose (mSv) (2/2)

- 10 and 20 mSv contours

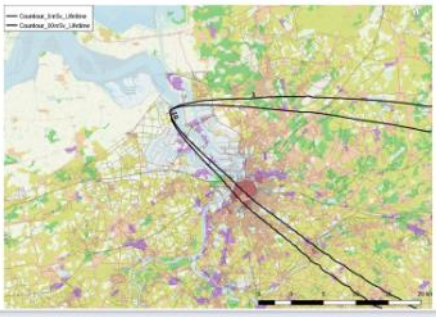


Lifetime ground dose (mSv) (1/2)



Lifetime ground dose (mSv) (2/2)

- 1 and 10 mSv contours



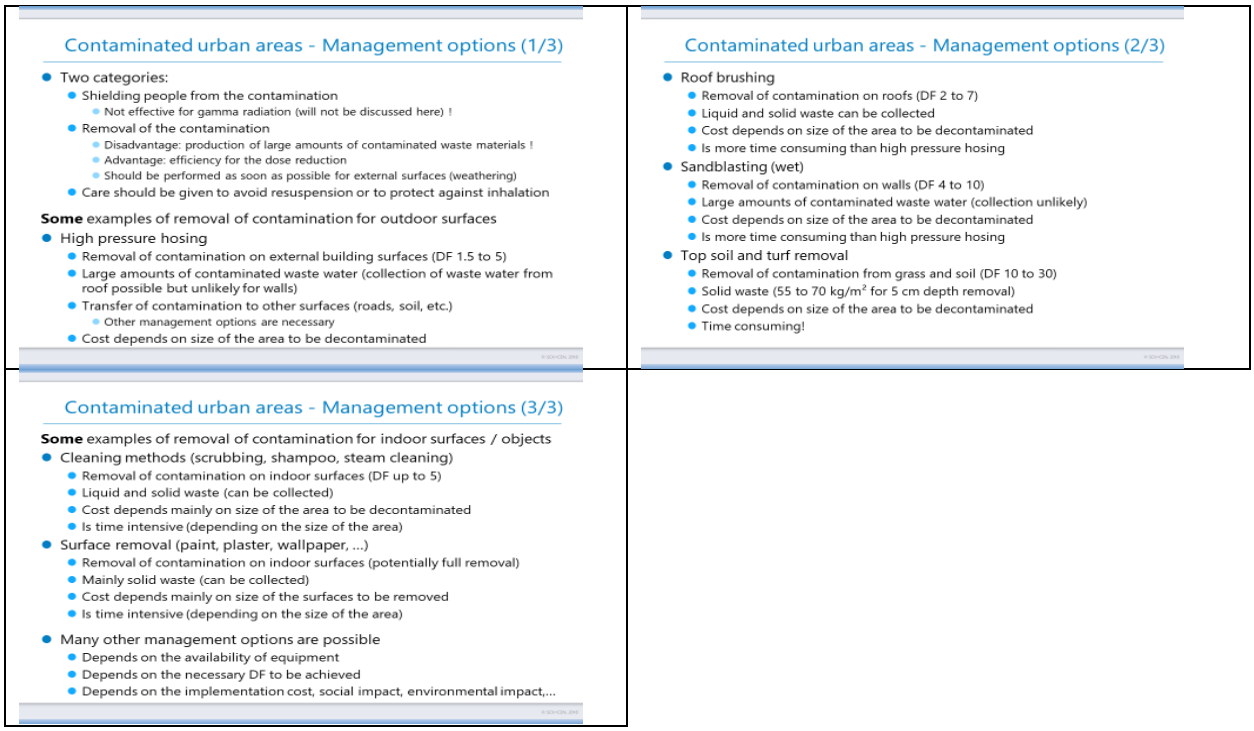


Fig. 6 Belgian stakeholder panel - Urban contaminated areas - Example of Belgium

2.2 Organization and schedule of the meeting

The stakeholder panel was held on December 18, 2018 at Campus Vesta. Campus Vesta is the multi-disciplinary education centre for professional safety trainings of the province of Antwerp. The cooperation with Campus Vesta was established via Geert Olyslaegers. The location was chosen based on convenience for panel participants and its proximity to the Nuclear Power Plant included in the scenario.

The agenda of the stakeholder panel meeting (**Fig. 7**) included presentations on the CONFIDENCE project, specifically the WP4 tasked with the management of uncertainties in the transition phase, a presentation of the objectives in the transition phase according to the Belgian nuclear and radiological emergency plan, a presentation of the scenario to be used as a starting point in the workshop, a moderated discussion on the management of inhabited areas in the transition phase and a focus group discussion related to stakeholder participation. The latter was held in collaboration with the European ENGAGE project, which is also part of CONCERT.

Stakeholder panel on the management of inhabited areas after a nuclear accident

18 December, 2018

Campus Vesta, Oostmalsesteenweg 75, 2520 Ranst

Agenda

09:30 – 09:40	Introduction – Bieke Abelshausen (SCK•CEN)
09:40 – 09:55	Objectives of the transition phase– Geert

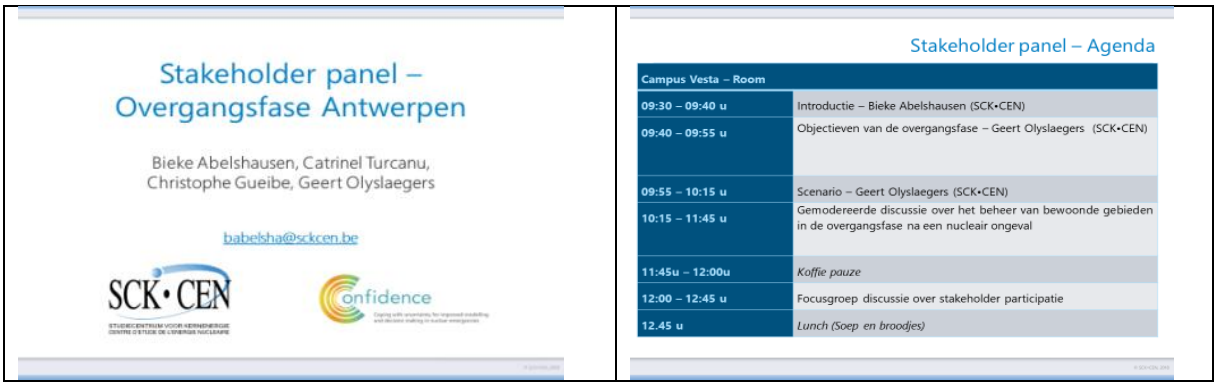
	Olyslaegers (SCK•CEN)
09:55 – 10:15	Scenario – Geert Olyslaegers (SCK•CEN)
10:15 – 11:45	Moderated discussion on the management of inhabited areas in the transition phase
11:45 – 12.45	Focus group discussion on stakeholder participation (ENGAGE project)
12.45	Lunch

Fig. 7 Agenda Belgian Stakeholder Panel

The meeting was introduced by Bieke Abelshausen (see presentation in **Fig. 8**). The introduction encompassed the agenda of the meeting and the overarching aims of the CONFIDENCE project, the specific work package related to the stakeholder panel on the transition phase (WP4). Furthermore, the objectives of the stakeholder panel were explained and the guiding questions to be addressed in the scenario-based moderated discussion were introduced as:

- Which uncertainties do we face/encounter in such a situation?
- How can we reduce these uncertainties?

An overview of the planning of the panel, highlighting the different sections, was presented. Additionally, the use of post-its was explained. The stakeholder panel consisted of two sections. The first section, a moderated discussion, addressed the two guiding questions, as aforementioned. The discussion was initiated with a presentation of the scenario (see **Fig. 6**), after which a 40 minutes discussion was held, addressing both questions. After these 40 minutes a presentation was given on experiences from Fukushima, with the intention to use the lessons learned in the discussion to provide more detailed answers to the guiding questions (**Fig. 9**). Post-it's in two colours were provided to the participants to write down initial answers/thoughts/questions on the two guided questions emerging during the presentation of the scenario and the lessons learned. The materials used for the panel included power point printouts, post-its and pens. The second section, a focus group discussion, was organized in collaboration with the European ENGAGE project, which is also part of CONCERT. The focus group discussion went further in depth into the subject of stakeholder participation in decision-making processes. The questions addressed were: 'can stakeholder participation aid in addressing uncertainties?', 'how can it (not)?'



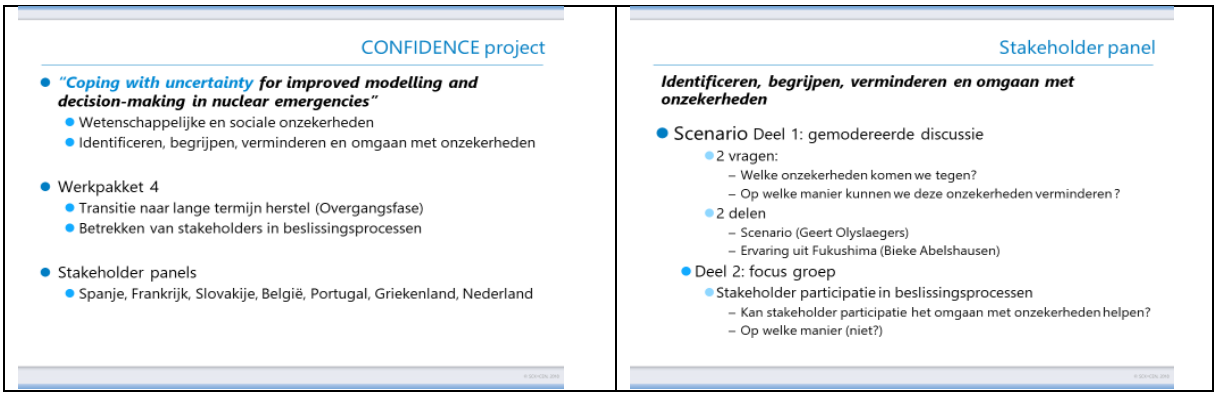


Fig. 8 Introduction to Belgian stakeholder panel (Dutch)

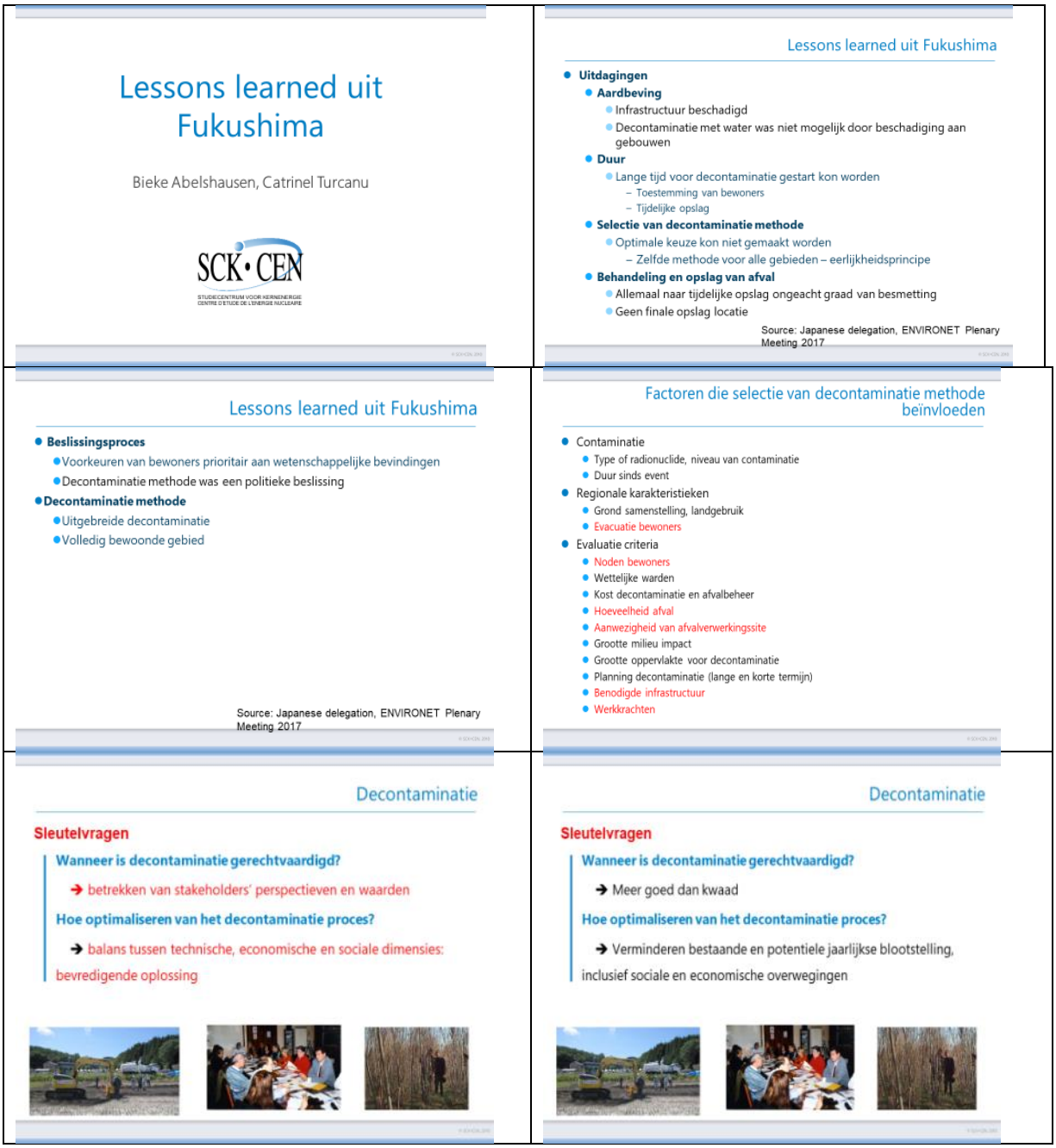


Fig. 9 Belgian Stakeholder panel - Lessons Learned from Fukushima (Dutch)

3 Composition of panel (participants)

Invitations were sent to several organisations, from civil society organisations, to regulators, emergency actors, environmental organisations, and regional and local authorities.

The final participants to the workshop are listed below. Some stakeholders could not participate to the workshop, but sent the completed questionnaires (Hans De Neef, coordinator CBRNe centre of the Belgian crisis centre; Sven Boden, Decommissioning and decontamination of SCK-CEN; An Fremout, head of health protection of FANC; Benoit Lance, ENGIE; Christophe Vincart, Department of Defence(Replaced by Helmuth Peeters)

Table 3 Composition of the panel

Province of Beveren	Yves d'Eer	Emergency planning Beveren
Federal Agency for Nuclear Control (FANC)	Christian Vandecasteele	Radiological expert, participant in the drafting of the IAEA document on the management of the transition phase
	Yannick Kerckx	Emergency Plan coordinator, measurement cell
	Lodewijk van Bladel	Senior Expert Radiological Protection
NIRAS/ONDRAF	Peter de Preter	National agency for radioactive waste and enriched fissile materials
MONA (partnership for LILW waste disposal, Mol)	Mark Loos	Member of the working group on emergency planning of MONA, STORA and NIRAS/ONDRAF
SCK•CEN	Johan Camps	Radiological expert
Department of defence	Lt. Helmuth Peeters	Laboratory for Radiological and Nuclear Protection

4 Results analysis and main issues identified

4.1 Survey results

The survey results presented to the participants are illustrated in **Fig. 10**. It is interesting to note that for the respondents to the survey the expected level of influence on decision-making matches in most cases the desired level of influence. Almost all criteria mentioned in the survey are deemed to have high importance for future recovery after an accident. The notable exception is waste management, although the experience after the Fukushima accident showed this to be a critical issue linked to the decontamination strategy for affected areas. The management of consumer goods was also considered overall to be less important.

Among the potential challenges, stakeholder engagement, communication with the affected population, availability of resources and acceptability of recovery strategies were unanimously considered as highly important in the transition phase. Opinions were divided with respect to the importance in the transition phase of legislation issues and the compensation of affected persons. Compensation was however revealed as a critical point in previous research on post-accident recovery (Turcanu et al, 2014).

Among the objectives of the transition phase, none of the ones mentioned in the survey was considered as not important. In particular, minimising the social and radiological impact to the population were unanimously considered as important.

Fig. 10 Belgian Stakeholder panel - Questionnaire results - Insights and preferences regarding the planning for recovery and the associated decision-making processes in the transition phase after a nuclear emergency

4.2 Section one – moderated discussion based on the scenario

A roundtable was done to introduce the participants and the role and function of their organization.

First the various participants presented themselves in short, as some participants had not previously met. Throughout the panel, it was difficult to make the distinction between the emergency and the transition phase, for this reason participants discussed uncertainties in relation to both.

The first uncertainty brought up by the participants relates to ***people/stakeholders needed to address both the emergency and the transition phase***. It was discussed that many people will be

needed, but not everyone can be obligated to participate in the response and recovery actions. Levels are set in the emergency plan concerning workers' doses, but the question still remains who will carry out the actions: "*cf decree: if it cannot be proven that it is below 20 mSv, they have to be volunteers; below 20 mSv they do not have to, but if somebody refuses, they cannot be obliged.*"

This indicates that willingness to participate by both emergency responders and persons involved in decontamination practices is an uncertainty that complicates decision-making processes. The willingness for participation should therefore be taken into account when making decisions on for example decontamination strategies as an unwillingness might make the specific strategy unfeasible to execute.

A related uncertainty is whether ***"people [in the affected areas] will want to take the actions" [recommended by authorities].*** An example of a survey in Mol-Dessel with MONA showed that some emergency actions will not be taken (e.g. leave the children at school). As a result from this survey, this measure was not included among the urgent actions in the latest information campaign (March 2019). An example from a different emergency situation showed a similar uncertainty. "*Also in classical contamination situations e.g. chlorine fumes in swimming pool, children were gathered and parents had to keep away, but you cannot keep away a mother that wants to see her child, and also in large evacuations e.g. in 2009 exercise we see there are challenges.*" As a solution, social marketing methods to make people aware of emergency actions are proposed.

Even though this specific uncertainty is framed within the emergency phase, similarities can be found with ***willingness to return*** after temporary relocation, which is considered a psychological problem. One participant argued that when lifting the evacuation countermeasure "*we should then trust that people will want to return; we have seen this [problem] in past cases; it is a psychosocial problem".* A solution that was brought forward during the panel relates to addressing not merely physical health issues but also psychological health issues in the transition phase. Already in the initial response to the introduction on the transition phase as delineated in Belgium, mental health should be a separate objective of the transition phase in order to precautionary address uncertainties related to willingness to return. Additional, making mental health as a separate objective would also address issues such as **unwillingness of people to house people** from the affected areas as they are relocated, as was the case when children from Chernobyl were housed in Belgium (see 2.1.1.1). Furthermore, placing importance on mental health might also address issues such as **trust in governments and science, reduction of stress, willingness to participate and work in contaminated areas** (see 4.3)

An additional uncertainty that is brought forward relates to ***the inclusion of stakeholders in the preparedness phase.*** According to the Belgian emergency plan, a stakeholder network needs to be prepared in the preparedness phase. One participant argued that "*participation of communes [in the transition phase] is easier than in the preparedness phase"* and mentioned that some emergency actors are concerned that being confronted with discussion about emergency situations will raise anxiety among the population.

A second uncertainty relates to **scientific uncertainty**. One participant argued that "*most decisions will come based on the model calculations, and there uncertainty can be also factor 1000 and we must decide based on this*". However the argument is brought forward by another participant that "*it is not acceptable to have such large uncertainty in the transition phase*". However, even if there is a general view on contamination, the uncertainty remains whether there is **enough knowledge to take decisions**? For example: "*contamination of food – is not only dependent on the deposition, but also soil, plants, etc. and there are great uncertainties; and we have to decide if relocation is necessary*".

Uncertainty exists on whether a **balance can be found concerning the timing of decisions**. "*Difficult balance: most options are efficient if done rapidly, but on the other hand you want to have an evaluation as good as possible: timing is a large uncertainty; you want a good inventory of contamination in details, but also what options will still be effective; what the best option is, is not clear".* The example was given that "*concerning resettlement you can decide faster; for other decisions, e.g. different food consumption you need more time".*

In response to the aforementioned uncertainties, the following solutions are discussed. For instance, in relation to the radiological assessment, while *"Transition has many unknowns",* there are *many measurements* necessary and *"capacity is often an issue",* a campaign could be carried out in the preparedness phase to *get "an idea […] how this has to be organized?"* Drawing on the experience from Fukushima, it is argued for instance that procedures are needed for fast measurements*, "as in Fukushima where they have developed technologies for rapid measurements for food."*

Besides the technical/scientific uncertainty, the following lay-uncertainties were mentioned, connected to daily life key questions of affected people, which go much broader than the experts' uncertainties: "*is there an **acceptable level of contamination**; **who will pay for compensations**? **How will I survive with my family if I cannot go in that area, I don't have my house**?*" The question is raised whether such issues can be anticipated and addressed in the preparedness phase: *"Are there things we can prepare now and inform people what will happen, e.g. compensations? It is a problem, you cannot answer now; there exists some budget that can be used for such situations, but it cannot cover all operations.*"

4.3 Section two – moderated discussion based on lessons learned from Fukushima

One participant mentioned that a fundamental uncertainty "***is the fact that we do not know what the effect is at low doses"*** *(e.g. 10 mSv) due to limitation of scientific methods.* Concern was expressed that this key uncertainty *"will trigger a race towards very low [dose] levels"* and will result in *high risk perception* and detrimental effects to health*; e.g. people do not go for a walk in the forest because of few nSv and stay at home [instead]."* This "race to bottom" is deemed to additionally increase uncertainty about **willingness to return.** Related to this is the potential uncertainty resulting from setting **limits** based on purely radiological criteria: "*E.g. in this street people can return, in another not?"* In relation to communication with affected population on such issues, one participants mentioned based on their *experience* with chemical incidents*,* that "*local authorities are trusted peers/partners",* as well as, pharmacies and house doctors.

As solution, putting mental health in the objectives of the transition phase, should be considered, as discussed before (see 4.2).

A second uncertainty relates to finding **an equilibrium between economic, social and ethical aspects:** "*how will decision-making be organised? How do you give all those people a voice and influence on how different zones are approached? How will this be done concretely*"?

A third uncertainty is related to the **difference between communication and stakeholder involvement**; "once the acute phase is done, you cannot have only one-way communication; there have to be large discussions; it disturbs me to see this differentiation."

The aforementioned solution of a campaign in the preparedness phase might address this uncertainty (see 4.2).

A fourth uncertainty relates to **mental health**. For example "*how to lower the stress level; in Chernobyl more deaths because of stress than radiological effects", "once this happens, every illness will be (psychologically) linked to this, and there will always be this uncertainty.*"

A fifth uncertainty relates to **trust** and **willingness to participate**: "trust in government and science is very important; if you start stakeholder engagement after the alarm phase, then you will get stakeholders that organise themselves to work against the government; if you start this in the preparedness phase, the situation will be easier; whether the stakeholder associations come or not, you do not control this". Additionally, it is difficult to get people to participate in the preparedness phase: "*You can have an ideal model, but the intrinsic difficulty is that it is about unlikely situations that we hope will it never happen, and the people will not spend this time and effort to prepare themselves thoroughly".*

A sixth uncertainty is related to waste including the **type of waste**: "*Will it be surface conditioned disposal? If there is a severe accident, then we are outside the system; we have difficulties to prepare; there will probably be enormous quantities of mostly low level waste apart from waste at the site. We go more in the direction of a well-engineered landfill, there are plans (designs) for this",* **the temporary storage of waste:** "*There will be also a decision on the site, where will we bring this? We need also a temporary disposal; in Goiania it lasted a long time until they found a place for the temporary storage, this has to be prepared in advance".*

A seventh uncertainty relates to people's ***willingness to work in the contaminated areas***. "*In Fukushima some older workers from the NPP have offered volunteers to help; will this be the same here? There is a big difference in the concept of life in Japan and Belgium. I hope this will be the same here as well, that there will be citizen solidarity".*

5 Conclusions and Perspectives

The main objective of the panel was to exchange views and experiences related to the scientific and societal uncertainties in the transition phase between a nuclear emergency situation and the recovery phase. The aim was to identify and analyse how decisions are taken, what issues are at stake, and how societal and scientific uncertainties influence decision-making.

Firstly, it is noteworthy that answering the question how decision will be taken in the transition phase is challenging; the question concerning finding a balance between various perspectives, willingness to participate, and timing remains. Participants in the panel however have an in-depth understanding of the challenges and uncertainties that are prominent in the transition phase and possible solutions to address these issues.

An important insight from the discussion is that most uncertainties, with the exception of scientific uncertainties, can be addressed starting in the preparedness phase creating a solid ground to build on during the transition phase. Two main solution emerged from the discussion: a campaign on how decision-making in the transition phase can/should be organised and mental health as separate objective of the transition phase. The campaign will address the following uncertainties: people/stakeholders needed to address both the emergency and the transitions phase (the inclusion of these stakeholders in the preparedness phase), find a balance concerning the timing of decisions, an equilibrium between economic, social and ethical aspects, difference between communication and stakeholder involvement, waste (type of waste, the storage of waste).

In the preparedness phase, mental health issues can be researched and precautionary addressed to build a solid ground to achieve the objective of mental health in the transition phase. Addressing mental health both in the preparedness and transition phase will allow for addressing the following uncertainties and thereby improving the decision-making process in the transition phase: willingness of people to take action, amount of knowledge needed to take decisions, willingness to return, acceptable level of contamination, lay uncertainties (who will pay me as compensations, how will I survive with my family if I cannot go in that area, I don't have my house), stress, trust, willingness to participate in preparedness, willingness to work in the contaminated areas.

6 References

Charnock T. , Andersson K., Montero, M. and Trueba C. (2018). D 9.20 - Addressing the uncertainties in urban/inhabited scenarios. Deliverable of the CONFIDENCE CONCERT Project. http://www.concert-h2020.eu/en/Publications

Montero M, Trueba C. (2018). D 9.18 - Methodology design of the multi-method consultation process. Deliverable of the CONFIDENCE CONCERT Project. http://www.concert-h2020.eu/en/Publications

Turcanu C., Olyslaegers G., Camps J., Rossignol N. (2014). Report of the First Meeting of the Belgian Stakeholder Panel. FP7 project PREPARE. SCK•CEN-ER-280. Belgian Nuclear Research Centre SCK-CEN.

B-02. Report of French National panel

Authors: Vanessa Durand (IRSN), Mélanie Maître, Sylvain Andresz, Thierry Schneider, Pascal Crouail (CEPN) and Sylvie Charron (IRSN)

Ref. Report: CONFIDENCE-WP4/T4.2.1-R03; CONCERT D 9.22 Part B-02. v1.0 Final

Summary

In the context of post-accident management following a nuclear accident (emergency and transition exposure situations), it is important to understand the main uncertainties which will play a key part in the decision-making process. The main goal of the work is to identify and evaluate these uncertainties during the preparedness phase with their interactions with decision processes. The French team (IRSN/CEPN) organized 2 panel meetings during 2018: i) in June focused on the emergency phase. The objective was to understand and evaluate how and on which uncertain elements a decision maker is basing her/his understanding and taking decisions in such a context; ii) in October, the panel focused on the transition phase. For this second panel meeting, the aim was to assess the influence of prior decisions taken during the emergency phase over the medium to long term decision process taking into account the uncertainty associated with the emergency phase. The French national panel was composed of several experts of the institutional French organisations and authorities. This panel is representative of some decision makers at different levels (local and national) of the French response system. The panel was focussed on two protective actions: evacuation and temporary relocation of populations and restrictions on consumption and distribution.

The methodology used for the two panel meetings was to consider inherent uncertainties about the real situation: for the first panel meeting, WP1 of CONFIDENCE outputs have been presented with other maps which showed challenges of the territory concerned. For the second meeting, a synthetic map of “real measurement data” provided by WP1 from simulated airborne monitoring has been used to show the difference between forecast data and measurement. For each panel meeting, several issues have been also provided to the panel.

Overall, these meetings resulted in the following findings: i) the temporal dimension (evolution of zoning with time) is confirmed to be very useful for decision-makers; ii) there is a need for different types of information to help decision-making (geographic information socio-economic issues of the territories, etc.) and not solely radiological impacts data; iii) the transition between emergency and post-accident phases (for all decision-makers) is critical; iv) the decisions would also be political and taken in high levels (but on a common basis). Beyond these elements, these meetings allowed to highlight several types of uncertainties associated with the production of information and associated with the use of information (related to the decision itself or to the governance, social and economic uncertainties, related to communication and to the evolution of the situation).

Table of Contents

1 Objectives and Scope

The French post-accident doctrine[4] in the event of a nuclear or radiological accidents, proposes several different criteria, which should be taken into account by decision makers for ordering the emergency countermeasures: temporary sheltering, iodine tablet distribution and intake, evacuation, food consumption and production restrictions, etc. These decisions, despite they are taken during the emergency phase, will inevitably impact the medium- (transition phase) and even the long- term (late phase). It was confirmed by the feedback experience from the Fukushima accident, where the return of the evacuated population is very limited, and where confidence about the quality of formerly restricted food products is long to recover.

In the context of post-accident management following a nuclear accident (emergency and transition exposure situations), it is so important to understand the main uncertainties which will play a key part in the decision-making process. The main goal of the CONFIDENCE WP4 French work was to identify and evaluate these uncertainties during the preparedness phase with their interactions with decision processes. To provide some answers, the French work focused on the emergency phase and on the transition phase. The objectives of the French work were:

- To analyse the implementation of the criteria proposed in the French post-accident doctrine in the decision-making process and identify the necessary data and the uncertainties that may arise and that should be considered;
- To assess if decision makers take into account uncertainty inherent to modelling in their decisions and if they do, to which extent;
- To present to, and discuss with the decision makers how the use of some criteria have impacted the lifted of evacuation order and the return of evacuated/displaced population and the restart of consumption/production of local foodstuff after the lifting of evacuation and restriction orders in Japan (post-Fukushima accident);
- To assess if decision makers take into account other types of uncertainty (e.g. social, economic) in their decisions and if they do, to which extent;
- To assess the relevance to present to decision-makers other types of model outputs and/or projection of consequences (e.g. probability map of exceeding some criteria or reference levels, maximum distance for reaching a given reference level +/- the uncertainty, map of local social/economic/cultural vulnerabilities, etc.);
- To evaluate what are the uncertainties which are the most important – for local stakeholders – and how they should be taken into account in the decision-making process (especially during the emergency and transition phases) in order to mitigate potential adverse consequences in the longer term.

2 Methodology

In such a context, the French team (IRSN/CEPN) have decided to organize a French stakeholder panel taking into account proposals made by CONFIDENCE WP1 team, that intends to provide a set of maps

[4] The French national doctrine in the event of a nuclear accidents is presented and detailed in the two following documents: the *National Response Plan [in the event of] Major Nuclear or Radiological Accidents* issued in February 2014 by the General Secretariat for Defence and National Security, and *Policy Elements for Post-Accident Management in the Event of Nuclear Accident*, issued by the Nuclear Safety Authority in October 2012.

for several forecast periods - output from dispersion simulation models for a reference accident scenario - which present the probability of exceeding different threshold criteria[5] (see Figures 1 and 2 below, as an example. The coloured zones are areas where the simulation forecasts show a risk of exceeding the threshold).[1]

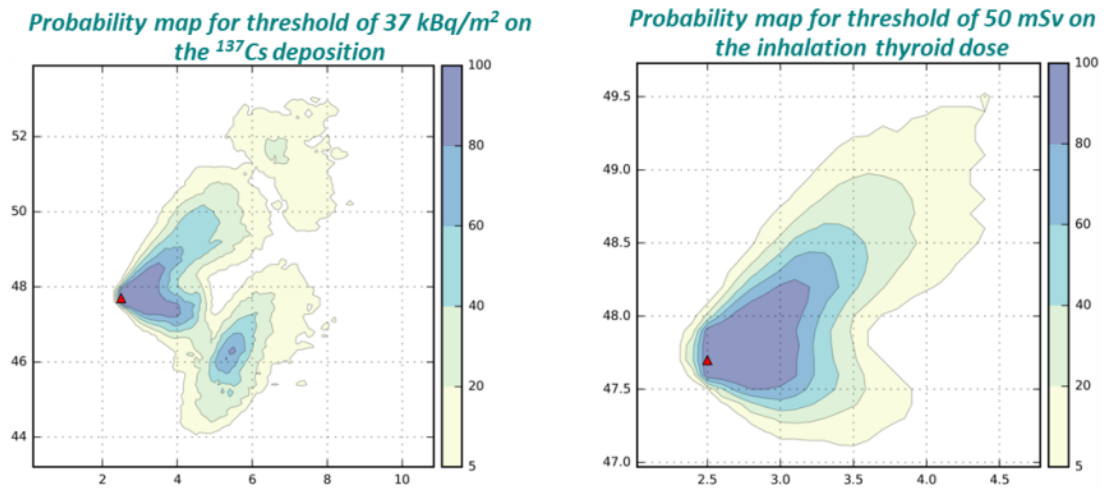


Figure 1: Example of CONFIDENCE-WP1 outputs [1]

The CONFIDENCE-WP1 provided so:

- Maps of probability of threshold exceedance, for reference levels
  - Deterministic simulation: a single contour shows the impacted area
  - Set of simulations: probability maps of threshold exceedance (computed by counting the number of simulation within the ensemble that predict a value above the given threshold at a certain point) = probability that a given zone is contaminated above a given level.
- Maximum distance for a reference level +/- the uncertainty;
- A synthetic map of "real measurement data" from simulated airborne monitoring has been used to show the difference between forecast data and measurement (zones not initially included in the decision, etc.).

[5] For example :

- 50mSv effective dose (French reference level for evacuation) for 7 days
- 50mSv inhalation thyroid dose (IAEA and French reference level for iodine intake)
- 37 kBq/m² Cs^{137} deposition (post-Chernobyl level)
- 555 kBq/m² Cs^{137} deposition (post-Chernobyl level)

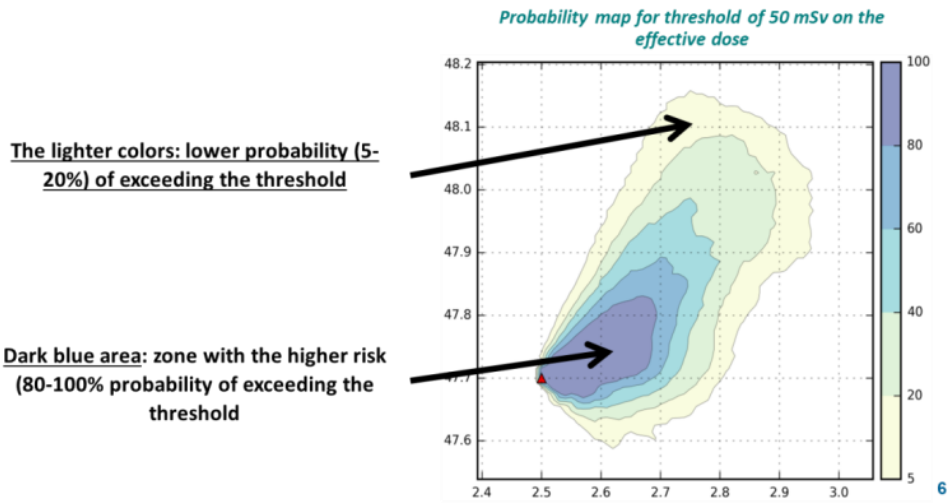


Figure 2: Explanation of CONFIDENCE-WP1 outputs

The French panel especially investigated two types of criteria, -those established and used to decide to evacuate part of the affected population, and -those for ordering the restriction/ban of (local) food consumption and distribution. For these two types of criteria, the objectives were to evaluate the consequences of the decision and its associated uncertainty for the long-term management of the situation. To illustrate and further discuss the importance of uncertainty with decision-makers, CONFIDENCE WP4 (IRSN) partners provided them with maps taking into account the population density (in the concerned areas) and agricultural productions (in the areas concerned by deposits, see Figure 3).

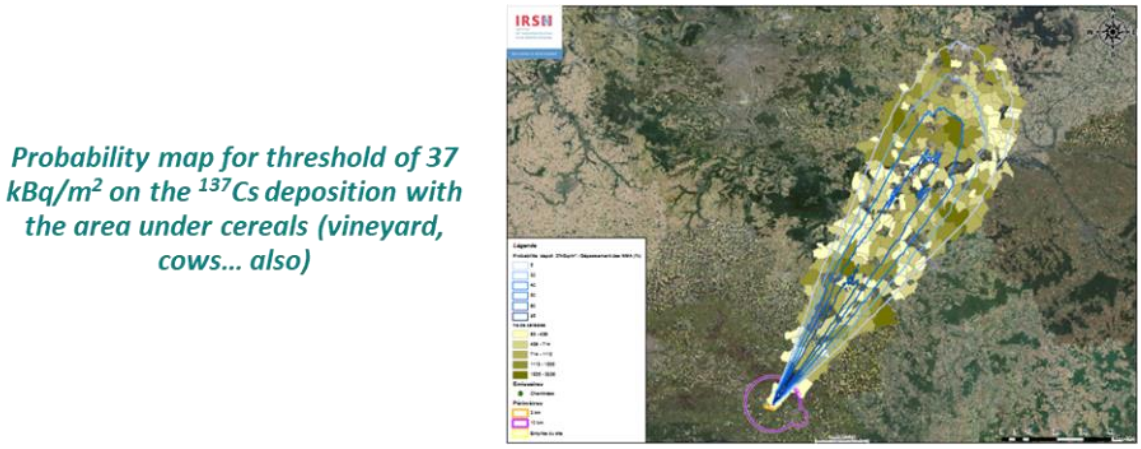


Figure 3: Example of map which presents the issues of the territory

2.1 Scenario and timeframe of interest

The French team organized two panel meetings in 2018: i) in June, the work focused on the emergency phase. The objective was to understand and evaluate how a decision maker is basing her/his understanding and taking decisions in such a context of uncertainties; ii) in October, the panel focused on the transition phase. For this second panel meeting, the aim was to assess the

influence of prior decisions made during the emergency phase over the medium to long term decision process: how could prior knowledge of these impacts have influenced the initial decision-making? What information would have been needed to facilitate and strengthen their decision?

For each of the two discussions (evacuation/relocation and food restrictions), a scenario was prepared and given to the participants. The scenario used is a fictitious nuclear accident on reactor no. 2 of the Dampierre-en-Burly nuclear power plant in the French department of Loiret (45) occurring on Tuesday, May 1, 2018 at 10:00 a.m. The source term comes from the scenario identified in CONFIDENCE-WP1 and, the meteorological data used come from the European project HARMONE.

The participants had to think about the decisions to be made regarding the evacuation of the population and the food restrictions (consumption and/or distribution) to put in place, while anticipating:

- the immediate consequences (difficulties in the implementation of the decision, socio-economic vulnerabilities of the affected territory, demographic, geographical context, transport issues, etc.);
- the long-term consequences (possibility and difficulties induced by the lifting the order of evacuation and the return of the evacuated populations, removal of non-evacuated populations, removal of bans on the consumption and/or distribution of locally produced food, restart of agricultural activities).

2.1.1 First panel meeting

Concerning the scenario, radioactive releases into the environment are expected within 24 hours (+/- 6h). The first dose evaluations are carried out by the experts.

In addition to the scenario information, participants thus have an "Evacuation" file built up with maps presenting the first dose assessment, taking into account the fictitious synthetic uncertainties that have been realized for the scenario:

- a first map provides the areas concerned by the probability that the effective dose exceeds the evacuation criteria used in France (50 mSv);
- the population (number of inhabitants) is presented on a second map;
- public buildings also appear on another map;
- a last map presents the areas concerned by the probability that the cesium-137 deposits exceed 555 kBq/m² (area within which the populations were likely to be relocated as a result of the Chernobyl accident).

Furthermore, participants have also in hands a “Food restrictions” file built up with maps presenting the assessment of the first deposits, taking into account the fictitious synthetic uncertainties that have been realized for the scenario:

- a first map gives the areas concerned by the probability that the cesium-137 deposits exceed 37 kBq/m² (one of the criteria used following the Chernobyl accident, leading in particular to the monitoring of certain foodstuffs) - zone within which radiological controls will be established in foodstuffs;

- the agriculture of the territory around Dampierre-en-Burly is provided on a second map - the data of the agricultural products come from the PAC (Common Agricultural Policy) declaration;
- maps with particular agricultural issues in the municipalities concerned by the aforementioned zones are also provided: number of dairy cattle, number of hectare of cereals and number of hectares of vines (Champagne, a very symbolic vine product) - the data come from the general agricultural census data of 2010;
- the characteristics of the agricultural environment around Dampierre is also included in the file. It specifies the sensitivity of the agricultural productions (vegetable and animal) present on the territory.

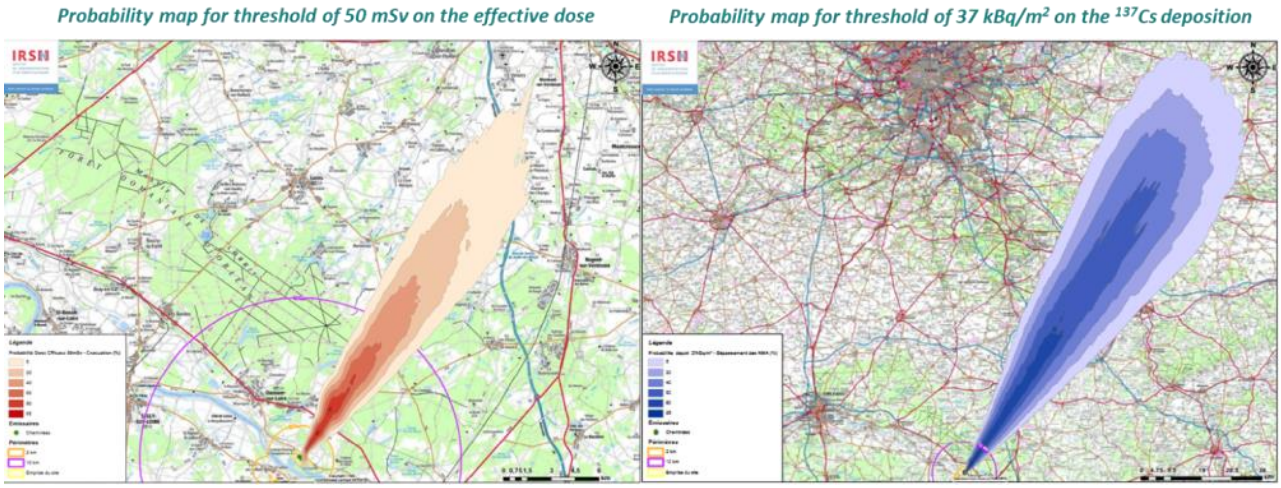


Figure 4: Example of maps provided to the participants

2.1.2 Second panel meeting

As mentioned above, the aim of this second panel meeting is to identify and to evaluate the uncertainties that come into play in the decision-making process during the transition phase on two important topics: the temporary relocation of populations and food restrictions (consumption and distribution). Therefore the objective for the participants was to evaluate the influence of decisions made during the emergency phase over the medium-long term phase.

For this second meeting, we considered the starting point to be few days after the end of the radioactive releases.

Airborne measurement campaigns were conducted and provided reliable zoning. The relocation zone was carried out by the experts. As for the first panel meeting, beyond the information on the scenario, each participant thus had two files in hands named "Relocation" and “Food restrictions” both of them built up with maps presenting the affected areas zoning from the results of on-the-ground measurements and taking into account the uncertainties inherent to the measurements. The “Relocation” file includes:

- a first map providing the municipalities concerned by the emergency decision about the evacuation during the first panel meeting (effective dose exceeding the evacuation criteria

used in France (50 mSv). It has to be noted that the municipalities of Dampierre-en-Burly and Lion-en-Sullias were totally evacuated as well as some inhabitants of the municipalities concerned by the atmospheric plume;

- a second map providing the municipalities concerned by the relocation zone (based on airborne measurement campaigns; the criteria used in France is external dose ≥ 20 mSv per year) ;
- the population (number of inhabitants) is presented on the same map;
- a map presenting the zone that will be concerned by the sustainable relocation i.e. where return may be difficult (evaluation made by the experts taking into account the radioactive decay only).

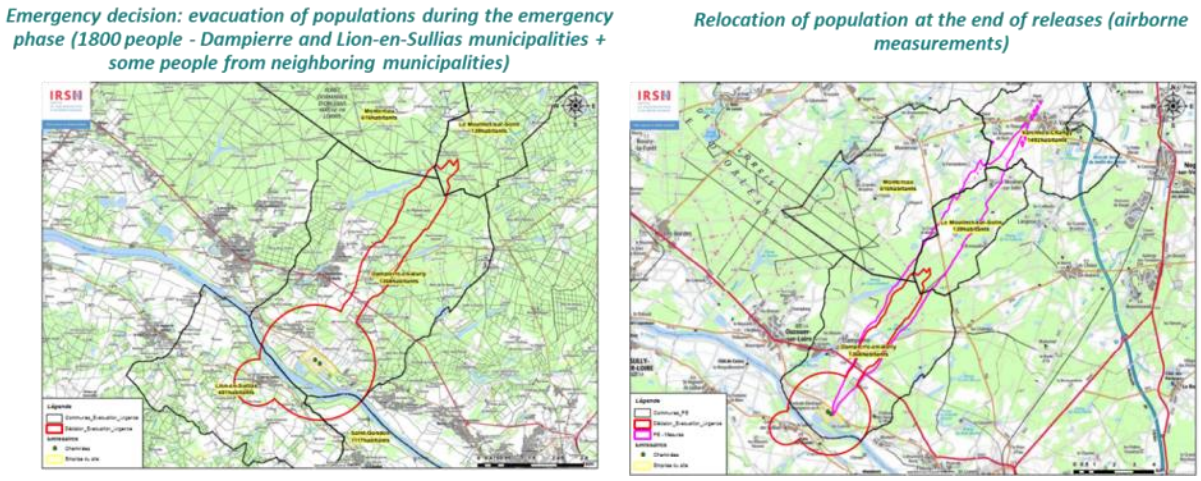


Figure 5: Example of maps provided to the participants during the second meeting ("Relocation" file)

In the "Food restrictions" file, participants have the following information:

- a first map provides the municipalities concerned by the restriction on food consumption established during the emergency phase (on the largest emergency perimeter, that in which the decision makers recommended the uptake of stable iodine tablets);
- a second map provides the municipalities concerned by the "territorial surveillance zone", based on the measurements and with the radiological criteria used in France (exceeding the maximum permissible European levels of foodstuff contamination);
- three other maps show the radiological contamination of some foodstuffs (cow's milk, beef and leafy vegetables) for cesium-137 and iodine-131 at two different moments (40 days and 6 months after accident).

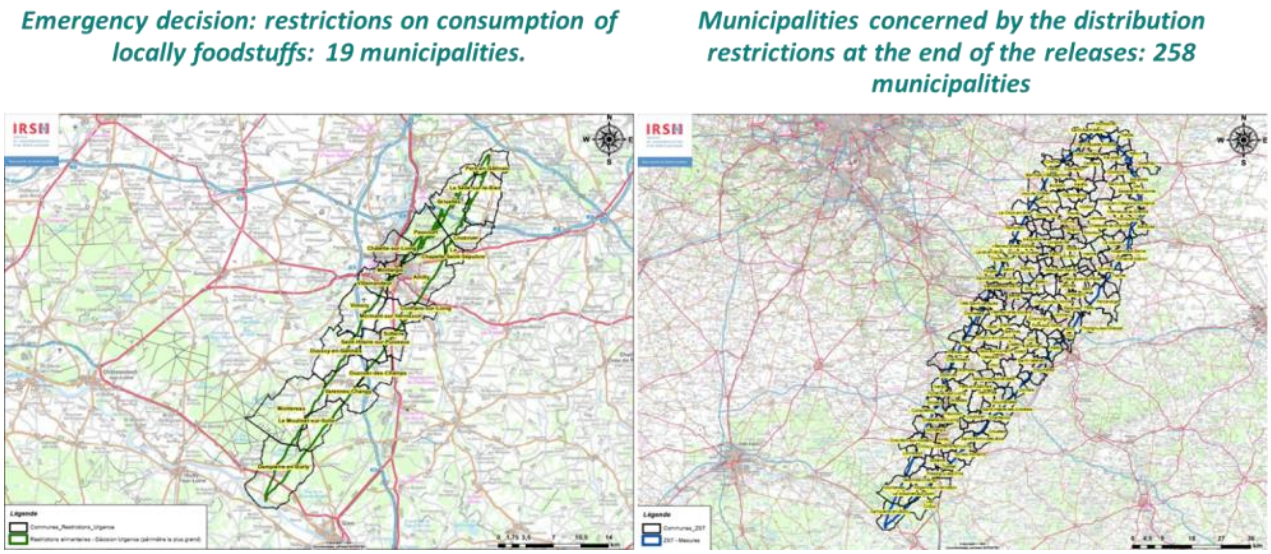


Figure 6: Example of maps provided to the participants during the second meeting ("Food restrictions" file)

2.2 Organization and schedule of the meetings

The time schedule of running the WP4 French panel is given below (see Figure 7).

Figure 7: Time schedule

3 Composition of the panel (participants)

The French national panel was composed of several experts of the institutional French organisations and authorities:

- Nuclear Safety Authority ,
- the Institute for Radiation protection and Nuclear Safety,
- Directorate General for Food,
- Consumer Affairs and Fraud Control,
- Regional Health agency,
- Departmental Directorate for the protection of population,
- Retired Prefect and retired mayor,
- Interdepartmental Civil Defence and Protection Service,
- Chamber of agriculture,
- Firefighter forces,
- Local Liaison and Information Committees.

This panel is representative of usual decision makers involved at different levels of the French response system either as actors at the early stage of emergency response or as observers in post nuclear accident crisis centre or actors in the transition phase (e.g. providing information to the population).

4 Results analysis and main issues identified

To summarize, these meetings resulted in the following findings: i) the temporal dimension (evolution of zoning with time) is confirmed to be very useful for decision-makers; ii) there is a need for a lot of information to help decision-making (geographic information socio-economic issues of the territories, etc.) and not solely radiological impacts data; iii) the transition between emergency and post-accident phases (for all decision-makers) is critical; vi) the decisions would also be political and taken in high levels (but on a common basis).

Beyond these elements, these meetings allowed to highlight several types of uncertainties associated with the production of information and associated with the use of information (related to the decision itself or to the governance, social and economic uncertainties, related to communication and to the evolution of the situation) – see the part after (part 5).

4.1 Methodology proposed to organize and classify the uncertainties raised by the French panels

During the panel meetings, a large number of uncertainties associated with the protective actions under discussion have been raised: in total, more than 50 uncertainties for evacuation/relocation and more than 30 uncertainties for food restrictions.

These uncertainties are dealing with very different themes, so in the panel meetings' minutes, the uncertainties have been listed and dispatched according to their theme in four tables. It is now proposed to synthetize these in two tables:

- One table presenting all the uncertainties linked with evacuation/relocation, and putting in regards the uncertainties (also dispatched by topics) raised by panel meeting no.1 (emergency phase) in one column and by panel meeting no.2 (transition phase) in another column. This refers to the Table 1 below.
- The other table presenting all the uncertainties linked with food restrictions, and putting in regards the uncertainties (dispatched by topics) raised by panel meeting no.1 in one column and by panel meeting no.2 in another column. This refers to Table 2 below

This methodology provides an exhaustive view of all the uncertainties raised by the two meetings and organize them by topic and also by time (emergency vs. transition). Using this two tables and this format allow for comparison and further analysis.

How to classify the uncertainties? – 'Uncertainties' can be from different form, type and nature and so it might be worthwhile to also classify (to some extent) all the uncertainties raised by the panels. However, many classifications of uncertainties can be found in literature and there is no common agreement on a classification[6].

- It is proposed to refer to and use the classification introduced by *S. French et al*. in *The Various Meaning of Uncertainties*[7] [2].
- It is also proposed to limit here the classification to the internal vs. external uncertainties (see French and al.). Using this classification allows to differentiate the uncertainty associated with the production of information (external) and those associated with the use of the information (internal). External uncertainties will be marked by a "E" in the Tables and internal with an "I".

4.2 The uncertainties raised by the French panels

The tables introduced in § 4.1 are presented down below (Table 1 for evacuation/relocation and Table 2 for food restrictions). The type of uncertainties (internal or external) is made apparent in a dedicated column.

[6] To such an extent than: "*Divergent, overlapping uncertainty classifications can be found in literature, the typology varying remarkably depending on the context and scope*" (L. Uusitalo et al, Environmental Modelling & Software **63** (2015) 24-31).

[7] 4th NERIS Workshop 2018. https://eu-neris.net/activities/workshops/dublin-2018.html

FROM panel meeting no. 1 DEBATE			FROM panel meeting no. 2 DEBATE		
Decisions	**Uncertainties**	**Type of uncertainty**	**Decisions**	**Uncertainties**	**Type of uncertainty**
TOPIC: Evacuation strategy timely phased with the potential releases			**TOPIC: Relocation of the population according to the zoning and in concertation**		
Strategy for evacuation	• Will this strategy for evacuation, decided at local level, be validated by higher authorities? • Will higher institutional actors/decision-makers change this strategy and implement a new one? • Taking into account the "Safety Contingency Plan" at communal level, is it possible that mayors decide evacuation by themselves?	I I I	**Strategy for relocation**	• Will the decisions-makers at local level really able to incorporate the decisions taken at a higher level (Prefecture or even at national levels) in their decisions? • What will be the reactions of the individuals that will be forced to relocate? • How will the individuals accept and respect the decisions we take? (ex. self-evacuation)? • What are the supporting measures for the relocated individuals? And for those who could return after their evacuation? • What are the socio-economic impacts for the affected territories? • How to ensure the safety of the dwellings and goods left behind by the relocated population (on the long term)?	I I I I I I
Probability map (50 mSv equivalent dose)	• What is the level of reliability of the probability maps? • To what extend can the situation on the nuclear plant evolve (deteriorate)? • What if the release occurs during a longer time frame? • How do we take into account the meteorological forecast (wind)?	E E E E	**Dosimetric criteria (20 mSv/y)**	• To what extent will the criteria be understood and accepted by the population? • Should we consider other criteria (geographical, socio-economic)? How to put into balance the different criteria?	I I
Zoning for evacuation ('high probability zone', > 60%)	• What is the comparison of these zones with the situation in the field? • Where is the acceptability level? • Is it possible to merge the field measurements with the estimation from the model? • How long before the field measurements are available?	E I E E	**Zoning for relocation**	• What is the level of reliability of the probability map (uncertainties, level of conservatism?) • What will be the radiological measurements performed at the boundaries of the zoning for relocation? • How to ensure that the boundaries of the zoning for relocation actually protect the individuals living nearby (but beyond)? • What will be the behaviour of the individuals living close to the boundaries?	E I I I
Evolution of the zoning	• What will be the evolution of the situation in the next hours? • Is it possible to anticipate now zoning at far distance from the nuclear plant that will be concerned by relocation?	E E	**Evolution of the zoning**	• What will be the evolution of the zoning for relocation in the next months? • What is the level of reliability of this evolution?	I E
TOPIC: Implementing the strategy			**TOPIC: Implementing the strategy**		
Mobilization of buses, military forces and law enforcement (ORSEC plan)	• How long does it take to mobilize enough buses? • What to do if the bus drivers use their right to withdrawal?	I I	**Mobilization of the of the actors and managing the relocation**	• How to manage and protect the actors in charge of the relocation? • What is the strategy if these actors use their right to withdrawal?	I I

FROM panel meeting no. 1 DEBATE			FROM panel meeting no. 2 DEBATE		
Decisions	**Uncertainties**	**Type of uncertainty**	**Decisions**	**Uncertainties**	**Type of uncertainty**
Implementing concretely the evacuation	• What about the retro-planning (are we able to start evacuation at 19h00 and having communicated about the strategy for evacuation before)? • To what extend does first responders/the actors understand the evacuation procedures? • Will the agenda and timing be followed, taking into account the uncertainties? • Will the military be able to contain any potential panic? • What are the options at our disposal if some first responders/actors (e.g. bus drivers) use their right of withdrawal?	I I I I I	*Topic not raised by the panel*		
Collateral impacts of the strategy	• What will be the reaction of the local population + the participants to the festival (occurrence of self-evacuation/shadow evacuation)? • How will the livestock be manged during the evacuation? • Will it be possible to displace the livestock from one place to a safe place? • How will the safety of the evacuated dwellings be ensured?	I I I I	*Topic not raised by the panel:*		
TOPIC: Communication			**TOPIC: Communication/providing information**		
Media and mode of communication	• What are the available media of communication (intended for the professionals / for the public)? • Who to warn first? • How long does it take to relay the evacuation order?	I I I	**Media and mode of communication**	• Besides traditional media (TV, radio), what can be done to limit the spread of rumours and broadcast reliable information on the social media? • When should we communicate about relocation? When the results of the model are available or after a few days when the zoning is well established based on field measurements?	I I

Broadcasting the messages	• What are the best messages given the circumstances?
	• Which zones should be alerted/which should not?
	• Will prior communication (by social media, traditional media, etc.) able to broadcast the "right" messages and prevent panic?
	• Will the strategy (which is phased in time with the releases i.e. people are not immediately evacuated) be understood and accepted?
	• Will the iodine thyroid blocking intake instructions be followed?
		I
		I
		I
		I
		I
			The messages	• How to adjust the message to the situation of the individuals?
				  • What information are clear and concrete enough to reassure on the effectiveness of protective actions and provide support to the individuals according to their situation:
				  ○ Those living at the boundaries of the zoning for relocation (results of the field measurement? explaining the criteria?)
				  ○ Those evacuated on the long term (for how long?)
				  ○ Those who can come back?
				• How to outreach the general population and the hosting territories in particular, and not generate stigmatization of the relocated individuals and affected territories?
					I
					I
					I

Understanding the messages	• To what extend does the population understand the evacuation procedures and the doctrine? • How will the messages be understood?	I I	**Understanding the messages**	• To what extent will the messages be understood? In particular for the individuals living outside the zonings?	I
TOPIC: Taking into account some specific populations					

FROM panel meeting no. 1 DEBATE			FROM panel meeting no. 2 DEBATE		
Decisions	**Uncertainties**	**Type of uncertainty**	**Decisions**	**Uncertainties**	**Type of uncertainty**
Evacuation of specific population (elders, vulnerable)	• Is it necessary to evacuate elders and vulnerable populations immediately? Is it not possible to wait for the situation to be stabilized and suitable solutions for these individuals found *before* evacuating them (so to avoid traumatism/over-burden)?	I	*Topic not raised by the panel*		
Topic not raised by the panel			**TOPIC: Managing the situation and considerations on the long term**		
			Support of the individuals	• What to do to support the relocated individuals when they arrive in the hosting territories? How to help them prepare the come back?	I
				• What to do for the non-relocated individuals living close to the boundaries of the zoning for relocation?	I
				• What strategy and criteria to decide the end of the relocation?	I
			Management of the affected territories with time	• What will be the socio-economic impacts on the affected territories? How to maintain an activity in theses territories over the long term?	I
				• How to adjust the strategy for relocation (and the protective actions) according to the evolution of the radiological condition?	I
				• What will be the roles and the responsibilities of decision-makers who will inherit the management of the post-accident situation?	I
			Vigilance over the long term	• How to plan the vigilance over the long term?	I
				• What are the organisations in charge of the census of the relocated/non-relocated individuals for epidemiological survey?	I
				• What measurement strategy over the long term (increasing the precision of radiological characterizations)?	

Table 1: Uncertainties and questions raised by panel meeting no. 1 (emergency) and panel meeting no. 2 (transition) during the debates on evacuation and relocation of population.

FROM panel meeting no.1 DEBATE			FROM panel meeting no.2 DEBATE		
Decisions	**Uncertainties**	**Type of uncertainty**	**Decisions**	**Uncertainties**	**Type of uncertainty**
TOPIC: Implementing food restrictions (yes/no)			**TOPIC: Implementing food restrictions (yes/no)**		
Non-consumption and non-commercialization	• Should we make a distinction between consumption and commercialization or link the two? • What will be the agricultural production sectors affected by restrictions of commercialisation?	I E	**Non-consumption and non-commercialization**	• Should we make a distinction between consumption and commercialization or link the two? • Where to put the higher protection: on food intended for commercialisation or food intended to self-consumption?	I I
Zoning for food restrictions	• Will this zoning be agreed and validated by higher authorities? • Will higher institutional actors/decision-makers change this strategy? • What strategy: an extended zoning reduced progressively with measurements ("from big to small") or a small one potentially increasing ("step by step")? • Should we not wait for the first map of contamination based on field measurements? • Should we introduce a zoning for each food production sector? • What will be the link between the zoning for evacuation and the zoning for food restrictions? • How can we adjust the perimeter with time? And based on what rationale? (Measurements?)	I I I E I I I	**Zoning for food restrictions**	• Should we really ban commercialisation and restrict consumption on the biggest zone (based on the MPLs for iodine in milk and leafy vegetables) or introduce other zoning? • Should we introduce a zoning for each food production sector? And should we relay this zoning to the decision-makers? To the concerned stakeholders (professionals)? To the population? • Should we introduce several Territorial Surveillance Zones (ZST) or implement some « specific food production monitoring zones »? • Should we simply remove the ZST?	I I/E I/E I/E
Criteria to be taken into account (Maximum Permitted Levels)	• Will the European MPLs be used in France as criteria? • What is the link between the MPLs and a health detriment (dosimetric criteria)?	I I	**Criteria to be taken into account (Maximum Permitted Levels)**	• The European MPLs are reference values used for international trade. Should we use MPLs as indicators for every food production under consideration, especially for local consumption (and including food produced in garden)? • Should we define specific MPLs for food produced and consumed locally? and can we define MPLs adapted to the end-products (those actually commercialised/eaten)?	I
Commercialisation of agricultural products and products from livestock	• What will be the socio-economic impacts on each production sectors (considering the added value of the sector and the actors)? • How to link the evolution of the restrictions with the calendars of harvest and effective consumption of the products?	I I	**Commercialisation of agricultural products and products from livestock**	• How to take care and manage food that is selling without intermediary? • Will the local producers' markets be forbidden? • How will the food restrictions be controlled and managed at the farm level?	I I I
Consumption of food produced locally	• What is the level of self-sufficiency of the population (consumption of the food produced in garden, harvest in forest, hunting etc.)	E	**Consumption of food produced locally**	• What is the sociological profile of the population? What is the level of self-sufficiency of the population • What are the products that have the higher impact (dose) when it comes to ingestion? • What is the level of exposure of the population? • And how to realistically evaluate the ingestion dose?	E E E E
TOPIC: Communication			**TOPIC: Communication**		
Media and mode of communication	• What are the available media of communication (intended for the professionals, for the public)? • Who are the people (professionals) to warn and how to reach them? • How long does it take to relay the information?	I I I	*Topic not raised by the panel*		

FROM panel meeting no.1 DEBATE			FROM panel meeting no.2 DEBATE		
Decisions	**Uncertainties**	**Type of uncertainty**	**Decisions**	**Uncertainties**	**Type of uncertainty**
Broadcasting the messages	• What messages to broadcast? And how? • Should we design recommendations for each food production sector? • In the case of food production sector with high added value (e.g. Champagne), should we really communicate before having the field measurements? • How to communicate about difference in size between the zoning for evacuation and the zoning for food restrictions? And how to inform about the evolution of these two zonings from emergency to the transition phases?	I I I I	**Broadcasting the messages**	• What message to broadcast? • If a distinction is made between restriction for consumption and restrictions for commercialisation, how to adjust the messages to the individuals: the general population, the clients, the sellers and distributors etc? • What about the social attention/care principle? • What will be the messages addressed to food producers (e.g. wine-grower, cattle breeder) that cannot produce or sell their products based on the contamination of leafy vegetables?	I I I I
TOPIC: Implementation of the strategy			**TOPIC: Implementation of the strategy**		
End of the restrictions	• What should be set up to ensure the end of the food restrictions?	I	**End of the restrictions**	• Should the restrictions end as a whole or one food production sector after another? • Should we take into account the very specific characteristics of the agricultural production sectors before implementing the controls/restrictions? • Should we give the priority to the food production sectors for which the restrictions are the easiest to lift off or the most at stake food productions sectors (economical, political, brand image etc.)?	I/E I/E I
Managing contaminated food	• How to manage the contaminated food (milk notably)?	I	*Topic not raised by the panel*		
Collateral impacts of the strategy	• What about the brand damages for the products and for the (affected) territories? And beyond the affected territories (at country level)?	I	**Collateral impacts of the strategy**	• What about the brand damage/loss for the products and for the (affected) territories? How can we evaluate the impacts? • What will be the situation for the affected territories? • What are the economic losses for each food production sectors if they are « stigmatized »?	I I I

Table 2: Uncertainties and questions raised by panel meeting no.1 (emergency) and panel meeting no.2 (transition) during the debates on food restrictions.

4.3 First results

A first result from the above-mentioned methodology and the Tables is the high representation of internal uncertainties vs. external uncertainties. It can be concluded that the external uncertainties (related to the production of information: model, probability map etc.) have not been questioned that much by the participants.

Another result that comes from the organization of the uncertainties by theme (lines of the Tables) and by time (columns of the Tables) is that:

- Most of the themes of uncertainties raised by panel meeting no.1 are comparable to the themes from panel meeting no.2 (and considering the logical adaptation from emergency to transition phase);
- This applies for the debates on evacuation/relocation and also for food restrictions.
- There is a very limited number of themes raised in one meeting and not in the other meeting.

So finally, the discussions of the panels were driven by transversal uncertainties, that is to say uncertainties raised by participants during the two panel meetings and concerning the two protective actions.

But what are these "transversal uncertainties"?

1. The external uncertainties can be grouped together under a general "stochastic, epistemological, judgmental, computational and modelling uncertainties", covering the reliability of the calculation, of the models and the probability maps and how they confront with reality.
2. The Internal uncertainties are more numerous and should be differentiated. Given the themes, it is proposed to distinguish between uncertainties related:
    - To the decision-itself (how to shape the strategy given the information available);
    - To the governance (who take the decision actually?);
    - To communication issues;
    - To social acceptance, behaviour and reactions (of the individuals confronted with the strategy and the decisions);
    - To the economic and other side-effects (of the implemented strategy);
    - To the evolution of the situation with time (from emergency to transition and from transition to the long-term).

In the next part, the uncertainties (under the above-mentioned distinction) will be exemplified and discussed more deeply. From these elements and also a further analysis of the minutes to identify the benefits (and remaining needs) from the probability maps, lessons-learned and perspectives will be outlined.

5 Analysis of the different categories of uncertainties raised by the French panel

As mentioned in part 4, major issues raised by participants during the two panel meetings concern both external and internal uncertainties to the decision-making process.

Therefore, based on this first distribution, the objective of this part is to further analyse the different categories of uncertainties that have been highlighted by the French panel. Each category will be

illustrated with concrete examples showing the real difficulties of participants to take their own decisions.

5.1 External uncertainties to the decision-making - uncertainties associated with the production of information

In the document "*The Various Meanings of Uncertainties*", S. French *et al.* propose to gather under the term '*external uncertainties'* all uncertainties which are external to the decision-making process itself. In general, these uncertainties refer to physical randomness (stochastic / aleatory uncertainties), reliability of the models (modelling uncertainties), lack of scientific knowledge (epistemological uncertainties), errors in calculations (computational uncertainties), setting of default values or parameters in models on the basis of personal knowledge (judgmental uncertainties), *etc*. In the case of nuclear accident management, these various uncertainties are mainly found in the process of producing data and information (e.g. producing contamination maps from modelling, from field measurements, etc.) which will be used as basis and support for the decision-making process. As a result, for our analysis, external uncertainties are directly related to the production of information.

5.1.1 Stochastic, epistemological, judgmental, computational, modelling uncertainties

Although the participants of the French panel didn't focus so much on these types of uncertainties (see Part 4), some questions were raised and referred directly to stochastic, epistemological, modelling or computational uncertainties. For instance, during the meeting dedicated to the emergency phase, panel members questioned the probability maps which were given to them to take their decision:

- "What is the level of reliability of the probability maps?
- What if the release occurs during a longer time frame?
- How do you consider the meteorological forecast (wind)?"

Similarly, for the panel meeting dedicated to the transition phase, issues related to the reliability of field measurements and measurement maps – which correspond to modelling, epistemological, computational, stochastic uncertainties- have been raised by the participants:

- "What is the level of reliability of the probability map?
- What is the level of reliability of the measurements? What is the level of conservatism?"

These external uncertainties, directly related with the production of information, can have direct impacts on decisions and their evolution in the long-term phase. Therefore, the whole question remains to know how much trust can be placed in these data. And, despite these inherent uncertainties, how informed decision can be taken by decision-makers. Having asked some questions about these uncertainties, participants of the French panel acknowledged the existence of inherent uncertainties in the information production process. However, given the few questions raised on this matter by the participants (see Part 4), it should be highlighted that these types of uncertainties do not constitute real brakes for them to take their decisions. In fact, these uncertainties are outside their direct area of responsibility. Indeed, in the case of an emergency, decision-makers will have to take decision on the basis of this information, whether they are tainted by uncertainties or not.

5.2 Internal uncertainties to the decision-making - uncertainties associated with the use of information

Still in the document "*The Various Meanings of Uncertainties*", S. French *et al.* name '*internal uncertainties*' as the set of uncertainties which are internal to the decision process itself. In general, these uncertainties can take various forms and are difficult to apprehend and assess. For instance, internal uncertainties can be related to the decision maker's behaviour given the ambiguity or the lack of clarity of the situation, her/his understanding of the situation, her/his personal judgments, *etc*. Moreover, the way how the decision is formulated, disseminated and subsequently understood and implemented can also generate a lot of uncertainties (reactions of inhabitants, socio-economic impacts, etc.) which are also considered as '*internal uncertainties*'.

Therefore, the following paragraphs aim to present the various types of internal uncertainties which have been raised during the discussions with the French panel. These uncertainties have been divided into five broad categories related to:

- **the decision-itself** (how to shape the strategy given the information available);
- **the governance** (who take the decision actually?);
- **the communication** issues;
- **the social acceptance, behaviour and reactions** (of the individuals confronted with the strategy and the decisions);
- **the economic and other side-effects** (of the implemented strategy).

5.2.1 Uncertainties related to the decision itself

In both meetings of the French panel, several questions related to the decision-making process itself were raised by the participants. A first set of questions was about the best timing to take a decision. Indeed, as showed by the questions below, participants wondered what could be the time limit to obtain a maximum of reliable information before taking a decision:

- "When should we communicate about relocation? Is it when the results of the model are available or after a few days when the zoning is well established based on field measurements?"
- "Should we not wait for the first map of contamination based on field measurements?"

In addition, participants also raised the issue of the criteria supporting the decision:

- "Should we consider other criteria (geographical, socio-economic) in addition to the radiological ones? How to put into balance these different criteria?"

Indeed, according to the discussions, it seems that criteria specific to the territory, such as the presence of schools or hospitals, the type of occupation of the territory (e.g. agricultural fields, houses, forests) can weigh in the decision-making process, especially when the decision-makers have to establish the boundaries of the evacuation/food restriction zones. However, the way of these criteria can be collected and the importance of such criteria in comparison with radiological ones remain unresolved and create new uncertainties.

Also, the relevance of the decision and its impact on the long-term management was also tackled, particularly during the debate on evacuation. Indeed, during this debate, the limits of the evacuation zone were strongly questioned:

- "How do we know if we are evacuating too far away or not enough the local population?
- Is it possible to anticipate right now the zonings at far distance from the nuclear plant that will be concerned by relocation?"

Still on these aspects, the strategies to be adopted to take a decision were also subject of many concerns by the French panel. For example, during the debate dedicated to food restrictions, panel members asked the following questions:

- "Should we make a distinction between consumption and commercialization or link both?
- Where to put the higher protection: on food intended for commercialisation or food intended for self-consumption?
- Which strategy to adopt? Create an extended restriction zone to be reduced progressively according to on-the-field measurements ("from big to small" approach) or instead, a small restriction zone that could be expanded if necessary ("step by step" approach)?"

On these strategic choices, the French panel could not find a consensus. It turns out that these choices involve personal judgments and convictions, which highly vary from one decision-maker to another. Indeed, the criteria used and the weight given to each of them could differ from one decision-maker to another (is it the health that matters or the continuation of the economic activities or the risk of contamination or the feasibility of the evacuation?). Measurement results, which provide factual information about possible contamination would maybe help participants to better cope the situation and so, take their decision. However, these results cannot be obtained in the first hours after a nuclear accident while strategies will have to be chosen. So, these strategies will highly depend on convictions and points of view of the decision-makers, and so will constitute important uncertainties.

Another element clearly highlighted by the participants is the existence of uncertainties associated with the means to implement in order to ensure the decision. For instance, during the debate related to the evacuation, the panel wondered whether the means needed for the evacuation (buses, police force, emergency shelters, etc.) would be available in the allotted time and whether responders would master the emergency procedures and would be able to respect the timeline established:

- "How long does it take to mobilize enough buses?
- What about the retro-planning (are we able to start evacuation at 19:00 and having communicated about the strategy for evacuation before)?
- To what extend does first responders/the actors understand the evacuation procedures?
- Will the agenda and timing be followed, taking into account the uncertainties?
- Will the military be able to contain any potential panic?"

Similarly, regarding the debate on food restrictions, participants stressed out possible uncertainties in the ability to implement appropriate and sufficient control systems, and to have the required analytical capabilities:

- "Will the control systems adequate and sufficient?
- How will the food restrictions be controlled and managed at the farm level?"

In parallel, participants also highlighted that means to manage products unfit for consumption or commercialisation will have to be implemented, and so, it represents a major challenge for which

many uncertainties are remaining: how to manage these contaminated wastes? Where these wastes will be stored? *etc.*

In fact, discussions with the French panel reveal that the lack of experience in a large-scale control and management of contaminated goods causes many uncertainties about the effective and appropriate implementation of decisions.

5.2.2 Uncertainties related to the governance

Another topic which appeared several times during the debates is the question of governance of the decision-making process, and the real weight of local decision-makers (mayors, prefect) facing a national or even international crisis.

For instance, in the case of evacuation, the existence of "Safety Contingency Plan" gives the possibility to mayors to evacuate its population, regardless the local decisions. Therefore, during the debate on the evacuation, none of the participants underestimated the consequences of a possible incoherence between the decisions taken by (i) local elected people, (ii) the prefect of the affected territory, or even (iii) the national government. This highlights a strong uncertainty about the decision process itself, but also on the way to balance local, national and international interests. These elements were reflected by the following participants' questions:

- "Taking into account the "Safety Contingency Plan" at communal level, is it possible that mayors decide evacuation by themselves?
- Will this strategy for evacuation, decided at local level, be validated by higher authorities?
- Will higher institutional actors/decision-makers change this strategy and implement a new one?
- Will this zoning for food restrictions be agreed and validated by higher authorities?"

The debate on food restrictions has shown that, given the size of the areas potentially concerned by restrictions, and given the lack of feedback experiences of France in this regard, any decisions go far beyond the local level prerogatives. Indeed, according to the panel members, in such a situation, the decision would be taken at high level, most probably at the government level where political, economic and social dimensions as well as the pressure of lobbies will be considered. More specifically, participants also raised the point that, in agri-food sector, in addition to the national dimension, European (or even international) dimension will have to be considered in the decision-making process, especially with the establishment of specific MPLs.

Therefore, in the case of nuclear accident, decision-making process implies important uncertainties regarding the governance of the decisions to be made and the weight given to each criterion (health, economic, politic, etc.) which could be supported by different decision-makers. The place to be given to local decision-makers, who face the reality of the affected territory and who are likely to be in the front line to manage the long-term situation remains a real challenge.

5.2.3 Uncertainties related to communication issues

During the emergency and transition phase, communication about decisions taken or about to be taken is a major lever of success for the management of the situation.

During the debates, the timing at which communication shall be done about decisions (population protection, food restrictions…) appeared to be important. Any delay or lack of communication would

be understood as a lack of capability to handle the situation and would result in a global mistrust towards the decision itself and beyond the authorities. The same mistrust would appear if the communication is done in advance compared to the implementation of the decision, giving time for other (legitimate) stakeholders to propose alternatives to the decision or to challenge the effectiveness of the decision. The speed at which information is broadcasted through social media imposes to decision-makers to communicate accurate information in limited time and in order to anticipate any false information. These issues were tackled by participants as we can see with their followings questions:

- "Will prior communication (by social media, traditional media, etc.) able to broadcast the "right" messages and prevent panic?
- Besides traditional media (TV, radio), what can be done to limit the spread of rumours and broadcast reliable information on the social media?
- When should we communicate about relocation? When the results of the model are available or after a few days when the zoning is well established based on field measurements?"

Therefore, it turns that decision-makers shall use all media (TV, radio, social media) to ensure that their own communication will be heard by those who needed.

The ability of the decision makers to explain in plain language, simple terms the situation actually faced seems also an important issue. The population will be incline to trust those of the decision makers able to explain easily the decision taken and how this will benefit to the population. During an emergency, the ability of a member of the public, due mainly to the stress, to process and understand information about its own situation decrease. The simplicity of the message to be broadcasted seems then an important factor of the success of the communication. However, participants highlighted the fact that a number of uncertainties are at stake on the key messages to be provided to the different target populations (evacuees, producers, consumers, etc.) and how it should be disseminated:

- "What are the best messages given the circumstances?
- Which zones should be alerted/which should not?
- Will the strategy (which is phased in time with the releases i.e. people are not immediately evacuated) be understood and accepted?
- Will the iodine thyroid blocking intake instructions be followed?
- To what extend does the population understand the evacuation procedures and the doctrine?
- How will the messages be understood?
- What information is clear and concrete enough to reassure on the effectiveness of protective actions and provide support to the individuals according to their situation?
- If a distinction is made between restriction for consumption and restrictions for commercialisation, how to adjust the messages to the individuals: the general population, the clients, the sellers and distributors etc.?"

Furthermore, the transparency is important and necessary. So, the decision-makers and the authorities should provide (publish) all the information available to them at the time they have it in order to avoid public defiance of the action taken.

5.2.4 Social acceptance – behaviours and reactions

Other uncertainties emerged several times during the debates related to reactions and behaviours of the various stakeholders (e.g. local inhabitants living in the affected territory, responders, economic actors, inhabitants living outside the evacuation/food restriction zones) following the implementation of the decision. These various uncertainties can be named 'social uncertainties'.

For instance, during the debate on evacuation, panel members raised some questions related to the possible reactions of responders, including their possible refusal to engage themselves in the operations:

- "What to do if the bus drivers use their right to withdrawal?
- Will the military or police forces be able to contain any potential panic?
- What are the options at our disposal if some first responders/actors (e.g. bus drivers) use their right of withdrawal?"

Uncertainties regarding the reactions and behaviours of the local inhabitants were also tackled:

- "What will be the reaction of the local population + the participants to the festival (occurrence of self-evacuation/shadow evacuation)?
- To what extend does the population understand and respect the evacuation procedures and the doctrine?
- How will the messages be understood?"

Still on this topic, the participants wondered which criteria will be used by local inhabitants to assess their situation and judge the relevance of the authorities' decisions. More specifically, the French panel asked if only radiological criteria will make sense to avoid panic and explain calmly the necessity of evacuation or food restrictions. According to the panel, the way the decision will be disseminated and explained could play an important role to foster understanding (see section 5.2.3).

Similarly, reactions and behaviors of people living outside affected areas raised some questions:

- "How to outreach the general population and the hosting territories in particular, and not generate stigmatization of the relocated individuals and affected territories?
- To what extent will the messages be understood? In particular for the individuals living outside the zoning borders?"

In fact, discussions of the French panel revealed that decision-makers do not have a clear vision on social uncertainties and do not know how to cope with such aspects. According to the participants, it would be important to collect/assess data focused on the possible reactions and behaviours of local residents and other stakeholders, trying notably to identify criteria which could make sense for them and foster their understanding. Unfortunately, these data are not easy to obtain objectively, which again, constitutes real uncertainties.

5.2.5 Economic and other side-effects uncertainties

During the emergency phase, decisions are made according to several criteria (radiation protection and feasibility) but the economic factor is not taken into account. This was confirmed by the debates of the first panel meeting on the emergency phase where few issues about the economic aspects were raised.

Otherwise, during the transition phase and more, in the recovery process, the economic dimension is progressively introduced although it was not the main criterion at the time when the decision was

taken. Thus, the economic impact of a decision is usually measured after taking the latter which is often irreversible. Concerning the debate on the temporary relocation, some participants asked about the economic impact of the long term relocation strategy on the affected territory:

- "What will be the socio-economic impacts on the affected territories? How to maintain an activity in theses territories over the long term?"

Regarding the debate on food restrictions, the French panel tackled the economic impacts of the food production sectors which will be concerned in the affected territories but beyond, on the national scale as well:

- "What about the brand damage/loss for the products and for the (affected) territories? How can we evaluate the impacts?
- What will be the situation for the affected territories?
- What will be the socio-economic impacts on each production sectors (considering the added value of the sector and the actors)?
- What are the economic losses for each food production sectors if they are « stigmatized »?"

Following these discussions, it turns out that anticipation to reduce the economic risks associated with decisions notably involves introducing a scalability of the decision over time and an ability to modify these decisions after the introduction of additional criteria (e.g. eco criteria).

5.3 Uncertainties related to the evolution of the situation

From the first panel meeting dedicated to the emergency phase, participants wondered about the evolution of the situation over time:

- "What will be the evolution of the situation in the next hours?
- Is it possible to anticipate now the zonings at far distance from the nuclear plant that will be concerned by relocation?"

Indeed, even if these projections are tainted of uncertainties (external uncertainties), it appears that decision-makers need them to guide their decisions.

So, the panel members expressed the need to have elements allowing them to anticipate the evolution of the situation with time, especially to assess the influence of the decisions which could be taken at the beginning of the recovery phase on the longer term phases. Then, during the second panel meeting dedicated to the transition phase, maps of radiological contamination at different times were provided to the participants:

- following the airborne campaigns and 6 months after for the temporary relocation and,
- 40 days and 6 months after the end of the releases for food restrictions.

Even though these maps have been very useful for participants in decision-making process related to the temporary relocation and food restrictions, a number of questions were raised (see below). Indeed, their major concern was to evaluate what will be the evolution of the radiological situation, if countermeasures would be put in place (e.g. decontamination) or not (effect of the radioactive decay only). For instance, participants would have liked to have maps and figures providing information about dose rate and effective dose forecasts, at different period of time (3 months, 1 year, 3 years, etc.) with an assessment of associated uncertainties:

- "What will be the evolution of the radiological situation?
- What will be the evolution of the zoning for relocation in the next months?
- What is the level of reliability of this evolution?"

Therefore, it appears that it is difficult for the decision-makers to envisage calmly the lifting of restrictions that could be pronounced as well as to organize and to anticipate the possible time frame for the return of the evacuated people:

- "How to adjust the strategy for relocation (and the protective actions) according to the evolution of the radiological condition?
- How to link the evolution of the restrictions with the calendars of harvest and effective consumption of the products?"

It will be also interesting to get feedback on the effectiveness of the decisions taken (from the radiological protection point of view on the relevance for the various actors). What criteria to evaluate this effectiveness and make this information available to decision-makers? How to take into account the temporal evolution? How to anticipate this at the moment of the decision?

5.4 What information and support of information should be produced?

During both meetings, discussions of the French panel clearly emphasised the importance of providing to decision-makers various information which are not only focusing on radiological aspects. Moreover, the French panel highlighted several times the need to produce support of information which can reflect external uncertainties, as much as it can be done.

5.4.1 What information should be produced?

As mentioned above, the identification of information needed for the decision-making process itself was raised several times by participants. Indeed, participants have repeatedly insisted on the fact that, in order to make informed decisions, information on radiological contamination are needed, but should not be the only information to consider.

For instance, during the debates on evacuation and relocation, participants clearly expressed the interest of having socio-economic data on the affected territory, which could facilitate their decisions. In fact, in addition to the probability maps that the effective dose exceeds the evacuation criteria (in France: 50 mSv), various maps were providing to the French panel, mainly representing the issues at stake in the affected territory: types of farms, types of food production, location of public establishments (schools, hospitals), etc. This specific information proved to be a real asset to the participants who were able to rely on them to take and adapt their decisions. In case of nuclear crisis, decisions should be taken in short timing and it is clear that, providing various information reflecting the various issues at stake in the affected territory (radiological, agricultural or socio-economic aspects, etc.), this highly support the decision-makers.

Similarly, during the debate on food restrictions, participants regretted not having access to specific information, as illustrated by the following questions:

- "What is the sociological profile of the population? What is the level of self-sufficiency of the population (consumption of the food produced in garden, harvest in forest, hunting, etc.)?
- What are the products that have the higher impact (dose) when it comes to ingestion?

- What is the level of exposure of the population?
- Which agricultural sectors are most impacted? What are the agricultural characteristics (flowering date, harvest date, etc.) of the affected sectors?"

Therefore, during the two meetings, French panel clearly emphasized the need to provide specific data related to the various issues of the affected territory in order to make informed decision. The wish to set up a cartographic database (coordinated by a dedicated organization) gathering all these issues was expressed by several participants. Also, some members highlighted the importance of owning field data to reflect the real situation and so adapt the decision accordingly. For example, if decision-makers are hesitating to evacuate a village but learn at the same time that the inhabitants of the same village have largely self-evacuated, their decision may be in favor of an evacuation. However, it should be noticed that all these specific data are not easy to collect or even easy to assess. Therefore, the remaining question is to know how far to make such data available to facilitate decision-making reflecting the associated uncertainties.

5.4.2 What support of information?

During the first panel meeting, which focused on the emergency phase and during which participants had to take decisions regarding evacuation and food restrictions, probability maps were provided to them. As explained in part 2, these probability maps seek to reflect the various uncertainties associated with the modeling process (e.g. stochastic, modeling, epistemological uncertainties) by proposing different areas of probability of occurrence of the criteria (evacuation or food restriction). The participants greatly appreciated these maps, presenting for them a real asset to better consider external uncertainties in their decision-making process. However, these maps have posed some difficulties to the panel, such as not clearly reflecting uncertainties associated with the boundaries of the delimited zones. This is what the following remark shows:

- "The map showing the areas concerned by the probability that the effective dose exceeds 50mSv may lead to think that, outside these areas of probability, the effective dose is 0 mSv. While that is not true."

Similarly, during the second meeting, the panel members largely questioned the reliability of the measurements made to establish the relocation zone and the food restriction zone. More specifically, their questions once again focused on the uncertainties associated with the boundaries of the zoning:

- "What is the reliability of the boundaries proposed for the relocation zone?
- What will be the radiological measurements performed at the boundaries of the zoning for relocation?
- How to ensure that the boundaries of the zoning for relocation actually protect the individuals living nearby?"

Providing support of information that reflects external uncertainties related to modeling or measurement processes appears to help decision-makers to take an informed decision. Probability maps which were provided to the French panel constitute an approach which should be further improved, notably to avoid the biases mentioned above. For instance, in order to better reflect uncertainties associated with boundaries, one idea could be to provide several maps of probabilities of exceeding several criteria. In the case of evacuation, it could be a probability map of exceeding the 50 mSv criterion and another probability map of exceeding the 10 mSv criterion. This would allow

decision-makers to better visualize the entire territory potentially impacted, as well as the possible dose variability.

It should be noted that, in addition to the probability maps, the participants strongly appreciated to have maps showing them the possible evolution of the contamination over time. In fact, during the second panel meeting, the participants had:

- for the relocation debate: a map showing the area likely to be affected by a sustainable relocation of population (zoning carried out by experts, considering only the radioactive decay);
- for the food restriction debate: maps showing the contamination of foodstuffs (milk, beef and vegetables) with cesium-137 and iodine-131 at two different time periods: 40 days and 6 months after the accident.

Following the discussions, it appears that these projection maps help participants to better understand the possible evolution of the situation over time, and so, help them to adapt their decisions accordingly.

Also, it appears from the discussions that participants would also appreciate to have some comparison between data resulting from modeling and data resulting from measurements. Indeed, as the remarks below show it, it seems important for the French panel to check if their first decisions (taken on the basis of models' results) are consistent with the real situation (measurements' results):

- "Is it possible to merge the field measurements with the estimation from the model?
- How long before the field measurements are available?
- What is the comparison of these zones with the situation in the field?"

6 Conclusions and Perspectives

The two French panels meetings organized in 2018 were respectively focused on the emergency and the transition phases. For the first meeting, the objective was to understand and evaluate how and on which uncertain elements a decision maker is basing her/his understanding and taking decisions in such a context. For the second one, the aim was to assess the influence of prior decisions taken during the emergency phase over the medium to long term recovery process taking into account the uncertainty associated with the emergency phase.

The different discussions revealed that i) the temporal dimension (evolution of zoning with time) is confirmed to be very useful for decision-makers; ii) there is a need for different types of information to help decision-making (geographic information, socio-economic issues of the territories, etc.) and not solely radiological impacts data; iii) the transition between emergency and recovery phases (for all decision-makers) is critical; iv) the decisions would also be political and taken in high levels (but on a common basis).

From these findings, various types of uncertainties have emerged and can be classified in two main categories:

- the *external* uncertainties to the decision-making process which generally speaking refer to uncertainties associated with the production of information (modelling, measurements, etc.);

- the *internal* uncertainties to the decision-making process which are directly linked to the use of the information to take decision (reaction of decision-makers given the ambiguity, clarity of the situation, personal judgement, social reactions, economic impacts, etc.).

The analysis of these debates clearly emphasizes that external uncertainties are acknowledged by decision-makers but do not constitute a real brake on their decision-making process. The data provided need to be robust and clearly presented but the decision-makers rely on the experts to provide adequate information.

Regarding internal uncertainties, one of the major lessons is that to take decision, decision-makers need information which not only concern radiological situation (e.g. geographic information, socio-economic issues of the territories, food behaviours of people, etc.). However, this information is difficult to collect (because difficult to access), and even more in an emergency situation. And even if these data would be available at the time of decision-making, uncertainties will remain notably on how to integrate this information and which weight will be granted by the different decision-makers. Indeed, these criteria may be more or less important depending on the decision-makers but also depending on the time situation (emergency, transition, long-term phases) and on the areas where the decision will be implemented (inside the evacuated/restrictions zone, at the boundaries or outside). And so, the main question will be to know how to integrate the different criteria in the decision-making process, taking into account the above mentioned elements.

These unresolved questions represent important uncertainties for the decision-making process and so constitute a major challenge for the preparedness phase. For now, the important points to investigate are:

- to improve the robustness of dosimetric and radiological data and the way this information can be provided to decision-makers by reflecting clearly the remaining uncertainties;
- to collect and propose contextual information related to the concerned population, the affected territory and the local situation which could help decisions-makers;
- to further analyse how this contextual information comes into play in the decision-making process considering the various points of view, the time evolution, etc.;
- to prepare the upstream messages associated with the decision to be understood by the population.

These elements will be further discussed with the French panels in the coming months during a dedicated meeting in the perspective of identifying lessons learned and recommendations for improving preparedness.

7 References

[1] Irène Korsakissok and al., 2017. EJP-CONCERT – CONFIDENCE_D 9.3 – Published sets of probability maps of threshold exceedance for scenarios provided to WP4, WP5 & WP6

http://www.concert-h2020.eu/en/Publications

[2] Simon French and al., 2018. EJP-CONCERT – CONFIDENCE - The Various Meanings of Uncertainty.

B-03. Report of Greek National panel

Authors: Vasiliki Tafili; Dimitris Mitrakos (EEAE)

Ref. Report: CONFIDENCE-WP4/T4.2.1-R04 / CONCERT D 9.22 Part B-03. v1.0 Final

Summary

This document presents the results of the stakeholders' panel held in Greece, as part of tasks included in the Work Package 4 (WP4), "Transition to long term recovery involving stakeholders in decision-making process" of the European project CONFIDENCE (COping with uNcertainties For Improved modelling and Decision-making in Nuclear emergenCiEs. HORIZON 2020 EJP-CONCERT, EC GA 662287. https://portal.iket.kit.edu/CONFIDENCE/index.php), which aims to understand and reduce the uncertainties associated with decision-making in the management of a nuclear emergency.

The organization of stakeholders' panel was part of a methodological approach focusing on the transition phase of a nuclear emergency, identifying and attempting to reduce the uncertainties in the management of the emergency. The role of interested parties is fundamental in the methodological approach applied; consequently, the combination of tools used are aiming at a broad participation of stakeholders.

In this perspective, EEAE organized a meeting of the national stakeholders with the aim to discuss about decision-making process and uncertainties embedded during the transition phase of a nuclear emergency. Since Greece is a non-nuclear country, the discussion was based on a hypothetical accident occurring in a neighbouring country with significant consequences.

The details regarding the methodology, the organization and the results of the stakeholders' panel held in Greece are presented in the following pages.

Table of Contents

1 Objectives and Scope

The organization of a stakeholders' panel aimed at initiating consultation and dialogue at national level about the inherent complications of transition phase management. The transition and recovery phases of a nuclear emergency present challenges that require the establishment of understanding among involved bodies. The broad spectrum of consequences that a nuclear emergency can trigger, i.e. social, economic, psychological, can be managed on the basis of an approach that takes into account the views of the stakeholders.

Panel discussions facilitate stakeholders' involvement and provide valuable input in the process of decision-making. Therefore, the main objective of national stakeholders' panel is to trigger the active participation of the stakeholders, and of any interested party, in formulating an effective approach, especially designed for dealing with the inherent uncertainties of the transition and recovery phases of an emergency.

2 Methodology

The organization of the meeting begun in the mid of May 2018. EEAE sent an information letter-invitation about the panel to 45 stakeholders (persons). The invitation was sent to stakeholders that have a critical role in the national emergency management plans. They can be grouped in 3 categories: (a) stakeholders representing governmental bodies (mainly involved Ministries), (b) stakeholders representing local communities and (c) stakeholders with expertise in the field of radiation protection and remediation.

The information letter provided to them some background information regarding the CONFIDENCE project, as well as the objective of the stakeholders' panel and a brief outline of the meeting agenda. The drafting of the agenda, as well as the moderated discussion among the panel's participants, were in line with the guidance provided in the methodology document entitled "Scenario-based Stakeholders Engagement, Guidelines for national discussions" (see Reference 1).

2.1 Scenario and timeframe of interest

Nuclear or radiological emergency management in Greece is integrated in the general civil protection system. Since there are no nuclear facilities in the national territory, nuclear emergencies are relevant with severe nuclear accidents that may happen abroad.

The Greek Atomic Energy Commission (EEAE) is responsible for information collection, activation of the plan, assessment of the situation and proposal of measures to higher levels of the plan hierarchy, namely the General Secretary for Civil Protection. EEAE activates and coordinates any radioactivity measurement campaign around the country in which various laboratories countrywide also participate in case of an emergency and acts as the contact point for receiving and communicating information to the IAEA and EC, through the established emergency response mechanisms (USIE, ECURIE).

Discussions in the panel were focused on a scenario of a hypothetical severe nuclear accident abroad with large radioactive release that, as a result of the prevailing adverse weather conditions, affects Greece. The release date was selected among dates identified by CIEMAT characterized by significant radiological contamination in Greek territory, as a result of enhanced - mainly wet - deposition. The

source term from the accident was determined according to the latest approach used by IAEA for the purposes of estimating the emergency planning zones (IAEA 2013), namely, 10% in the core of the volatile fission products, is assumed to be released within 10 hours. The core inventory is scaled to that of a typical nuclear power reactor (IAEA 2017). JRODOS was used for atmospheric dispersion and deposition calculations, using reanalysis meteorological data from US NOAA NOMADS servers. A picture of the radiological impact in the country is given in figure 1, where Cs-137 deposition as a measure of the long term contamination is shown.

Two successive phases regarding emergency management can be defined for the scenario. The first phase is the emergency response phase where the appropriate protective and response actions are taken with the primary aim to protect the public from exposure to radiation. This phase is followed by the transition phase, where, having ensure protection of the public, the focus is now on restoring the normal economic and social life (see for example IAEA (2018)). Although it is difficult to distinguish between the two phases by a clearly defined line, it is convenient, for the shake of emergency management and planning, to use such sort of distinct terminology to denote the gradual shift of the objectives as the emergency evolves. In the scenario examined the evolution of the response could be illustrated with the help of figure 2.

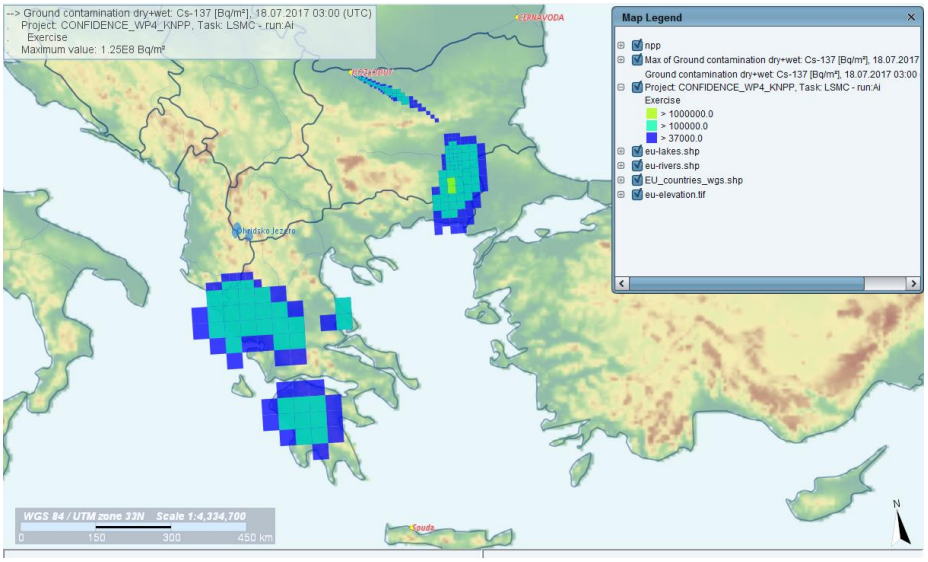


Figure 1. Cs-137 deposition from a hypothetical nuclear accident abroad, as calculated for the scenario considered in the panel.

In the first phase, according to the scenario, restrictions on agricultural production and distribution are implemented in the whole mainland and in the islands in the Northern Aegean Sea. This a decision taken as a precautionary response on the basis of the possibility for radiologically significant deposition in Greece, taking into account the modeling results. In addition, advice is given to the general public to reduce their contact with the environment. This, rather far conservative approach, it is expected that would help in maintaining public trust from the beginning, which in turn would later support the acceptance of a more refined and sound response when new data for the actual contamination become available.

In this first phase an extended measurement campaign should also be organized, so as to reach to an adequate radiological characterization of the contamination in the county, as soon as possible. Greece territory is not included in the emergency planning of any nuclear power plant abroad. As suggested by IAEA (e.g. IAEA 2017, IAEA 2011) food restrictions and other actions taken in the Ingestion and Commodities Planning Distance (ICPD) can be extended to longer distances based on a relatively quick assessment of the deposited radioactivity through measurements of the ground dose

rate. This sort of measurement campaign is assumed to be implemented during the first phase, and within some weeks, in order to gain a preliminary estimation of the actual contamination and radiological impact in the country and refine accordingly the areas where the initial precautionary restrictions are imposed. For the purposes of the scenario, OIL3 of IAEA (IAEA 2017) expressed in terms of ground dose rate, with a threshold value of 1μSv/h is used. Areas where restrictions are assumed to have been implemented, i.e. areas where dose rate exceeds OIL3, are illustrated as colored areas in figure 3.

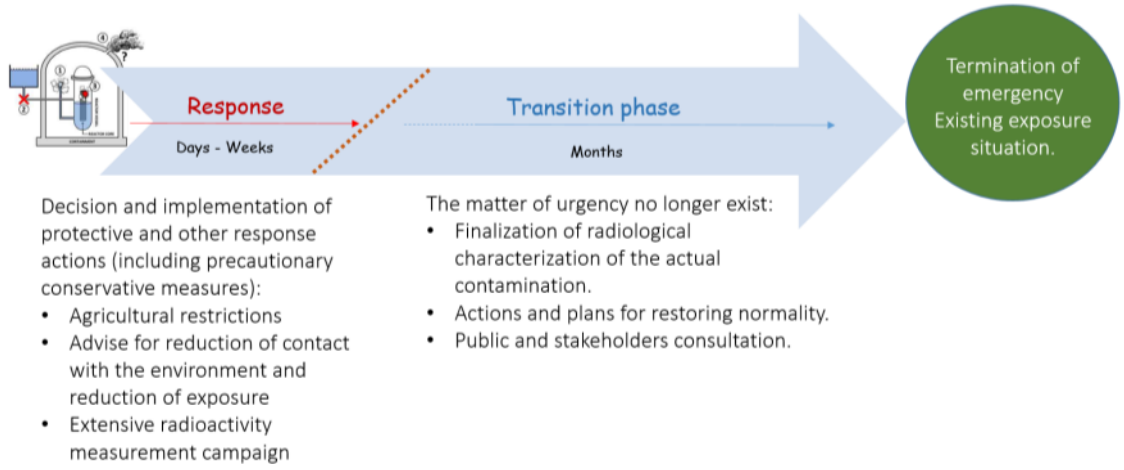


Figure 2. The phases of the emergency scenario evolution in time.

The completion of the dose rate measurement campaign and mapping of the preliminary estimated contamination is assumed to mark the end of the emergency response phase and the start of the transition phase, where the final radiological characterization is performed based on detailed sampling and radionuclide concentration measurement in soil, food, milk water and other samples. This is also the phase where the actions for restoring normality and consultation and public information is commenced to prepare the ground and gain public trust before declaring the end of the emergency

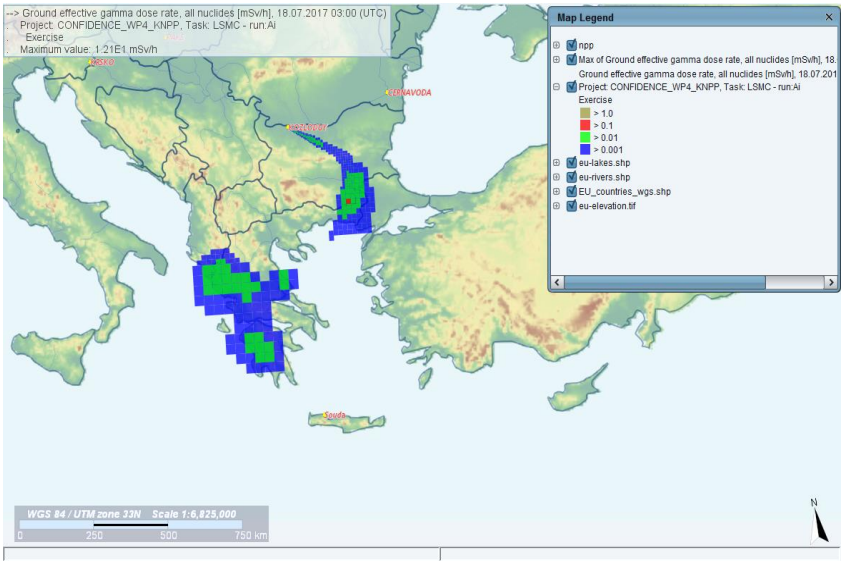


Figure 3. Areas where OIL3 (ground dose rate>1μSv/h) is exceeded. Food restrictions it is assumed that are in place in these areas after a few weeks (end of the emergency response phase).

2.2 Organization and schedule of the meetings

The panel was organized on July 6, 2018 at EEAE premises in Athens. The one-day meeting begun at 10.00 a.m. and concluded around 16.00 p.m. Figure 4 presents the agenda of the meeting.

The first part of the meeting was dedicated to introductory presentations made by EEAE. The second part of the meeting was actually an open discussion about transition phase management. The discussion evolved around the case-study presented earlier. The aspects to which the EEAE moderator devoted more time are the following:

- Roles and involved bodies
- Exercises – training
- Cooperation with interested parties
- Uncertainty
- Management of consequences of contamination in local populations
- Management of consequences in agriculture
- Coordination and interaction of involved bodies
- Dissemination of information to the public

CONFIDENCE WP4, Stakeholders meeting at EEAE, 6 July 2018
Welcome - Introduction of participants
Presentations by EEAE: • National plans for the management of radiological/nuclear emergencies • Presentation of the CONFIDENCE project – Work Package 4 • Scenario of nuclear accident abroad
Break
Discussion about: • Roles and involved bodies • Exercises – training • Cooperation with interested parties • Uncertainty • Management of consequences of contamination in local populations • Management of consequences in agriculture • Coordination and interaction of involved bodies • Dissemination of information to the public Other issues of concern

Figure 4: The agenda of the panel meeting held on July 6, 2018.

3 Composition of panel (participants)

The organization of the meeting begun in the mid of May 2018. EEAE sent an information letter-invitation about the panel to 45 stakeholders (persons). The information letter provided to them some background information regarding the CONFIDENCE project, as well as the objective of the stakeholders' panel and a brief outline of the meeting agenda.

Finally, 17 persons confirmed their participation in the meeting of the 6th of July. Those persons represented 10 organizations/bodies, including EEAE. The names of the bodies/organizations represented are listed in table 1.

Table 1: Bodies/organizations represented in the panel

Bodies/organizations represented
General Secretariat for Civil Protection
Hellenic Food Authority (EFET)
Ministry of Economy and Development, General Secretariat for Industry
Ministry of Rural Development and Food
National Research Centre "Demokritos" (member of the national network of collaborating laboratories)
National Technical University of Athens (member of the national network of collaborating laboratories)
Prefecture of Attica – Civil Protection department
Prefecture of Peloponnisos - Civil Protection department
Prefecture of Eastern Macedonia and Thrace - Civil Protection department
EEAE

Figure 5: Photo of the panel participants

Figure 6: Photo of the panel participants

Even though the number of the participants was smaller than the number of stakeholders invited, the representation was satisfactory mainly because:

a. the main stakeholders involved in the decision-making (e.g. EEAE, General Secretariat for Civil Protection, Ministry of Rural Development and Food, civil protection departments of different Prefectures) process during the transition phase of an emergency were represented;
b. the main stakeholders involved in radiation measurements were also represented;
c. all the participants were familiar with the general emergency response mechanism of the country.

In addition, the Greek stakeholders contributed significantly in the Delphi survey (1st round).

4 Results analysis and main issues identified

In the following section we summarize the opinions exchanged during the meeting. Based on the minutes of the meeting and the notes kept by EEAE, the main thematic areas of the discussion among stakeholders, as well as the main points/arguments made, are the following:

– Consultation process:

- The consultation is considered as “sine qua non” for the emergency management of the transition phase. Acknowledgement of the importance of the stakeholders meetings and views exchange: sharing of experience, better coordination, establishment of communication channels.
- It was highlighted that is important to invite to the discussions the industry.
- Training of personnel at local level is required in order to deal with the inherent fear and lack of knowledge about radiation.
- Requests to conduct exercises more often were made.

– General questions and concerns:

- Currently the transitional phase is not included in the national emergency management plans.
- The terminology used to describe radiological and nuclear emergencies is often different from the one used in national civil protection – this causes confusion.
- The duration of the transitional phase is a challenge.
- Not all panel participants were aware of the changes in the legislation and standards and how they are implemented in practice.
- Most of the stakeholders, especially civil protection staff, although they are familiar with other conventional emergencies, are confused about the response needs due to the special nature of radiological emergencies.

– Protective actions

- When the food restrictions are imposed? Under which circumstances and when?
- Legal aspects of the compensations policy shall be considered.
- The food and feed restrictions may not be followed if compensations are not provided.
- To what extent the protective actions will be implemented by the producers and the population?
- How the control of protective actions implementation will be organized?
- A control mechanism is established, but amidst a crisis situation problems will arise.
- How we will deal with the fear of non-radiation personnel, e.g. local inspectors, to perform sampling in contaminated areas?
- We choose a “precautionary option” in taking food measures.
- Communication and consultation with industries is necessary in favor of an effective response.

– Measurements campaign

- Are we ready to deliver dose rate measurements in due time for the whole country?
- How cooperation with other countries can be achieved, i.e. assistance requests.

– Information actions

- The public information is of paramount importance for the efficacy of protective actions.
- The assessment of the psychological impact shall be taken into account.
- Mobile apps and social media shall be considered for better and direct information dissemination.
- EEAE is working on increasing public awareness on radiation protection.
- An updated list of all involved bodies shall be always available for use.

5 Conclusions and Perspectives

To sum up, the analysis of the main uncertainties identified could be categorized as follows:

1. Associated with the radiological situation of the scenario contributing to the overall uncertainty associated with the estimated impact:

- Mapping of the radiological contamination may take a lot of time – in the meantime the radiological impact is not completely defined - actual contamination may remain unknown for a long time.

2. Associated with the goals and criteria used in the design of the protection strategy:

- Radiological criteria: The link of the applied Operational Intervention Levels (e.g. OIL3) with dose reference levels may not be easy to be communicated.
- What are the appropriate means and methods to use for the characterization of the contamination in large areas?

3. Associated with the implementation of protection strategy:

- Level of compliance with the protective actions
- Actual costs cannot be estimated in advance
- Compensation policy: needs to be clarified
- Doubts on the availability of resources

4. Associated with the social pressure:

- Psychological impact in the affected population/area – familiarization with existing exposure situation conditions
- Acceptability of the recovery actions
- Impact on the economic activities of the affected area.

6 References

[1] Montero, M.; Trueba, C.; Sala, R. (CIEMAT), "Scenario-based Stakeholders Engagement, Guidelines for national discussions", Document Number: T4.2.1-R01.

[2] IAEA (2011), Criteria for use in Preparedness and Response for a Nuclear or Radiological Emergency. GSG-2, IAEA, Vienna.

[3] IAEA (2013), Actions to protect the public in an emergency due to severe conditions at a light water reactor, EPR-NPP PUBLIC PROTECTIVE ACTIONS 2013, IAEA, Vienna.

[4] IAEA (2017), Operational intervention levels for reactor emergencies and methodology for their derivation, EPR-NPP-OILs 2017, IAEA, Vienna.

[5] IAEA (2017), Arrangements for the Termination of a Nuclear or Radiological Emergency, GSG-11, IAEA, Vienna.

B-04. Report of Irish National panel

Authors: C.Hilliard (EPA)

Ref. Report: CONFIDENCE-WP4/T4.2.1-R05 / CONCERT D 9.22 Part B-04. v1.0 Final

Summary

Ireland does not have any nuclear facilities but there are a large number of nuclear sites across Europe which could result in widespread but low level contamination of the Irish environment if a nuclear accident at one of these sites were to occur. The most significant route of potential exposure for members of the Irish public would be from the consumption of food containing increased levels of radioactivity. The concentrations of radioactivity in food would be dependent on the severity of the accident and the quantity of radioactivity reaching Ireland. It would also be dependent on food controls and protective actions implemented during the operation of Ireland's National Emergency Plan for Nuclear Accidents (DECLG, 2005).

Most of the potential dose to the Irish population could be averted by taking protective actions to reduce the transfer of radioactivity to food products and by restricting the sale of contaminated food. While these measures have been shown to be very effective in controlling radioactivity levels in foods for sale, and hence radiation doses to people, they do have significant socio-economic implications which could last for months or even years.

Ireland's national panel under CONFIDENCE WP4, focused on the uncertainties associated with decision-making regarding food and feed protective actions because this is the dominant exposure pathway for people in Ireland in the aftermath of a nuclear accident abroad and also because of the importance of agriculture and food to Ireland's economy. Communication around the implementation of protective actions and messages to the public and export markets about the safety of Irish food was at the forefront of discussions, particularly in relation to identifying and addressing elements of uncertainty

Table of Contents

1 Objectives and Scope

The scope of the panel for Ireland was the issues surrounding the contamination of food and animal feedstuffs in the aftermath of a nuclear accident abroad.

The objective, as outlined to the participants, was to identify and address the uncertainties associated with making decisions on food and feed protective actions in the aftermath of a nuclear accident abroad.

2 Methodology

Ireland has hosted two stakeholder engagement panel meetings for CONFIDENCE WP4. The first meeting was held in November 2017 and the second in October 2018.

Both Irish stakeholder engagement panel meetings were held in the National Emergency Coordination Centre (NECC) in Dublin City Centre. The NECC is managed by the Office of Emergency Planning which is a section within the Department of Defence. The NECC is used on a regular basis for meetings of the Government Taskforce on Emergency Planning and for hosting the National Emergency Coordination Group (NECG). This is a cross-government group which is convened by the Office of Emergency Planning, at the request of the Lead Government Department for the relevant emergency type, as part of the response to a threatened, or on-going, national-level emergency. It has become easily identifiable by the Irish public as it was the control centre for several recent, high profile, weather related emergencies e.g. Hurricane Ophelia, Storm Emma and the 2018 Summer drought, and as such has had much media exposure.

Both panel meetings were facilitated by Behaviour & Attitudes – a Dublin based market research company. This was to ensure that all stakeholders were encouraged and given an opportunity to participate and no one person dominated proceedings. It was also to ensure that the full proceedings of each panel were appropriately captured.

The meetings were chaired by Mr. Paul McDonald, Principal Officer at the Department of Communications, Climate Action and the Environment. This Department is the Lead Government Department for radiological and nuclear issues. Mr. McDonald would chair the NECG in the event of a real nuclear emergency.

The participants of the panel were representatives from the food and feed sector, the food retail sector, government decision makers/experts and the Consumer Association of Ireland.

In both panel meetings, participants were presented with a nuclear emergency scenario and were asked to respond as they would to a real-time event, in essence, as decision makers and as those who would have to implement those decisions. Discussions were held on the feasibility of various protective actions that could be introduced in Ireland to prevent or reduce contamination of food intended for consumption and sale. There were also discussions on controlling and structuring communications for both a national and international audience.

2.1 Scenario and timeframe of interest

Panel meeting 1

This meeting was held in November 2017.

The timeframe of interest in this meeting was the early and intermediate response phases and transition to recovery.

The scenario was a three-step process, based on an accident at the Paks nuclear power plant in central Hungary. This scenario was used in the IAEA's Convex-3 exercise in which Ireland participated in June 2017. Each stage of the scenario, and supporting dispersion model outputs, was presented and was followed by a discussion.

The three steps were:

1. Upon notification of the accident before there was any release or knowledge of the severity of the event. Information available to participants at this stage was very limited. Matters of uncertainty were highlighted.
2. Three hours later with limited information on the accident and no further information on a release. Predictive modelling data was presented and discussed.
3. Post plume passage, seven days later. Information was provided on deposition levels measured in the country.

Points of discussion

While Section 4 gives a detailed breakdown of results the overall points of discussion were grouped as follows:

- Identifying the needs of a range of stakeholders.
- The challenge of considering uncertainty in decision-making.
- Assessing risk – water supply, food contamination, human health.
- Variations depending on the season of an accident i.e. harvesting early, sheltering animals, feed levels.
- Effect of decisions on the economy.
- Communication.
- Trade and assurances around consumption of produce for export.

Panel meeting 2

This meeting was held in October 2018 and was divided into two parts. The first half of the meeting was attended by relevant government stakeholders (staff in the various government departments and agencies that would have a key role in decision-making in the response to a nuclear/radiological emergency affecting Ireland). This group was presented with the scenario outlined below. They were advised at the outset of the meeting that the desired outcome of this section of the meeting was an agreed set of 'protective actions'. These actions would then be presented to key stakeholders in the second half of the meeting.

A number of farming and food production representative bodies, large retailers and the Consumers Association of Ireland joined the group for the second half of the meeting. This group includes the industry/consumer stakeholders who would be expected to implement or deal with the

consequences of these proposed protective actions and so their insights into the practicalities surrounding these actions are valuable.

The timeframe of interest in this panel meeting was the early and intermediate response phases.

The scenario used was a two-step scenario based on an accident at Wylfa nuclear power plant in Anglesey, Wales, UK at 8am on the morning of the meeting. While the Wylfa nuclear power plant is currently not operational, it is one of the sites that has been identified by the UK for the construction of a new nuclear power plant. The site is the closest to the east coast of Ireland (approx. 110 km). Participants were asked to act as decision makers in real-time for the purpose of this exercise.

Prior to the panel meeting the EPA Technical Assessment Team completed a similar table top exercise which shaped the scenario presented to the meeting participants.

The two steps of the scenario were:

1. 08:00 accident. – approx. 10:00 pre-release. Wind and rainfall modelling data available. A four hour release from 14:00 to 18:00 is predicted. Weather models estimate a plume arrival time of six-seven hours later (20:00-21:00). Counties expected to be affected are named and cover the southern half of the country.
2. Three days after release including predicted doses etc.

Points of discussion

Many of the points discussed were similar to those outlined for the first panel meeting. While Section 4 gives a detailed breakdown of results the overall points of discussion were grouped as follows:

- The need to convene the National Emergency Coordination Group quickly so that the decision-making process at a national level can begin.
- Identifying the needs of a range of stakeholders.
- The challenge of considering uncertainty in decision-making.
- Assessing risk – water supply, food contamination, human health.
- Variations depending on the season of an accident i.e. harvesting early, sheltering animals, feed levels.
- Effect of decisions on the economy.
- Communication.
- Trade and assurances around consumption of produce for export.

A ‘disruptor’ was used in this meeting to refocus the minds of participants to the immediacy of such an event and to highlight the reality of public attention. The following tweet was presented to the group:

The tweet was from 'Liveline' which is a popular radio programme which broadcasts nationally on a daily basis in the early afternoon. The programme draws a large and varied listenership and is influential on the national discourse.

This was an effective tool for bringing the attention of participants to the elements of communication which are completely outside the control of government departments attempting to 'manage' a public message and resulted in a discussion around the risks associated with, and most productive methods of, engaging with the public via social media in an emergency.

2.2 Schedule of meetings

Table 1 **Agenda - Panel Meeting 1**

10:10	Emergency Response in Ireland: a case study of Storm Ophelia
10:35	Strategic Emergency Management in Ireland
10:50	ConvEx-3 Nuclear Emergency Exercise June 2017
11:20	Discussion: • Accessing information on the accident and its consequences • Making decisions when information has been gathered • Communicating decisions and actions to your stakeholders
12.55	Wrap up

Table 2 **Agenda - Panel Meeting 2**

Session 1 – Decision Makers	
09:30	Introduction and welcome
09:40	Exercise Scenario
09:45	Decision-making prior to a release of radioactivity
10:20	Decision-making 3 days after a release of radioactivity
10:55	Proposed protective actions and wrap up

Session 2 – Producers and Retailers	
11:30	Introduction and welcome
11:40	Exercise Scenario
11.45	Presentation of proposed protective actions and feedback from stakeholders – Part 1, prior to release
12:20	Presentation of proposed protective actions and feedback from stakeholders – Part 2, 3 days after release
12:55	Discussion and wrap up

3 Composition of panels

Table 3

Government Departments	• Department of Agriculture, Food & the Marine (DAFM) • Department of Communications, Climate Action and the Environment (DCCAE) • Department of Housing, Planning and Local Government (DHPLG) • Office of Emergency Planning (OEP) • Department of An Taoiseach - Government Information Service
State Agencies	• Environmental Protection Agency (EPA) • Food Safety Authority of Ireland (FSAI) • A Bord Bia (Irish Food Bord)
Dairy Sector	• Dairy Industry Ireland • Ornua (Dairy Co-op)
Farming Sector	• Irish Farmers Association
Meat Sector	• Meat Industry Ireland
Crops Sector	• Teagasc (Agriculture and Food Development Authority) • Irish Grain and Feed Association (IGFA)
Seafood Sector	• Sea Fisheries Protection Authority (SFPA)
Retail Sector	• Musgraves Group • Tesco Ireland • Lidl Ireland
Consumer Sector	• Consumer Association of Ireland

The majority of the participants had no background in radiation or radioactive contamination. However, all participants are either involved in emergency preparedness and response or, are involved in the food industry in Ireland and have insight into food contamination.

4 Results analysis and main issues identified

The main issues identified by stakeholders at the two panel meetings can be grouped together under three main headings: Communications, Agriculture and Trade.

Communications

- It is important to communicate with the public and other stakeholders early, even if there is a lot of uncertainty. Messages should be based on the current situation.
- It is important to provide one clear and coordinated message from all government departments. This helps allay public fears in a crisis.
- When public fear is at its highest, trust in public authorities may be low. Consideration could be given to providing an independent expert voice, with no vested interest, to explain the key messages in relation to food safety.
- Explaining background/normal levels of radiation may help to provide context as the public are unlikely to know much about radiation. Use comparisons to explain risks: e.g. "a person would need to eat X kilos of contaminated beef every day for Y days before it would affect their health".
- Decisions being made that involve uncertainty should assume a 'worst-case-scenario approach'. This can be scaled back as information becomes available.
- Key messages must be simple and clear.
- Tailor messages to different groups e.g. family with young children, elderly etc.
- Messages should be provided on a national basis even if there are regions of the country unaffected.
- Consumers need to know that supermarket shelves will be restocked. Some information on food which is already in the supply chain could be given to prevent panic buying.
- A range of organisations who would be important in communicating with the public and producers were identified. The Food Safety Authority of Ireland, Bord Bia, the Chief Medical Officer and the Irish meteorological office, Met Eireann, would all have an important role.
- Communication with farmers on their requirements and precautionary measures to include:
    - Any food related produce indoors is safe,
    - Food related produce outdoors should be covered where practical,
    - Animals can be penned but animal feed is a concern
        - Prevent animals eating contaminated food where possible,
        - Animals close to slaughter should not eat contaminated food,
        - Animals further from slaughter can eat contaminated food if adequate time can pass prior to slaughter to allow radioactivity to pass.
- There should be 'industry-specific playbooks' to detail individual crisis management strategies.
- Consideration should be given to one way communication on social media as reactionary dialogue can prove unproductive and can drown out core communication. There are two sides to this argument.
- Retailers should be considered to be a front-line communication resource and should be informed as soon as possible. Customers trust that their suppliers are informed. Retailers

should not be expected to rely on the media as their primary source of information. Consideration should be given to providing major retailers with a direct line of communication to the relevant experts.

- There is a need for coordination with our counterparts in the UK and Northern Ireland. Communication needs to be consistent across the island of Ireland to reduce uncertainty.
- Anything that can be done to reduce uncertainty should be done, to stop panic harvesting and panic storing of goods.
- More consideration should be given to advanced preparation of food labelling that would clarify the content and inspire confidence in Irish produce.
- While images are a valuable tool in communicating information, it is important to note that people receiving the information may interpret it differently to how it was intended by the author. This potential for misinterpretation poses a risk in the dissemination of information.
- The word "contamination" should not be used in public messages.
- The public need to be reassured that the food currently in their homes and in Irish shops is safe to eat.
- Farmers need to be told which animals are safe for slaughter.
- Producers should be given all the information they need, so that they don't put products which are potentially contaminated on the market.
- As the situation progresses it would be very helpful to advise people of whether the maximum concentrations in the Irish environment are likely to have been reached.

Agriculture

Agricultural processes are inextricably linked to seasons and weather conditions. The uncertainties posed through the playing out of the scenarios, highlighted the difficulties involved in decision-making in these circumstances. However, the following issues need to be considered:

1. Housing of animals (particular concerns if this was in Spring/early Summer),
2. Drying off of dairy herds,
3. Prioritising animals close to slaughter,
4. Covering crops,
5. Liability issues for government departments giving protective action advice to farmers based on uncertain conditions.
6. Flash labelling could be used to show when an animal was slaughtered.

Trade

To reduce uncertainty in the aftermath of a nuclear accident, it will be critical to provide measurements of radioactivity concentrations as soon as possible. Ireland has one laboratory which is accredited to ISO 17025 for the measurement of radioactivity in food and environmental samples. This laboratory is operated by the EPA and all routine national monitoring is carried out there. There are no commercial laboratories in the country providing these measurements and there is a very limited capability in the third level education sector.

Following a nuclear emergency abroad affecting Ireland, there would be great demand for sample analysis. It would be very challenging to sustain such an increase in long term throughput. It was suggested that industry or other analytical laboratories could be used to provide a screening service and that the EPA's accredited laboratory could be used for official certification. It must be remembered that unlike other food contamination events, the effects of a nuclear emergency can be

felt for a very long time. This was highlighted by the fact that Ireland is still required to certify the levels of radioactivity in some food exports, 33 years after the Chernobyl accident.

5 Conclusions and Perspectives

Ireland does not have any nuclear facilities on the island. It is well established that even an accident at the nearest nuclear power plant from Ireland (on the west coast of the UK) will not result in immediate health effects or cause significant radiation exposure to people living in Ireland if appropriate food and feed protective actions are implemented. (RPII, 2013). It is the economic consequences rather than the health effects that may have the largest impact on the Irish public. The export of safe food, particularly beef and dairy products is very important for the Irish economy. So, a key element of the response in Ireland to such an accident in Europe is the implementation of food and feed protective actions to reduce the transfer of radioactivity into food, to protect both the public and international trade markets.

In the event of a nuclear accident abroad, the NECG will have responsibility for making decisions on which protective actions are most appropriate. These decisions will need to be made when very little information about the accident is available. In Ireland's panel discussions, the uncertainties associated with these decision-making processes were discussed and a number of key issues identified.

Ireland's National Emergency Plan for Nuclear Accidents (DECLG, 2005) is currently undergoing a review process to update it with lessons learned from key developments in emergency preparedness and response, since it was last updated in 2005. There were a number of key issues identified during discussions of the Irish stakeholder panels. Stakeholders strongly support the preparation of key communication structures ranging from access to expert advice, preparation of key messages, an informed media community and effective emergency labelling. These have been addressed in the draft revised national plan. There is also awareness that the lack of emergency capacity within the national laboratory framework may pose a risk to the food supply chain (and particularly to the certification of products for export) and, like other countries, this is an ongoing issue for Ireland.

This is a timely and valuable opportunity for the outcomes of the CONFIDENCE WP4 discussions to feed into the review of the National Emergency Plan for Nuclear Accidents in Ireland.

6 References

Department of Environment, Community and Local Government, 2005. *National Emergency Plan for Nuclear Accidents*. Dublin, Ireland.

RPII, 2013. *Proposed Nuclear Power Plants in the UK - Potential Radiological Implications for Ireland. Report RPII 13/01.* Environmental Protection Agency, Dublin, Ireland.

Appendix

Questions to Stimulate Discussion for meeting 2

Session 1 – Decision Makers - Stage 1 (pre-release)

1. Is the information from the EPA clear?
2. Is it too technical or not technical enough?
3. Do you require additional information to be able to make decisions on food and feed protective actions?
4. What protective actions will you recommend?
5. Are you confident that the correct decisions have been made?
6. What other information would you require to reduce uncertainties on these decisions?
7. What are the first steps in implementing these protective actions?
8. What difficulties do you see implementing these protective actions?
9. What are the key messages for the public?
10. What are the key messages for those involved in the food industry and agriculture?

Session 1 – Decision Makers - Stage 2 (3 days post release)

1. Is the information from the EPA clear?
2. Which is better – maps and graphs or tables of data?
3. What information would make the assessment of the situation clearer for you?
4. Do you require additional information to be able to make decisions on food and feed protective actions?
11. Have your recommendations on protective actions changed? (Note: Protective actions should be captured for presentation to the Stakeholder Group in Session 2)
5. Are you happy with the decisions you made earlier before the radioactivity was released from the power plant?
6. Are you confident that the correct decisions have now been made?
7. What other information would you require to reduce uncertainties on these decisions?
8. If protective actions have changed what are the first steps in implementing these protective actions?
9. Three days into the emergency what difficulties do you anticipate now with implementing these protective actions?
10. What are the key messages for the public now?
11. What are the key messages for those involved in the food industry and agriculture?

Session 2 (Industry)- Stage 1 (pre release)

1. Are the decisions on food and feed protective actions from the National Emergency Coordination Group clear?
2. Is it clear how they arrived at these decisions?
3. What additional information would you like to have?
4. Are you confident that the correct decisions have been made?
5. There is a lot of uncertainty at this stage about what will happen. Is there any ways you can think of to reduce this uncertainty?

6. How could you influence these decisions?
7. What are the first steps in implementing these protective actions?
8. What difficulties do you see in implementing these protective actions and how would you convey this back to the National Emergency Coordination Group?

Session 2 (Industry) - Stage 2 (3 days post release)

1. As before, are the decisions on food and feed protective actions from the National Emergency Coordination Group clear?
2. Again, is it clear how they arrived at these decisions?
3. What additional information would you like to have now that we are three days into the emergency?
4. Are you confident that the correct decisions have been made?
5. How could you influence these decisions?
6. Three days into the emergency what difficulties do you see implementing these protective actions and how would you convey this back to the National Emergency Coordination Group?

B-05. Report of Dutch National panel

Authors: Esther van Asselt (DLO-RIKILT); Chris Twenhöfel (RIVM); Ronald Smetsers (RIVM)

Ref. Report: CONFIDENCE-WP4/T4.2.1-R06 / CONCERT D 9.22 Part B-05. v1.0 Final

Summary

In 2018, two panel meetings were organised in the Netherlands. The first meeting focused on identifying criteria and issues that are relevant to establish a recovery strategy in the transition phase of a nuclear incident. In the second panel meeting, the MCDA tool as developed within WP 6 of the EU project Confidence was evaluated on its usefulness in the decision-making process. Various stakeholders participated in the panel meetings ranging from decision-makers at regional and national level to scientists involved in advising decision-makers after a nuclear incident. The stakeholders indicated that the aim of a recovery strategy in the transition phase is to allow society to return to a normal situation as fast as possible. Various criteria were identified that are relevant to include in the decision-making process. Apart from this, consistent communication was seen as a vital point in the transition phase and a broad range of stakeholders should be involved in the decision-making process. Based on the initial list of criteria established in the first panel meeting, the most relevant criteria were selected in the second panel meeting. Some of the criteria were quantitative, such as costs and health, whereas others were more qualitative criteria, for example feasibility. The criteria were scored, weighed and incorporated into the MCDA tool to allow for selecting the most optimal recovery strategy. The stakeholders indicated that the MCDA tool may improve a structured and transparent decision-making process.

One of the uncertainties identified in the panel meetings were the effects of recovery strategies on the long term. Human response to a recovery strategy is also uncertain. When incorporating various stakeholder groups in the decision-making process, this uncertainty may be minimised. Furthermore, there are judgmental uncertainties as some of the criteria that are relevant to include in the decision-making are uncertain. Therefore, further research is needed to get better estimates of the more qualitative criteria, such as feasibility of a recovery strategy, administrative dilemmas and quality of life.

Table of Contents

1 Objectives and Scope

Two panel meetings were organised in 2018. The aim of the first meeting was to identify the criteria and issues that are relevant to establish a recovery strategy in the transition phase of a nuclear incident. The aim of the second panel meeting was to test the usefulness of the MCDA tool that was developed within WP 6 for supporting decision-making after a nuclear incident.

2 Methodology

The first meeting was held at DLO-RIKILT, Wageningen, the Netherlands; the second meeting at RIVM, Bilthoven, the Netherlands. The project team identified relevant stakeholders to be invited to the meetings. An invitation letter was drafted indicating the aim of the meeting as well as the program of the meeting. The participants were invited via email. Several reminders were sent to maximise the number of participants.

2.1 Scenario and timeframe of interest

A fictive incident at the NPP of Borssele was used for our case studies. The incident was drafted by CIEMAT and resulted in a contamination of the 'Noordoostpolder' in the Netherlands. The incident and the affected area for which a recovery strategy had to be established for the urban and the agricultural area are indicated in Figure 1. Based on this scenario, the following points were discussed in the first meeting:

1. How will society respond to this fictive incident?
2. What is the ultimate aim of a recovery program in the transition phase?
3. What are the main aspects/criteria to take decisions?
4. Does uncertainty influence the decision-making?

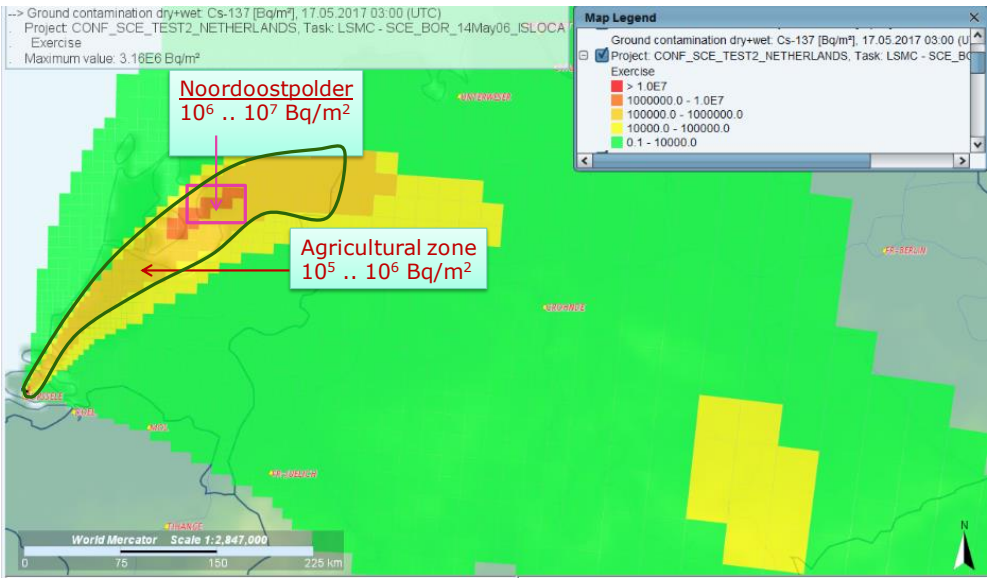


Figure 1. Fictive incident in the NPP of Borssele with consequences for agriculture and the urban area of the 'Noordoostpolder' in the Netherlands.

In two subgroups, the criteria and possible recovery strategies were discussed separately for the urban and agricultural environment. A set of options was drafted based on the EU project HARMONE[1] prior to the meeting and their consequences for health, costs and waste were evaluated. The results were shared with the group as a starting point of the discussions.

The same case study was used for the second panel meeting. However, this meeting focused solely on the urban scenario. Five strategies with different recovery options, based on the EU project HARMONE[1], were presented to the panel. Recovery options aimed at the clean-up of small areas of grass, soil and plants, the interior and roofs. Three of the five clean-up strategies could be combined with a two month relocation period, increasing the number of strategies to eight. Note that the HARMONE project was not specifically targeted towards the situation in The Netherlands, i.e. dose contributions in a typical Dutch living environment may therefore deviate from those assumed in the case study. Discussion points in this second meeting focused on which criteria to include in the MCDA tool and the usefulness of this tool.

2.2 Organization and schedule of the meetings

For both meetings, a facilitator was appointed to streamline the discussions during the meeting. This enabled the project team to focus on the content of the meeting and to take notes during the meeting. Both meetings started with introductory presentations after which the group was split in two to enable a more thorough discussion of the topics. The outcome of the discussions was shared with the whole group during the following plenary sessions. The program of both meetings is included in Annex I.

3 Composition of panel (participants)

The following organizations and institutions were represented in the first panel meeting (n = 18):

- The Ministry of Health, Welfare and Sport (VWS)
- The Ministry of Infrastructure and Water Management (IenW-DCC)
- The Ministry of Justice and Security (JenV-NCC)
- The Ministry of Agriculture, Nature and Food Quality (LNV)
- The Safety Regions Twente and Zeeland
- The Authority for Nuclear Safety and Radiation Protection (ANVS)
- The Institute of Physical Safety (IFV)
- The Community Health Services (GGD)
- Wageningen University
- Radboud University
- Agrifirm
- DLO-RIKILT
- RIVM

The second meeting was attended by representatives of (n = 12):

- The Ministry of Health, Welfare and Sport (VWS)
- The Ministry of Infrastructure and Water Management (IenW-DCC)
- The Safety Regions Twente and Zeeland
- The Authority for Nuclear Safety and Radiation Protection (ANVS)
- The Community Health Services (GGD)

- Wageningen University
- DLO-RIKILT
- RIVM

4 Results analysis and main issues identified

After the first response phase, normal living in the contaminated territory will be highly disrupted. The population will become critical towards the government. After some time, most of the population want to return to normal living conditions. The intended result of the recovery strategy, as viewed by the participants in the first panel meeting, is a functioning society: restoring normal living conditions and food production as quickly as possible. Psychological and social factors are much more important in the transition phase than they were in the first phase, which focuses primarily on minimising the human health risks.

Stakeholders indicated that communication is very important: people must have the feeling that their concerns are taken seriously and that the government is really helping them. It is important to find out what citizens and industry expect from the government. Furthermore, it is important to give citizens and industry some flexibility in taking actions. The same accounts for local governments. Nationally, uniform decisions should be taken, but local governments should have the flexibility to apply them as seems fit for their region.

It is important to gain the thrust of the people, but for agriculture also the neighbouring countries should thrust the countermeasures taken to secure the export position. Adequate communication with neighbouring countries, the EU and IAEA is therefore important.

A range of aspects were discussed that need to be taken into account when building a recovery strategy in the transition phase. Aspects mentioned in the discussion were: health (radiation related and psychological consequences), acceptance of the protective actions and the recovery options, the prevention of fear and social unrest, economical aspects (direct cost of the recovery strategy, health costs, export losses), the ability to cope with the situation, the perception of risks, the communication strategy, continuity of the functioning of society, ethical aspects, international arrangements, trust of the consumer and civilians, feasibility (of implementing countermeasures, waste storage issues).

This list was used as a starting point in the second meeting, in order to select the main attributes to be included in the MCDA tool. This resulted in the following list:

- Health (avoided dose, psychosocial consequences)
- Public support (confidence in the strategy, inconvenience, benefits, justice, transparency)
- Feasibility (technical, logistics, lead time, worker availability)
- Costs (countermeasures, avoided health costs, infrastructure)
- Administrative dilemmas (review of legal framework/international guidelines, (inter)national image, administrative complexity, possibility for customization versus coercion, preventing unrest, communication strategy)
- Quality of life (healthy urban living)

Some of these criteria can be quantified (e.g. health and costs), but others are more qualitative (such as feasibility or administrative dilemmas) and need to be investigated further to determine how such attributes can be included in an MCDA tool and/or how they can be incorporated in the decision-

making process. In the panel meeting, these qualitative criteria were ranked using a score between 0: totally disagree and 10: totally agree. An example for the criterion 'feasibility' is indicated in Figure 2. This method allowed to distinguish the best and worst strategy related to one single aspect as well as the consensus range between stakeholders. Figure 2 for example indicates that the feasibility scores for the strategy 'Do nothing' were comparable between stakeholders, whereas there was a wide variation in scores for the strategy 'Low waste 2 + relocation'.

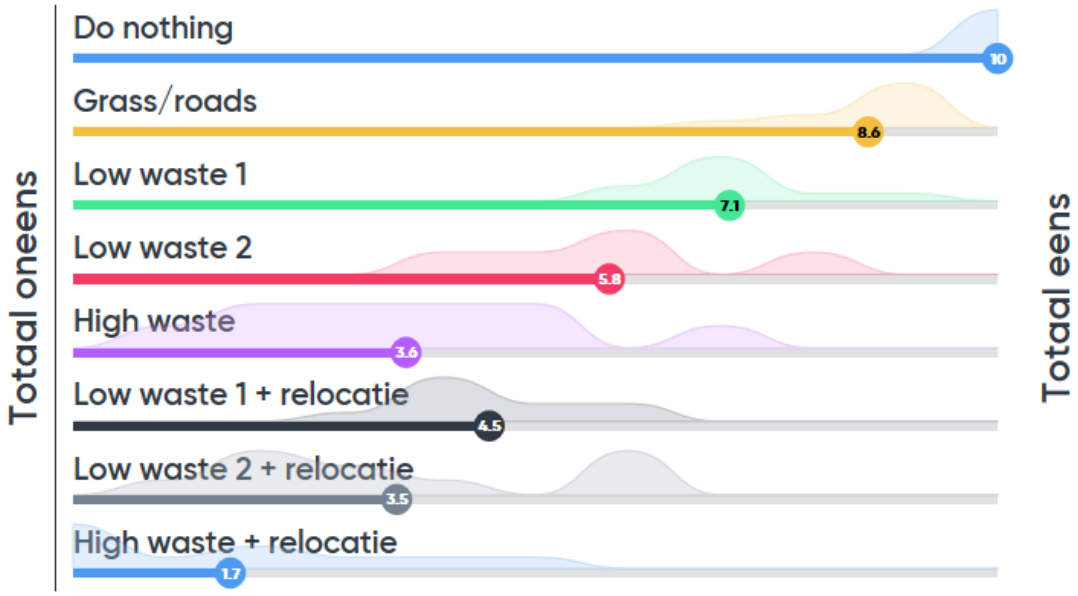


Figure 2. Scores for the proposition 'This clean-up strategy is easily feasible', ranging from 'Totally disagree' (Totaal oneens) to 'Totally agree' (Totaal eens).

The six criteria indicated above were included in the MCDA tool to determine the most optimal set of countermeasures within this case study. The stakeholders indicated that the MCDA tool might be helpful in establishing a structured and transparent decision on a recovery strategy to implement in the transition phase of a nuclear incident. The tool could also be used in exercises. However, the tool is limited to a small set of criteria and recovery strategies. As such, a two-step process was proposed: clean-up strategies that do not fulfil some minimum requirement (e.g. first year dose above 20 mSv) are excluded from the MCDA in the first step. In the second step, only feasible strategies are to be included in the tool.

5 Conclusions and Perspectives

The stakeholders concluded that the main aim of a recovery strategy in the transition phase is to return to a functioning society as fast as possible.

As indicated above, the stakeholders' main concern was a uniform communication towards citizens and industry. It is important to include a range of stakeholders in the decision-making process of the transition phase of a nuclear incident. An MCDA tool might be helpful to structure discussions in such a setting.

Furthermore, stakeholders indicated that a recovery strategy should be temporary and restricted as it is easier to upscale a recovery strategy then to downscale it. Countermeasures included in a recovery strategy should be flexible, enabling local governments, citizens and industries some self-control. When deciding upon a recovery strategy, it is important to think thoroughly about the long term consequences.

This also relates to the uncertainties identified in the panel meetings:

- The effect of a recovery strategy on the long term is uncertain, although several scenarios may be incorporated to get a rough estimation of the long term effects.
- Human response to countermeasures is uncertain. When incorporating various stakeholder groups in the decision-making process, this uncertainty may be minimised.
- There are judgmental uncertainties as some of the criteria that are relevant to include in the decision-making are uncertain. Further research is needed to get better estimates of the more qualitative criteria, such as feasibility of a recovery strategy, administrative dilemmas and quality of life.

6 References

[1] Nisbet, A., Charnock, T., Watson, S. 2017. HARMONE Guidance Handbook for Recovery after a Radiological Incident. OPERRA Deliverable D5.55. 73 p.

Annex I. Programs of the panel meetings

Program panel meeting 1 – 14 June 2018

09:15h *Welcome with coffee/tea*

09:30h Opening Workshop (Ira Helsloot)

09:40h Aim and background of the Workshop (Esther van Asselt)

09:50h Presentation nuclear incidents and countermeasures (Ronald Smetsers)

10:15h Explanation of the case study (Chris Twenhöfel)

10:35h General discussion on criteria with respect to countermeasures after a nuclear incident (under the direction of Ira Helsloot)

12:30h *Lunch*

13:15h Case studies: discussion on criteria and countermeasures after a fictive incident, in two groups: urban and agriculture

15:15h *Coffee/tea*

15:30h Plenary feedback on the case studies (under the direction of Ira Helsloot)

16:15h Conclusions of the day (Ira Helsloot)

16:30h *Drinks*

Program panel meeting 2 – 26 November 2018

9:30h *Welcome with coffee/tea*

9:45h Opening workshop by the chairman (Johan Polder)

10:00h Explanation MCDA and case study (Esther van Asselt, Chris Twenhöfel)

10:30h Establishing a list of criteria for the MCDA tool in two groups

11:30h Plenary discussion of the results

12:30h *Lunch*

13:15h Application of the MCDA tool (Chris Twenhöfel)

13:45h Weighing of the criteria in two groups

14:45h Plenary feedback on the results

15:15h Discussion on the usefulness of the MCDA in the case study used (under the direction of Johan Polder)

16:00h Closure

16:15h *Drinks*

B-06. Report of Norwegian National panel

Authors: Yevgeniya Tomkiv (NMBU, CERAD); Håvard Thørring, Lavrans Skuterud (DSA)

Ref. Report: CONFIDENCE-WP4/T4.2.1-R07 / CONCERT D 9.22 Part B-06. v2.0 Final

Summary

The scenario-based discussion panel in Norway as part of CONFIDENCE WP4 took place in April 2019. The discussions were based on an accident scenario involving a Russian floating nuclear power station barge towed along the Norwegian coast, which is the scenario DSA has contributed to CONFIDENCE WP1. The panel was composed of the food production related advisers to the Norwegian Nuclear and Radiological Emergency Preparedness and Response Organisation and representatives of the Norwegian Farmer's Union. The discussions focused on priorities and uncertainties related to selection of actions and strategies in the management of cow's milk and sheep meat production in transition to long-term recovery. Stakeholders have identified a wide range of factors that would be relevant for the selection of remediation strategies and countermeasures. Large uncertainty is associated with the consumer response to the countermeasures and food products from the affected areas. However, the positive experiences with consumers' acceptance of remediation strategies after the Chernobyl accident – which are still ongoing in Norway – make the Norwegian panel believe that consumer acceptance for the authorities' strategies also may be achieved in the future. Similarly, use of caesium binders like Prussian blue are considered as important components of potential future remediation strategies in Norway. Furthermore, it is also worth noting that the Norwegian stakeholders are reluctant towards soil removal and stopping agricultural production, even in scenarios with significantly higher contamination levels compared to the Chernobyl fallout.

Table of Contents

1 Objectives and Scope

The panel meeting was organized on April 29-30th 2019. The aim of the seminar was to discuss priorities and uncertainties related to selection of actions and strategies in the management of food production in transition to long-term recovery. Production of cow's milk and sheep meat where chosen as concrete cases for the following reasons: Cow's milk is an important dietary staple, generally produced in relatively intensive agriculture. Hence, cow's milk production is not particularly vulnerable to long-lasting contamination by radiocaesium. In contrast, sheep meat production in Norway depends heavily on using unimproved forest and mountain pastures for grazing during summer. It is thus vulnerable to radiocaesium contamination – as demonstrated by the still ongoing management of the Chernobyl consequences. On the other hand, sheep meat is not a dietary staple, and may more easily be substituted in the diet. Furthermore, it was found interesting to discuss a new contamination event affecting sheep meat production in Norway in light of the experiences after the Fukushima accident, where very different remediation strategies were chosen in food production compared to Norway's strategies post-Chernobyl.

2 Methodology

The meeting was held at DSA, Østerås. Relevant stakeholders were identified by project members and invited by email to participate in the national panel (see Participants below). No responses to emails was followed up by phone calls. Prior to the meeting, participants received some background information about the scenario and topics to be discussed.

2.1 Scenario and timeframe of interest

The hypothetical accident involving the floating Russian NPP *Akademik Lomonosov* contributed by DSA and Met to CONFIDENCE WP1 was the basis for the stakeholder discussions. In this scenario, a large radioactive release occurred outside the western coast of Norway. A number of radionuclides were considered – ^{140}Ba, ^{144}Ce, ^{134}Cs, ^{137}Cs, ^{131}I, ^{241}Pu, ^{103}Ru, ^{106}Ru, ^{89}Sr, ^{90}Sr and ^{95}Zr. For our seminar, some assumptions and restrictions were introduced in order to limit and focus the discussions:

- The original WP 1 source term was scaled down to 1:25. This was done to avoid discussing protective measures aimed directly at the population due to high radiation doses.
- Release date was set to 30 May 2018
- Focus was on radioactive caesium (^{134}Cs, ^{137}Cs)
- The food products considered were cow's milk and sheep meat

The situation during the first weeks / months after the hypothetical accident (2018) was that grazing plants were heavily contaminated from direct deposition of radioactive caesium on plant surfaces. This resulted in significant contamination of products from animals on pasture - with sales ban and extensive disposal as a result. For our panel discussion, however, we jumped to discussing plans for the grazing season 2019 (the spring of 2019). The contamination levels were presumed to be well surveyed throughout southern Norway, and the measurements showed that especially Rogaland and parts of Hordaland were hard hit. The affected area was divided into two zones based on contamination levels of radioactive caesium (Figure 1).

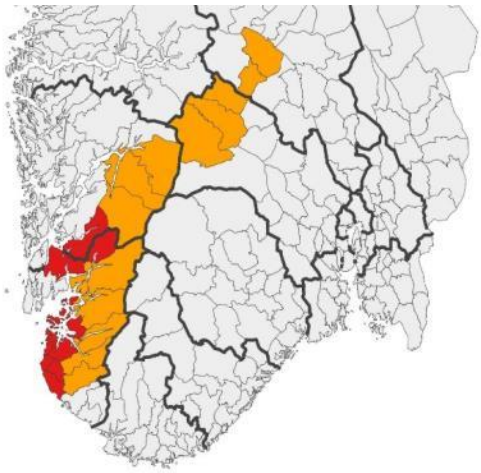


Figure 1 Map of southern Norway showing the specified contamination zones used in the discussions. Radiocaesium levels were >10–100 kBq/m2 in the orange zone and >100–1000 kBq/m2 in the red zone. External outdoor dose rates one year after the hypothetical fallout (taking into account all relevant radionuclides mentioned in the main text) were typically 1–10 µSv/h in the red zone and <1µSv/h in orange zone.

Note that the levels of radioactive caesium (Cs-137, Cs-134) within the orange zone is in the same order of magnitude as the Chernobyl fallout, whereas areas within the red zone are considerably higher than the maximum levels in Norway after the Chernobyl accident.

Distributed materials concerning transfer to cow's milk and sheep meat are shown in Annex A. The panel participants were split into three group, and each group was given a support sheet (Table 1) for each of the suggested countermeasure strategies (Table 2) to aid structuring the discussions and the outputs.

Table 1 Illustration of the support sheet for guiding group discussions. Separate sheets were provided for each strategy.

Strategy no. …….				
Zone/contamination level	**Benefits**	**Disadvantages**	**Prerequisites and uncertainties**	**Other comments**
10-100 kBq/m^2				
100-1000 kBq/m^2				

Table 2 Overview of the suggested countermeasure strategies for relevant zones.

Strategy	Description	Expected effectiveness[a)]	Zone
Milk1 Sheep1	No countermeasures (accepting contamination).	0%	Orange
Milk2	Normal plowing and fertilizing with K.	70 (0-95)%	Orange

Sheep2[b)]	Supplement with clean feed if required		Red
Sheep3 [b)]	Sheep grazing in contaminated fields are rounded up early and moved to improved pastures before slaughter	Will depend on the situation	Orange
Milk3 **Sheep4**[b)]	Use of Prussian blue: - mixed into fodder - sustained release bolus - salt licks	 80-90% 50–80% Up to 50%	Orange Red
Sheep5[b)]	Use of less contaminated pastures	Will depend on the situation	Orange Red
Milk4, Sheep6	Remove the top layer of soil, then plow and fertilize.	98% (90-99)%	Red
Milk5 **Sheep7**	Stop production of milk/lamb. If possible, replace with other agricultural production	Up to 100%	Red

[a)] *Expected effectiveness were based on the EURANOS handbook.*

[b)] *For these strategies, supplement of additional clean feed may be required before slaughter of sheep for the meat to be below the intervention level of 600 Bq/kg. Live monitoring of animals can be used as control of countermeasure effectiveness.*

2.2 Organization and schedule of the meetings

The meeting started with short introductory presentations that gave overview over the aims of the meeting, some historical background on the remediation strategies in Norway after the Chernobyl accident and in Japan following the Fukushima accident. Afterwards, the scenario was presented for the participants prior to dividing them into three groups for discussions. The participants were working on their own while project team members (i.e., the three authors of this report) were observing, answering questions, and taking notes. The results of the discussions were presented and discussed in plenary on day 2 (see meeting agenda in Annex B).

At the end of the meeting, all participants received an individual questionnaire. The purpose of this was to collect individual scores of countermeasure strategies – and opinions that might not have been voiced in the discussions (see Annex C).

3 Composition of panel (participants)

Participants of the meeting represented organizations that are part of the food safety group of the Norwegian Crisis Committee for Nuclear Preparedness, and the food industry. In total 15 persons from the following organizations and institutions participated:

- The Food Safety Authority (1 participant)
- The Norwegian Agriculture Agency (2 participants)
- Norwegian Radiation and Nuclear Safety Authority (5 participants)
- Norwegian University of Life Sciences (3 participants)
- Norwegian Institute of Bioeconomy Research (1 participant)
- Norwegian Veterinary Institute (1 participant)
- Norwegian Farmers' Union (2 participants)

Participation by two colleagues from the Institute of Marine Research where prevented due to airline strike. All participants did also answer the first WP4 Delphi survey prior to the seminar.

Representatives from another farmer's organisation, Norway's largest dairy, and slaughterhouses/meat processing industry were also invited, but did not participate.

4 Results analysis and main issues identified

4.1 Factors influencing choice of the countermeasure strategies

A variety of factors should be considered when choosing countermeasure strategies after a nuclear accident. The discussion during the meeting revealed five main factors that would affect the choice of countermeasures (Figure 2):

- Effectiveness of the countermeasure
- How easy it will be to implement (is there previous experience, established method)
- How invasive it will be into the normal practice (should not require farmers to do a lot of extra work beyond what they are already doing)
- How much it will cost (economic compensations, support for farmers, need for new investments etc.)
- Whether different actors in the production chain (farmers, distributors, consumers, etc.) will accepted it

To illustrate how consideration of the various factors would affect decisions on the countermeasure strategies, one can look at the results of the individual prioritization (Figure 3 and 4). For instance, removal of the top soil (strategies Sheep 6 and Milk 4) received low scores as however effective this strategy would be in reducing contamination levels in food products, it would also be costly and invasive, and would not likely be accepted by the farmers because soil is an important resource (soils are generally shallow in Norway, and good agricultural soils is generally a restricted resource). Another strategy that received low scores in most cases was the 'no-action strategy'. Although this strategy would imply that farming practices could continue as normal and would be very low in cost, it would

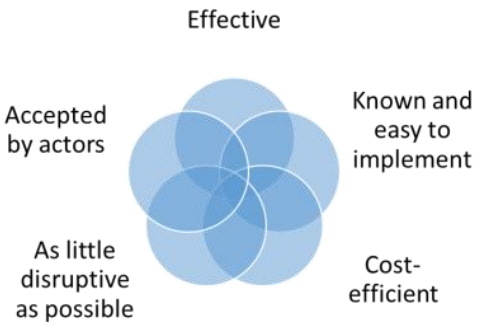


Figure 2 Factors that affect choice of countermeasures

not necessarily be effective in terms of producing food with acceptable levels and might not be accepted by the consumers as it would be hard for authorities to justify doing nothing. The most

appropriate countermeasures would be those that have a good balance in consideration of the different factors.

Besides the five main factors, participants named a range of other considerations that would need to be taken into account when choosing countermeasures. It is important that while dealing with the problem of radioactive contamination one doesn't create other problems for the environment (e.g. environmental effects of additional fertilizing, waste production when using Cs-binders or removing top soil, and potential effects of the alternative agricultural production). One also needs to consider and plan for accessibility and availability of resources; from feed and Cs-binders to equipment, infrastructure and alternative pastures. Application of countermeasures in agriculture should ensure that the end product reaching consumers is safe, thus, resulting in the dose reduction to the population. At the same time, discarding of the food should be minimized. When countermeasures are aimed at the farm animals, the issues of animal welfare will come to fore as well. For example, Cs-binders as mineral licks can cause spread of diseases. However, there are also wider societal and psychological factors to consider when devising countermeasure strategies. One of the important aims of the countermeasures in the post-accident situation is to help keep farmers in business and empower them to deal with the issue of contamination. Agriculture is an important source of workplaces in many areas in Norway, and if agricultural activities would be stopped, it might be hard to find alternative jobs, especially in rural areas. In addition, farming has an important traditional and cultural value as well. Countermeasures should be easy to communicate and contribute to building trust and confidence in the governmental response and safety of the food products. Here, a good monitoring system at the different stages of production processes is needed in order to document effect of the countermeasures and confirm that levels of radionuclides in food products are under food intervention levels.

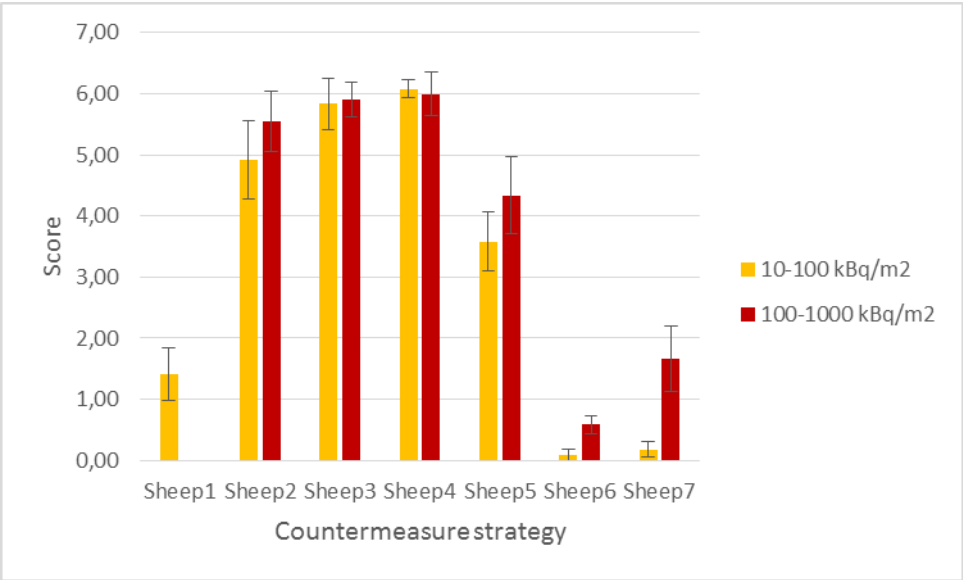


Figure 3 Average priority scores (± standard error) of the countermeasure strategies for sheep production based on the individual responses (Sheep1 – no countermeasures; Sheep2 – plowing and fertilizing; Sheep3 – clean feeding; Sheep4 – use of Prussian blue; Sheep5 – use of less contaminated pastures; Sheep6 – removal of the top layer of soil; Sheep7 – stop of production). Note that several of the respondents chose a combination of strategies as their preferred option particularly for the red zone. However, this is not reflected in the score plot.

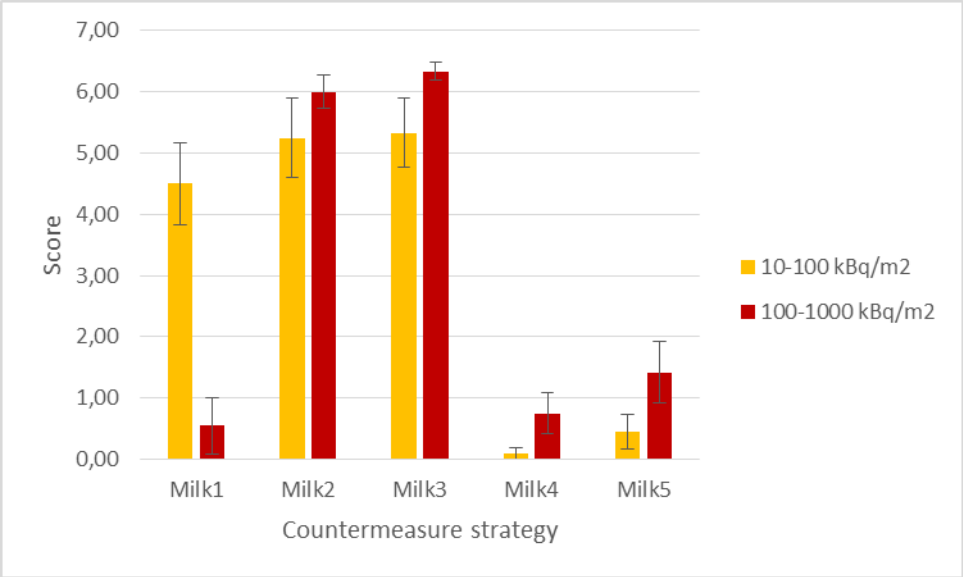


Figure 4 Average priority scores (± standard error) of the countermeasure strategies for cow milk production based on the individual responses (Milk1 – no countermeasures; Milk2 – plowing and fertilizing; Milk3 – use of Prussian blue; Milk4– removal of the top layer of soil; Milk5 – stop of production). Note that several of the respondents chose a combination of strategies as their preferred option for the red zone. However, this is not reflected in the score plot.

Finally, countermeasure strategies should be adaptable and applicable in the local conditions (e.g. ploughing) is impossible in the mountain areas and fertilization with potassium will not work in certain soils). In addition, a single countermeasure will likely not be enough as all of them have certain limitations, therefore, a combination of countermeasures should be considered.

4.2 Challenges and uncertainties

There is a range of different challenges and uncertainties that would need to be recognized and addressed in the selection of actions and strategies in the management of food production in transition to long-term recovery.

The immediate uncertainties and challenges will be related to the distribution of the contamination in the environment that is likely to be inhomogeneous, and the estimation of the site-specific levels of contamination in various agricultural products. These challenges highlight the importance of the extensive monitoring/measurement programs for environment, live animals and food products to uncover the contamination hotspots and sensitive areas, to document effect of the countermeasures, to show when there is need for adaptation of the strategies (and change in the countermeasure regimes) and to build consumer trust.

Effectiveness of countermeasures may vary depending on the local conditions (e.g. potassium fertilization will not be effective in certain soils) and so will the available resources for implementing those countermeasures in action (equipment, infrastructure, logistics). In order to address this challenge, preparedness on the local level is required with plans developed in advance for each strategy.

Another important dimension of uncertainty is the societal response to the actions and strategies chosen in the aftermath of the accident: how will consumers react to the choice of management strategies – will they accept them, see them as effective and trust that products reaching the market are safe? The management of the consequences of the Chernobyl accident in 1986 has been quite

successful, also with regard to the citizens' attitude towards countermeasures applied in agriculture and food produced in the contaminated areas. For instance, the increase of the intervention levels for the reindeer meat on the market that was applied in order to preserve Sami lifestyle and culture has been widely accepted by Norwegian citizens. There are other farming practices in Norway that have cultural value, which would make strategies like total stop of production not likely acceptable. However, the times have changes since Chernobyl and so have the premises, and people's expectations with regard to food safety and quality and it is uncertain whether the public would accept similar decision again in order to protect locally produced food. Nevertheless, based on the experiences with the consumers' acceptance of Chernobyl contamination management in Norway - where remediation strategies were developed and implemented in extensive cooperation between scientists, authorities, producers and other stakeholders - the panel participants believed consumers would accept well-founded strategies in a future contamination situation if they were communicated in an open and transparent way.

The ongoing climate changes, which result in an increased number of extreme weather events, pose an additional challenge to emergency management as it can affect the availability of alternative (clean) feed. In Norway, for instance, the rainy summer of 2017 was followed by the extremely dry summer of 2018 leading to shortage of feed all over the country.

Some of the countermeasures might require a resolution of the legal issues related to them. For example, change of pastures to less contaminated ones raise issues of pasture right regulations, while keeping animals indoors to ensure clean feeding goes against regulations on animal welfare that requires all farm animals to spend some time outdoors.

5 Conclusions and Perspectives

The Norwegian national panel discussed a relatively concrete scenario and strategies for production of two food products. The outputs of this somewhat restricted scenario discussion nevertheless shows that:

- Choice of countermeasure strategy is a complex task and has to consider a variety of factors: it's effectiveness, cost-benefit ratio, level of intrusion into the normal practice, how easy it would be to implement, and how it is perceived by various actors
- A single countermeasure will not likely be enough in many cases, therefore a combination should always be considered
- Local conditions are very important for both the applicability of a particular countermeasure and how effective it will be – need for planning in advance together with local actors
- Monitoring/measurement programs are extremely important for mapping contamination, identifying sensitive or less sensitive areas (in relation to food chain transfer), documenting effect of countermeasures and building trust to the strategy and products
- A great deal of uncertainty is associated with the consumer response to the countermeasures and food products from the affected areas. However, the positive experiences with consumers' acceptance of remediation strategies after the Chernobyl accident make the Norwegian panel believe that consumer acceptance for the authorities' strategies also may be achieved in the future.

With reference to the strategies chosen in Japan after the Fukushima accident it is also worth noting that the Norwegian stakeholders are reluctant towards soil removal and stopping agricultural

production, even in scenarios with significantly higher contamination levels compared to the Chernobyl fallout – and when discussing a product of relatively low dietary importance. Another interesting conclusion in light of the situation in Japan is that many years of positive experiences with Prussian blue in animal production in Norway makes the stakeholders give this countermeasure the highest priority also when discussing new fallout scenarios.

6 Annexes

6.1 Annex A: Contamination levels in cow´s milk and sheep meat used in the discussions

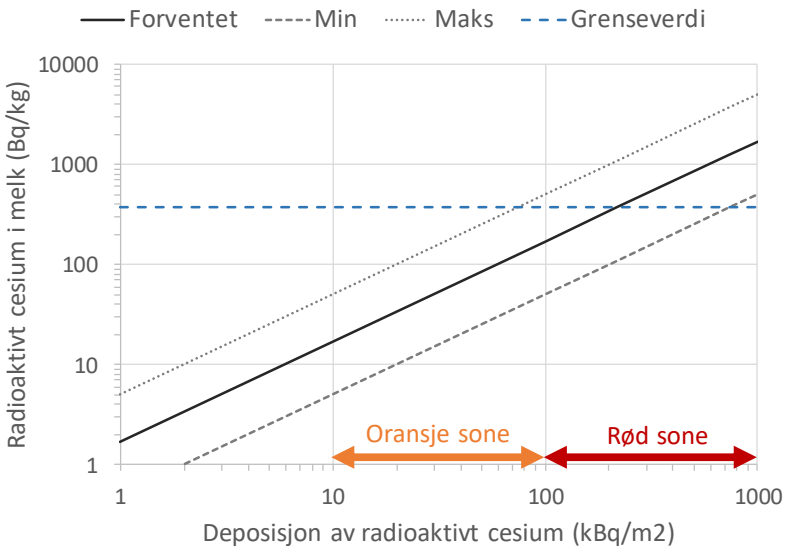


Figure 5 Activity concentrations in cow´s milk (Bq/kg) versus deposition density (kBq/m²). Expected concentration ("Forventet") with uncertainties (min-max) is estimated based on Norwegian Chernobyl data for milk. The current intervention level for cow´s milk (370 Bq/kg) is also shown ("Grenseverdi").

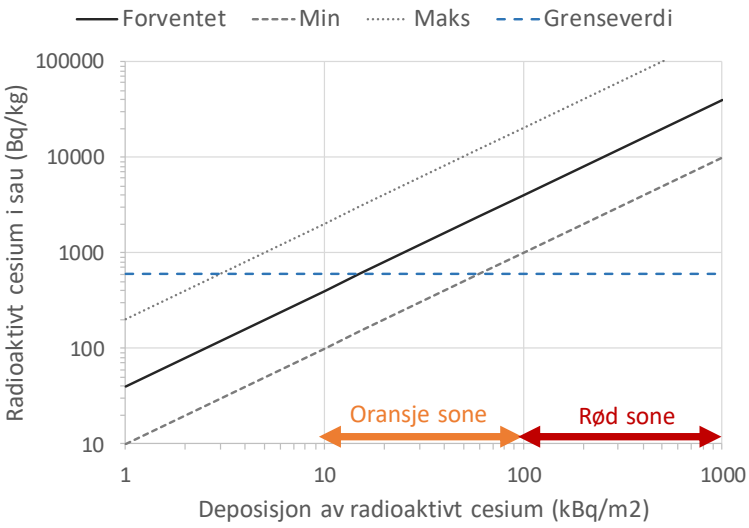


Figure 6 Activity concentrations in sheep meat (Bq/kg) versus deposition density (kBq/m²). Expected concentration ("forventet") with uncertainties (min-max) is estimated based on Norwegian Chernobyl data for sheep. The current intervention level for sheep meat (600 Bq/kg) is also shown ("Grenseverdi").

6.2 Annex B: Seminar agenda

Seminar on strategies for long-term recovery

Monday 29 April

12:00	Welcome. Objective and scope of the seminar Brief summary about the Chernobyl and Fukushima accidents
12:30	Lecture on the situation after the Fukushima accident by Ryoko Ando (ETHOS Fukushima)
13:30	Break for coffee
13:45	Introduction to the scenario (the basis for discussions)
14:15	Discussion in groups: Advantages, disadvantages, priorities and uncertainties when choosing remediation strategies
15:30	Break for coffee and a little to eat
17:00	End day 1
19:00	Seminar dinner

Tuesday 30 April

09:00	Summing up the group discussions from day 1
10:00	Two invited talks on the topic "Food safety as viewed by the industry" by: Dagligvarehandelens miljøforum ("Grocery sector's environmental forum")
10:30	Break for coffee
10:40	Norwegian Farmers' Union
11:10	Plenary discussion on the input from the industry Summing up and end of the seminar
11:45 – 12:30	Lunch

6.3 Annex C: Individual questionnaire distributed at the end of the seminar

Illustration of the questionnaire distributed to the panel participants at the end of the seminar. Separate forms where made for each food product in each contamination zone. The forms for sheep meat in orange and cow's milk in red zone are illustrated below.

Product in zone:	Sheep meat in orange zone							
Assessment of strategy:	Dismiss (0) (7)	1	2	3	4	5	6	Preferred
Sheep1: No countermeasures	☐	☐	☐	☐	☐	☐	☐	☐
Sheep2: Plowing and fertilizing	☐	☐	☐	☐	☐	☐	☐	☐
Sheep3: Clean feeding	☐	☐	☐	☐	☐	☐	☐	☐
Sheep4: Use of Prussian blue	☐	☐	☐	☐	☐	☐	☐	☐
Sheep5: Use less contaminated pastures	☐	☐	☐	☐	☐	☐	☐	☐
Sheep6: Remove top layer of soil	☐	☐	☐	☐	☐	☐	☐	☐
Sheep7: Stop production	☐	☐	☐	☐	☐	☐	☐	☐
Other / any combinations: ……..	☐	☐	☐	☐	☐	☐	☐	☐
What are the key factors for the choice of the preferred strategy/strategies?								
What makes the preferred strategy decision difficult? What are the biggest challenges in the decision?								
Other comments:								

Product in zone:	Cow's milk in red zone							
Assessment of strategy:	Dismiss (0) (7)	1	2	3	4	5	6	Preferred
Milk1: No countermeasures	☐	☐	☐	☐	☐	☐	☐	☐
Milk2: Plowing and fertilizing	☐	☐	☐	☐	☐	☐	☐	☐
Milk3: Use of Prussian blue	☐	☐	☐	☐	☐	☐	☐	☐
Milk4: Remove top layer of soil	☐	☐	☐	☐	☐	☐	☐	☐
Milk5: Stop production	☐	☐	☐	☐	☐	☐	☐	☐
Other / any combinations: ……..	☐	☐	☐	☐	☐	☐	☐	☐
What are the key factors for the choice of the preferred strategy/strategies?								
What makes the preferred strategy decision difficult? What are the biggest challenges in the decision?								
Other comments:								

B-07. Report of Portuguese National panel

Authors:. Paulo Nunes, Luis Portugal, João Oliveira Martins (APA); Mário Reis, Isabel Paiva, Octávia Monteiro Gil (IST)

Ref. Report: CONFIDENCE-WP4/T4.2.1-R08 / CONCERT D 9.22 Part B-07. v2.0 Final

Summary

The basic concept for the scenario tested in Portugal is focused on long-term recovery and the decisions to be taken during the transition phase. This includes the alternatives for protective actions and the development of countermeasures strategies for urban and agricultural areas.

The deposition scenarios include an urban environment and an agricultural area, with different levels of contamination.

The recovery strategies considered were discussed and decisions were taken by considering and weighting some criteria, like effectiveness, feasibility, constraints, side-effects, costs and social and ethical factors.

The obtained results, from the stakeholder's opinion, could be used on the multi criteria analysis.

Table of Contents

1 Objectives and Scope

A panel meeting was organized in 2019. The main purpose of the meeting was to discuss the implementation of recovery strategies in the transition phase of a nuclear event and to identify the main uncertainties related to the decision-making process.

The basic concept for the Portuguese scenario is focused on long-term recovery and the decisions to be taken during the transition phase: alternatives for protective actions and development of countermeasures strategies for urban and agricultural areas.

The deposition scenarios presented to the panel of stakeholders included an urban environment and an agricultural area, with different levels of contamination.

The recovery strategies considered were discussed and decisions were taken by considering and weighting pre-chosen criteria, like effectiveness, feasibility, constraints, side-effects, costs and social and ethical factors.

2 Methodology

2.1 Scenario and timeframe of interest

2.1.1 Deposition Scenario

The scenario that has been prepared is based in a "Level 2 PSA" severe accident sequence. The participants were provided with deposition (contamination) maps of the affected areas, including 3 distinct zones: contaminated, heavily contaminated and extremely contaminated.

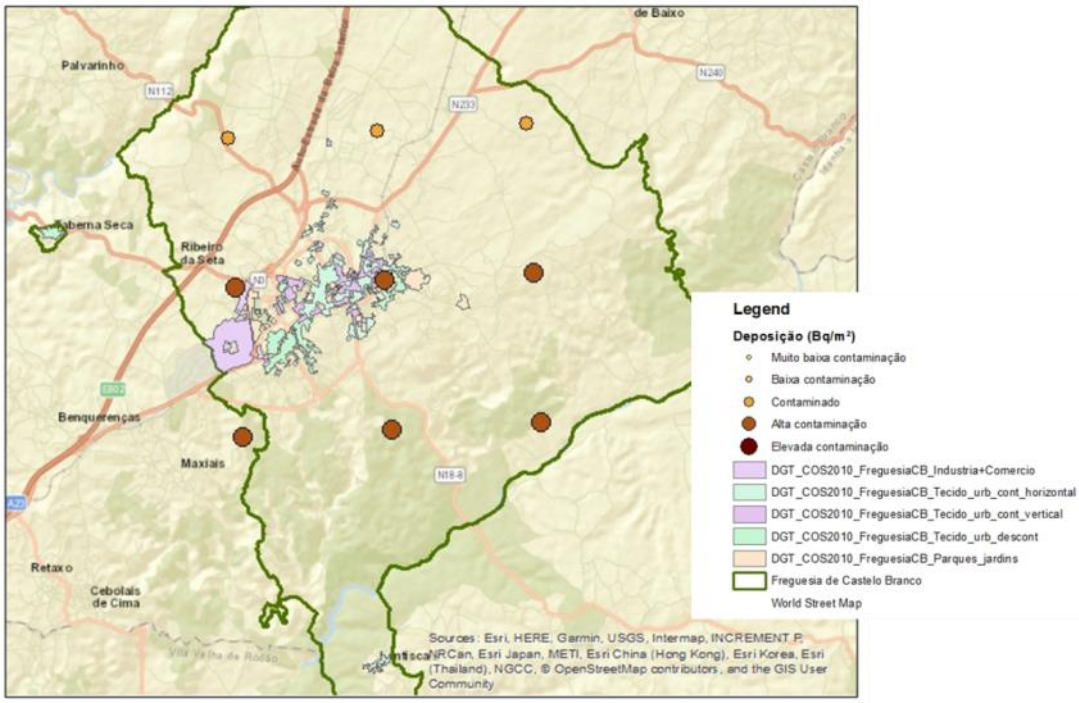


Figure 1. Deposition scenario in an urban environment indicating different levels of contamination, considering the different urban areas.

The contaminated areas include an important urban area, the City of Castelo Branco, near de Portuguese border with Spain which comprises several inhabited areas such as residential areas with different type of buildings (continuous vertical buildings and continuous horizontal buildings), industrial sites, commercial zones and green zones (parks and gardens) (Figure 1).

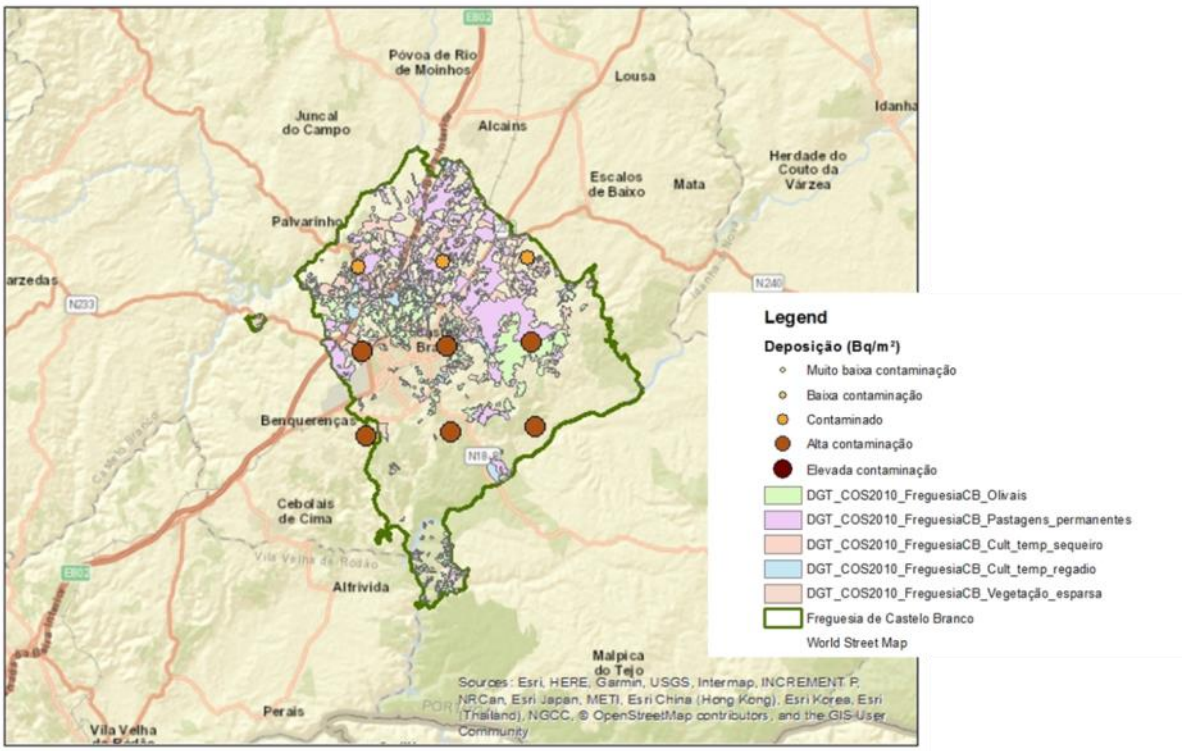


Figure 2. Deposition scenario in an agricultural environment indicating different levels of contamination, concerning the different types of agricultural activities.

Regarding the agricultural area, the main land use consists on permanent pastures, with milk, dairy and meat production; olive trees, rain fed crops like cereals and grain crops and irrigation crops like leafy vegetables. Most of these products are designates as “DOP –PROTECTED DESIGNATIONS OF ORIGIN” food products with a high impact on this area’s economy (Figure 2).

2.1.2 Recovery strategies to be presented to the panel

The recovery strategies were composed of a selection of countermeasures for medium/long-term actions, based on the recommendations of the EURANOS handbook for management of contaminated inhabited areas and of the EURANOS handbook for management of contaminated food production systems.

Regarding the urban scenario, the strategies are always composed by a combination of 3 countermeasures: one for external surfaces plus one for internal surfaces and one for green areas/parks, as shown in Table 1. They include a “no-action” strategy, a lower cost / low waste production strategy and a higher cost / high waste production strategy.

Table 1. Strategies for urban scenario

Strategies	Contaminated Areas		
	Slightly contaminated (10-100 kBq/m^2)	Contaminated (100-1000 kBq/m^2)	Heavily contaminated (1000-10000 kBq/m^2)
SU0. No active implementation of management options (do nothing)	X		
SU1. Roof brushing + Vacuum cleaning + grass cutting	X		
SU2. Fire hosing Roofs + Washing Interior Surfaces +Turf Harvesting	X	X	X

For the agricultural scenario, the strategies are also elaborated by a combination of 3 countermeasures, being one focused on soil/plant (crop) and two focused on livestock and animal products (see Table 2). Again, one of the strategies implies no action, other has low cost / low waste production and another one has high costs / high waste production.

Table 2 Strategies for agricultural scenario

Strategies	Contaminated Areas		
	Slightly contaminated (1-100 kBq/m^2)	Contaminated (100-1000 kBq/m^2)	Heavily contaminated (1000-10000 kBq/m^2)
SA0. No active implementation of management options (do nothing)	X		X
SA1. Soil shallow and deep ploughing +Live animals monitoring+ Processing of crops for subsequent consumption		X	X
SA2. Application of potassium fertilizers or lime to arable soils and grassland + Addition of AFCF (Ammonium-ferric hexacyano-ferrate, GIESE) to animals´ concentrate ration or animal clean feeding + Processing of milk for subsequent human consumption.		X	X

2.2 Organization and schedule of the meetings

The meeting started with an introductory presentation of the contamination scenarios and a simplified view of recovery strategies that could be applied. Afterwards, the participants were distributed in two independent groups and each group was provided with deposition maps in order to discuss the best recovery strategy and the uncertainties associated with the decision-making process. For each group, two facilitators and a secretary were appointed.

For each of the deposition scenarios (urban and agricultural), the participants were asked:

1) "Which are the main uncertainties considered when deciding for a specific strategy?".
2) "What factors do you consider in the decision-making process and how do you weight them, according to Table 3".

Table 3. Table of weighting factors to be filled by the panel participants.

Factors	Weight From 1-not important to 10-very important									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Effectiveness										
Feasibility										
Constraints										
Side-effects										
Cost										
Social aspects										

2.3 Composition of the panel (participants)

The meeting had the participation of several local and national stakeholders from municipalities, civil protection, environmental authorities, health authorities, food and water authorities, agriculture authorities, representatives of the industrial sector, law enforcement authorities and first responders, in a total of 25 participants:

- Magarefa, Associação de Produtores Florestais (Forest' Products Association)
- Escola Superior Agrária de Castelo Branco (Agriculture School)
- Instituto Politécnico de Castelo Branco (High Level Technical Institute)
- Câmara Municipal de Castelo Branco (Mayor's Office)
- Autoridade Nacional de Protecção Civil (National Authority on Civil Protection)
- Comando Distrital de Operações de Socorro de Castelo Branco (Local Relief Operational Command)
- Bombeiros de Vila Velha de Rodão (Firemen Corporation / First responder)
- Bombeiros de Castelo Branco (Firemen Corporation / First responder)
- Comando Operacional Distrital de Operações de Socorro (Regional Relief Operational Command)
- Guarda Nacional Republicana (National Guard- Police forces)
- Direcção Regional de Agricultura e Pescas do Centro (Regional Directorate for Agriculture and Fishery Activities)
- EPAL, Empresa Portuguesa de Águas Livres (Water's Portuguese Company)
- Agrupamento de Escolas Nuno Álvares (Local Schools)
- INEM, Instituto Nacional de Emergência Médica (National Institute for Medical Emergency)
- PSP, Polícia de Segurança Pública, Comando Distrital de Castelo Branco (Local and Regional Police Commands of Castelo Branco)
- Protecção Civil de Castelo Branco (Civil Protection Command of Castelo Branco)
- Delegação Regional de Saúde de Castelo Branco (Regional Delegation of the Directorate-General for Health)
- Cruz Vermelha Portuguesa, Delegação de Castelo Branco (Portuguese Red Cross Local Delegation)

3 Results analysis and main issues identified

Regarding the first topic: "Which are the main uncertainties considered when deciding for a specific strategy?", the key points raised by the stakeholders were:

Urban scenario

- The choice of strategies should be dependent on the level of contamination and according to the urban tissue;
- How to communicate? Communication is very important and the population should be involved and understand the message, communication strategies should be developed;
- Public acceptance of the strategy and its credibility is very important;
- How will the strategy impact the community;
- Uncertainties related to the effectiveness of the strategy to implement, logistic constraints and costs need to be taken into account;
- How much waste will be produced and how safe is to transport it? Are there places to store the great amounts of generated wastes?;
- Special attention should be given to schools and hospitals, when choosing for a specific strategy;
- Social cost is very important;
- Improvement of the radiation monitoring in order to decrease uncertainty by increasing confidence in the measurements;
- Do nothing (strategy SU0) is not an option, a combination of strategies according to the contaminated areas should be the better solution.

Agricultural scenario

- Uncertainty regarding the stigmatization of the affected area was a factor of concern;
- How will the economy be affected, if the regional products are not accepted/not trusted by the population;
- More information is needed to make decisions (compared to the information that was made available to the panel participants);
- Environmental monitoring and health monitoring were considered fundamental to increase people trust;
- Difficulties in defining an effective strategy that can be understood and accepted once the results are not immediate;
- Local producers may face economic problems;
- How to re-establish the consumer trust?;
- The implementation of any of the measures (strategies) would always increase production costs;
- Communication with the populations and social aspects are important: uniformed or badly informed people may refuse to consume the products from the affected region. How will this affect the local and regional economy?;
- The application of the 3rd strategy (SA2) would be costly and is not sure if it would decrease the stigma related to the food products. There was the sense that, at the end, people would not buy the products anyway;

- Strategies to recovery foodstuff safety should be effectively communicated to the main (target) actors emphasizing again the paramount role of the communication tools in the context of post emergency;
- Both strategies (SA1 and SA2) should be adopted, depending on the soil type of occupation and on the levels of contamination;
- Phased planning for implementation of measures;
- Do nothing (SA0) should not be considered as an option.

Figure 3 and Figure 4 summarize the results of the discussions on the second topic: "What factors do you consider in the decision-making process and how do you weight them, according to Table 3".

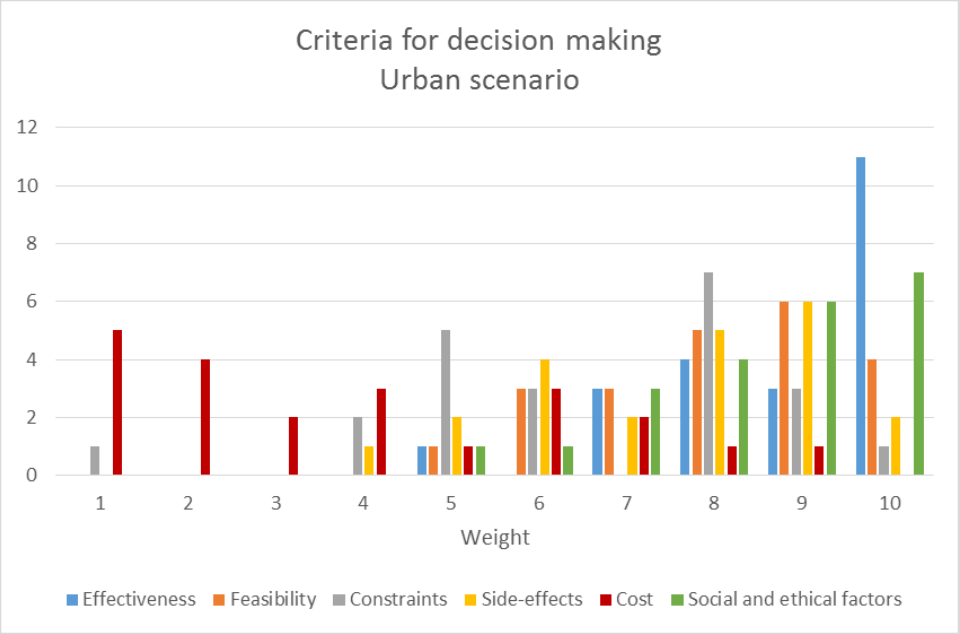


Figure 3. Scores, from the stakeholders, for the weighting factors considered in the decision-making process (urban scenario).

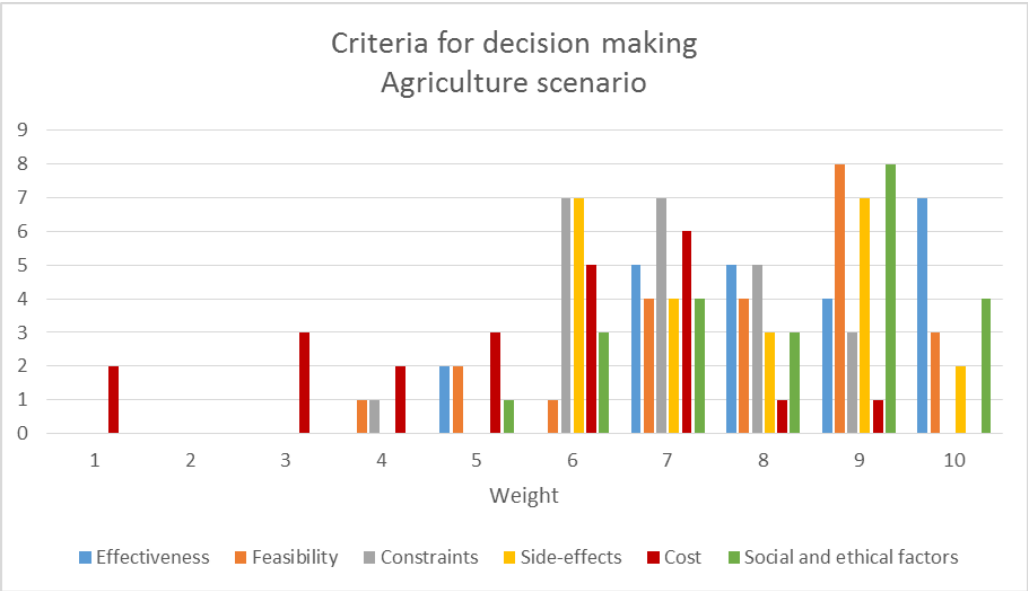


Figure 4. Scores, from the stakeholders, for the weighting factors considered in the decision-making process (agricultural scenario).

4 Conclusions and Perspectives

The stakeholders concluded that the main goal to achieve in the transition phase of a nuclear accident is to return to the normal living conditions, which may not be exactly the same conditions as before the accident, but the safety of the populations should be assured.

The stakeholders pointed out that communication and information to the population are one of the most important issues in order to gain the public trust in the implementation of a specific recovery strategy. Also the population and the main actors should be involved in the decision-making process.

For both urban and agricultural scenarios, the strategy referred as “no active implementation of management options (do nothing)” should never be an option. The stakeholders considered that the population needs to know that the involved authorities are taking some actions in order to feel safe and to feel that something is being done.

The stakeholders considered that the better solution would be a combination of strategies, that should be implemented according to the level of contamination in the different areas and a graded implementation depending on the follow up of the situation combined with the results of monitoring measurements.

As can be seen in Figure 3 and Figure 4, the cost has the lower scores in terms of importance for the decision-making process in the urban scenario. This factor tends to gain more importance in the agricultural scenario. On the other hand, for both scenarios, the effectiveness, feasibility and social and ethical are some of the factors considered by the stakeholder involved in this panel to have more importance in the decision-making process.

As a general remark, the analysis of the stakeholder’s position in terms of scores for the weighting factors considered in the decision-making process show slightly differences dependent on the scenario. It is not surprising how the economic aspects, the cost effectiveness and the feasibility are taken into account by the different stakeholders in both scenarios. Regardless the fact that the composition of the panels could affect the results of the exercise, one common aspect is clear: The global need to return to normalized living conditions, without the least repercussion in aspects that are fundamental for the Communities: Safety of the food, water and air; economic constraints and feasibility of the recovery processes and trusty communication.

B-08. Report of Slovak National panel

Authors: Duranova T.; Bohunova J. (VUJE)

Ref. Report: CONFIDENCE-WP4/T4.2.1-R09 / CONCERT D 9.22 Part B-08. v1.0 Final

Summary

Stakeholder discussion panel have been set up in Slovakia in the framework of the project CONFIDENCE – WP4 (Transition to long-term recovery, involving stakeholders in decision-making processes) and WP6 (Decision-making under uncertainties) to deal with decisions taking in the transition phase on urban decontamination issues and the impact of relocation as well as continuation of the previous activities related to establishing and assessing the processes for national dialogue with stakeholders during the transition to recovery phase, based on representative contamination scenario. The target of the discussions has been focussed on what to do and how to proceed in such contamination scenario and how to evaluate the potential impacts of decisions on achieving acceptable living conditions. The formal decision aiding tool such as multi-criteria decision-making (MCDA) have been presented and tested during the stakeholder panel to see how it can be adapted and used for uncertainty handling and "robust" decision-making for radiological emergency. These discussions were mindful of the inherent uncertainties associated with the real consequences of the contamination scenario, the strategies to be implemented and the potential socio-economic impacts on the affected population. Preferences collected within WP4 panel discussion served the inputs to the MCDA by WP6. The appropriate means of visualisation in terms of information for decision-making when based on an MCDA tool have been discussed and evaluated.

Table of Contents

1 Objectives and Scope

The main objective of the panel was to facilitate stakeholders' involvement and to provide valuable input in the process of decision-making to improve preparedness for and response during the transition phase.

The objective of the Slovak panel was to incorporate the views of the stakeholders in the governance of the exposure situation, taking into account the inherent uncertainties associated with:

- the real consequences of a contamination scenario,
- the goals and criteria influencing development of the recovery strategies,
- the strategies to be implemented,
- the potential socio-economic impact on the affected population and
- the preferences that should be incorporated in the multi-criteria decision-making (MCDA).

The main areas of interest were evacuation/relocation of population and urban area recovery. In that sense the objectives were focusing on following issues:

- To determine which criteria are important for which stakeholder groups;
- How certain criteria impact the return of evacuated/relocated population or opposite – impact further extended evacuation/relocation;
- How these criteria and their uncertainties could be taken into account in post-accident decision-making on decontamination and recovery management.

2 Methodology

The seminar with stakeholders from already established national panel invited to participate in the CONFIDENCE project activities and workshops took place in VUJE premises in February 8, 2018 with the main goal to introduce CONFIDENCE project objectives and particular tasks of the WP4 (Transition to long-term recovery, involving stakeholders in decision-making processes), WP5 (Social, ethical and communicational aspects of uncertainty management) and WP6 (Decision-making under uncertainties) and their interaction. The date and duration of workshops as well as WP4 questionnaire have been discussed to collect the ideas of experts and stakeholders on issues to deal during the transition phase.

Stakeholders have been informed about the surveys and interviews planned to be conducted within work-packages WP4-WP6 and Delphi study and their importance in terms of fulfilment of project objectives.

Active participation of Slovak stakeholder in all tasks provided basis for the scenario preparation. First Delphi study results have been presented at the NERIS Platform workshop in Dublin, April 2018 and also at the national Slovak stakeholder panel.

It was agreed to have two two-days combined panels organized by VUJE in VUJE premises in Modra-Harmonia:

1) first in December 10-11, 2018 (WP4+WP6) and

2) second in March 4-5, 2019 (WP5+WP6+WP4).

The aim of first workshop was through open facilitated discussion on criteria in decision-making and uncertainties to get and prioritize stakeholder preferences on criteria and alternatives of countermeasures that should be incorporated in the MCDA tool, its testing and use as a decision aiding tool.

The stakeholder dealt with urban decontamination issues and the impact of relocation was treated.

2.1 Scenario and timeframe of interest

2.1.1 Contamination scenario

The scenario was situated during the transition phase after a fictitious nuclear accident in the Bohunice NPP with external release of radioactivity to environment. The release has ceased, and the control over the source has been taken. The radioactive contamination has spread in the surroundings of the damaged NPP and transported and dispersed through the borders of the country affecting the neighbouring regions. Early emergency actions have been taken to avoid the exposure to population, including evacuation, access restrictions and food restrictions. It has to be decided how to proceed in such a situation and prepare recovery of contaminated areas.

Following figures are presenting ground contamination, areas affected by evacuation and temporary relocation.

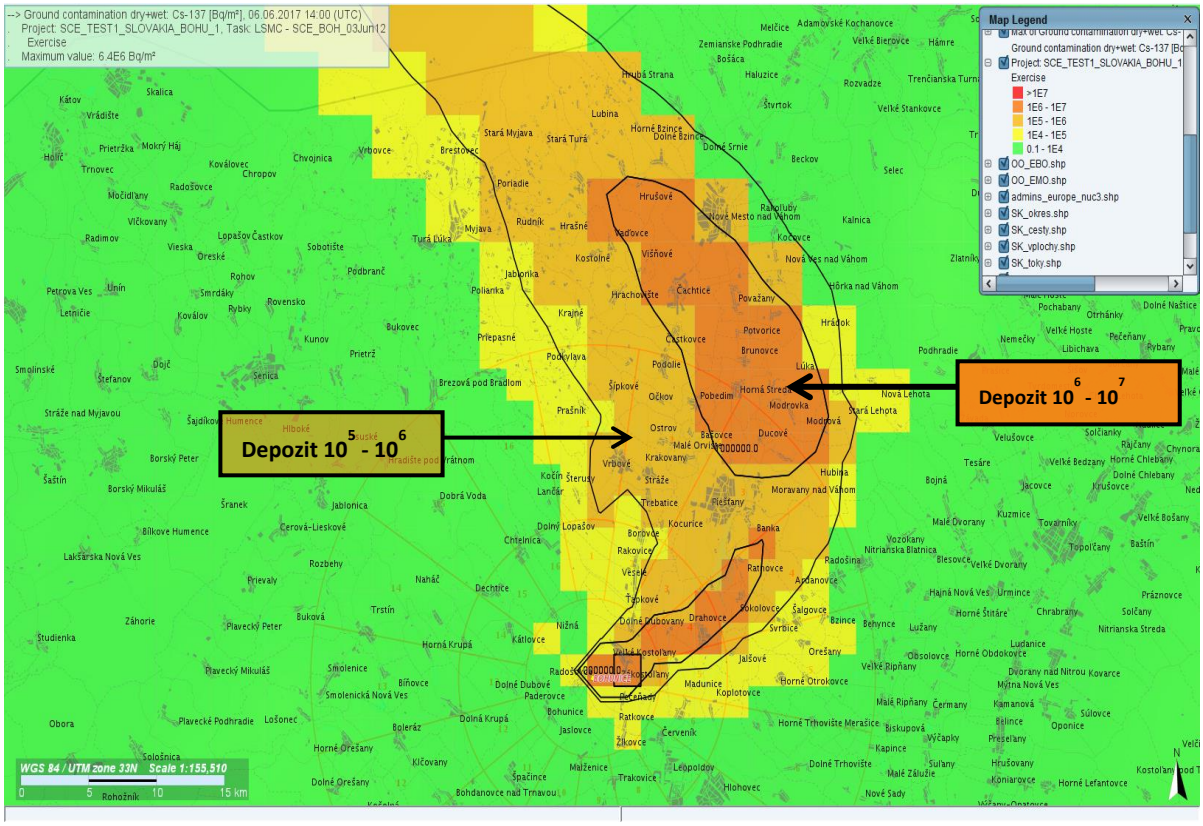


Figure 1: Scenario Bohunice (release: June 3 at 12:00) ground contamination (dry+wet) for Cs137 at ~3 days after start of release

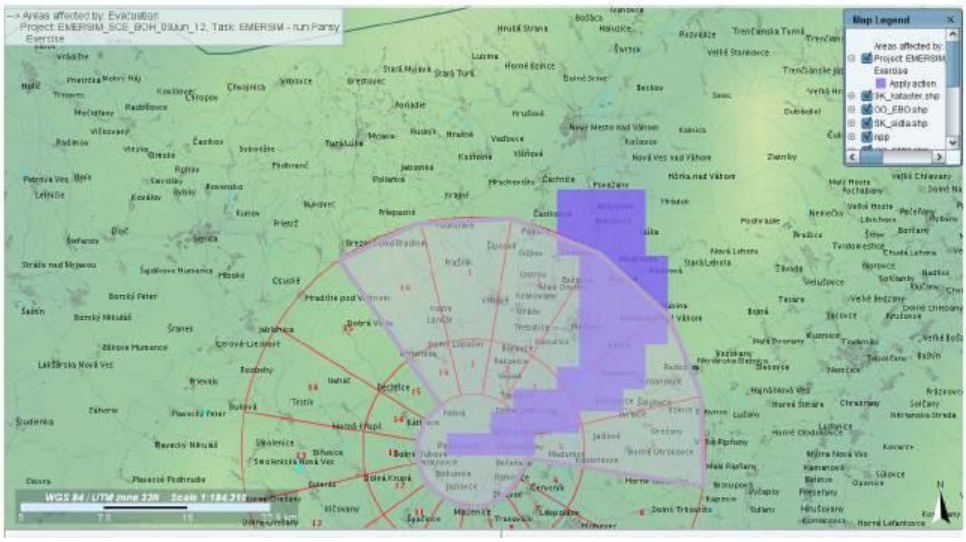


Figure 2: Areas affected by evacuation (effective dose, integration time 7 days, 100 mSv)

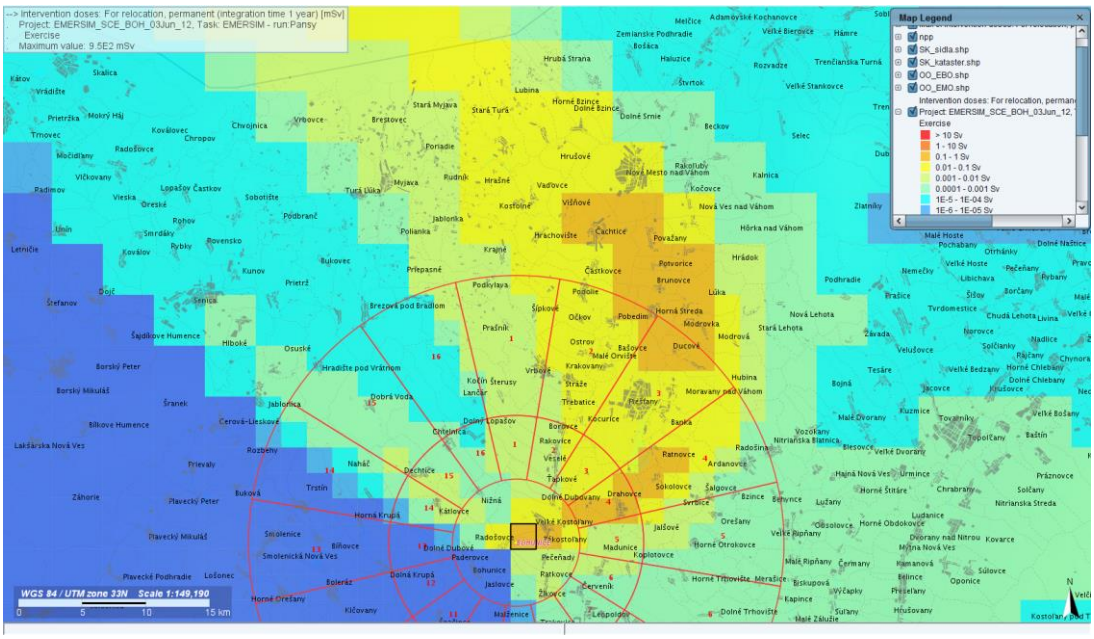


Figure 3: Areas affected by temporary relocation (effective dose, int. time 1 year, 100 mSv - GSR Part 7)

2.1.2 Case study: urban issues in Piestany

Municipality Piestany, spa town within the Trnava region, Piestany district was the main area for the discussions. The Piestany population is about 27666 citizens and in addition 6 000 spa guests. The area of municipality is about 44.2 km^2 with 24% of build-up area ~ 10.7 km2 including buildings with different walls and roofs, interiors, streets and pavements, areas of grass, trees, plants, soil, playing grounds, sport fields, water areas and others.

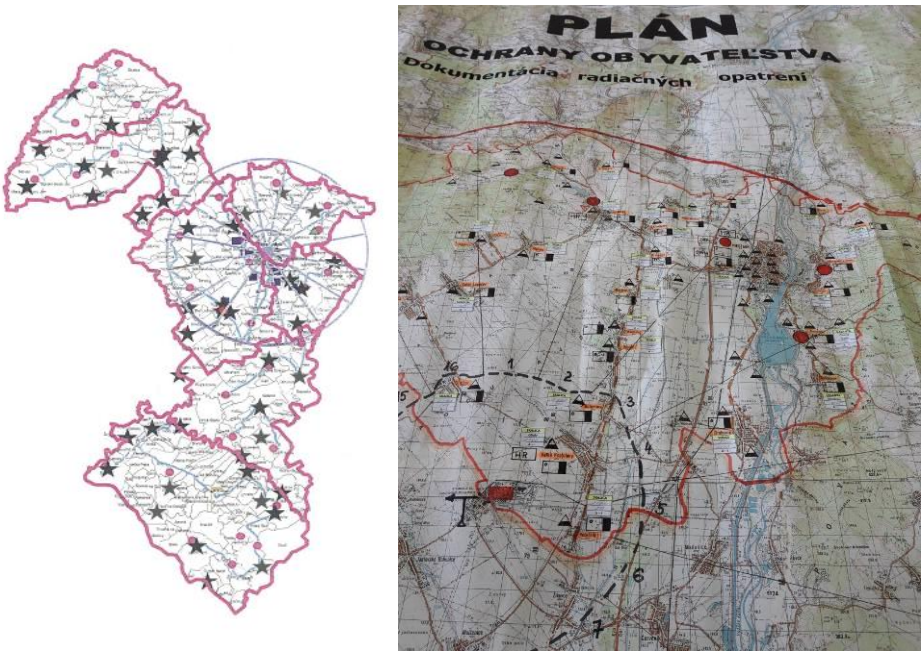


Figure 4: Region Trnava, District Piestany

Municipality Piestany is situated on the right bank of the river Vah south of the town is the Slnava water reservoir created by a dam on the Vah river.

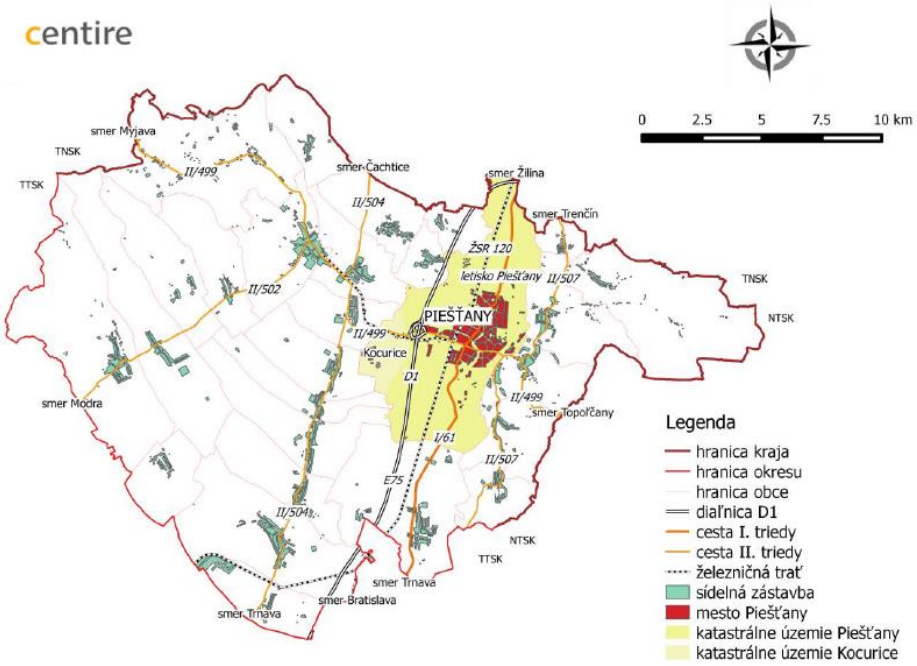


Figure 5: Location of District Piestany

Under the scenario the situation in Piestany 3 days after an accident was supposed to be as follows:

- Contamination 3 - 4 MBq/m^2 137Cs
- Doses ≈ 20 mSv/year

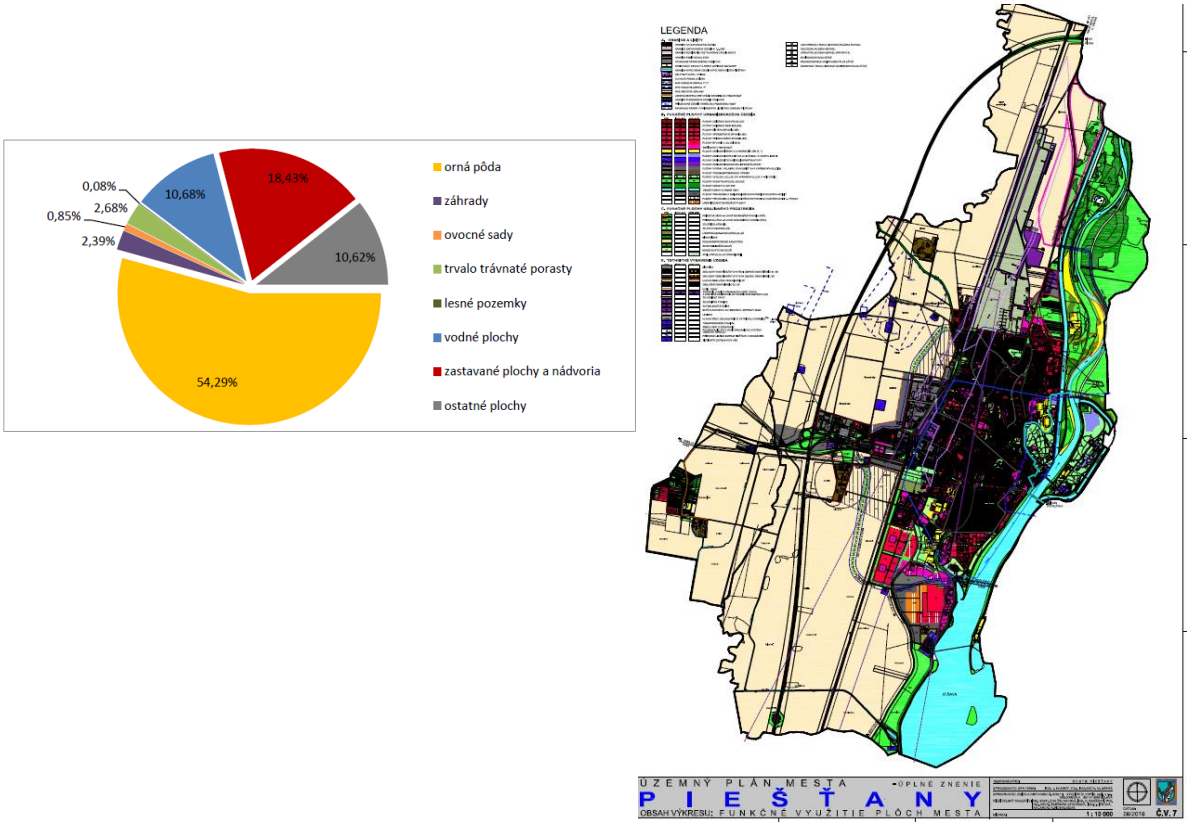


Figure 6: Municipality Piestany, urban area composition

As under the scenario panel was gathered for the discussion 3 days after the accident, aspects and information about the daily life issues and plans have been prepared as well.

Traditional events in Piestany during summer - period in 3 month after an accident:

- 1.– 3.6.2018 Opening on the spa season
- – 3.6.2018 International Canoe Regatta Piešťany - International event for the young canoeists
- 15. – 16.6.2018 Car at tuning party – party motorisms, sport, music, dance, fashion and entertainment
- 6. – 8.7.2018 Motorcycle race with side rock concerts, paragliding and other site events
- 10. – 11.8.2018 Grape Festival is a summer music open-air festival
- 30.8. – 1.9.2018 Country Lodenica – a festival dedicated to country and folk music
- 17. – 23.9.2018 Victoria Regia is the major florist event in Slovakia – an international competition in flower arranging. The annual Slovak championship in flower arrangements and traditional flower promenade are enriched by Unusual Flowers Festival

2.1.3 Recovery strategies

Eight strategies have been defined based on the EU project HARMONE. Five strategies with different recovery options aimed at the cleanup of areas of grass, soil and plants, the interior and roofs. Three of the five cleanup strategies were combined with a three month relocation period.

1. Do nothing (introducing of monitoring strategy)
2. Grass cutting, vacuum cleaning (roads)

3. Roof brushing (roofs), vacuum cleaning (internal building), tree/shrub removal (trees and shrubs), grass cutting (small and large areas of grass), plant and shrub removal (small area of plants) (*low waste 1*)
4. Roof brushing (roofs), vacuum cleaning (internal building), tree/shrub removal (trees and shrubs), grass cutting (small and large areas of grass), plant and shrub removal (small area of plants), rotovating carried out after plant, grass and shrub removal (*low waste 2*)
5. Roof replacement (roofs), vacuum cleaning (internal building), tree/shrub removal (trees and shrubs), grass cutting (small and large areas of grass), plant and shrub removal (small area of plants), topsoil removal carried out after plant, grass and shrub removal (*high waste*)
6. Roof brushing (roofs), vacuum cleaning (internal building), tree/shrub removal (trees and shrubs), grass cutting (small and large areas of grass), plant and shrub removal (small area of plants) (*low waste 1*) + relocation for three months
7. Roof brushing (roofs), vacuum cleaning (internal building), tree/shrub removal (trees and shrubs), grass cutting (small and large areas of grass), plant and shrub removal (small area of plants), rotovating carried out after plant, grass and shrub removal (*low waste 2*) + relocation for three months
8. Roof replacement (roofs), vacuum cleaning (internal building), tree/shrub removal (trees and shrubs), grass cutting (small and large areas of grass), plant and shrub removal (small area of plants), topsoil removal carried out after plant, grass and shrub removal (*high waste*) + relocation for three months.

The results of ERMIN module of JRODOS system have been used as a basis for discussion.

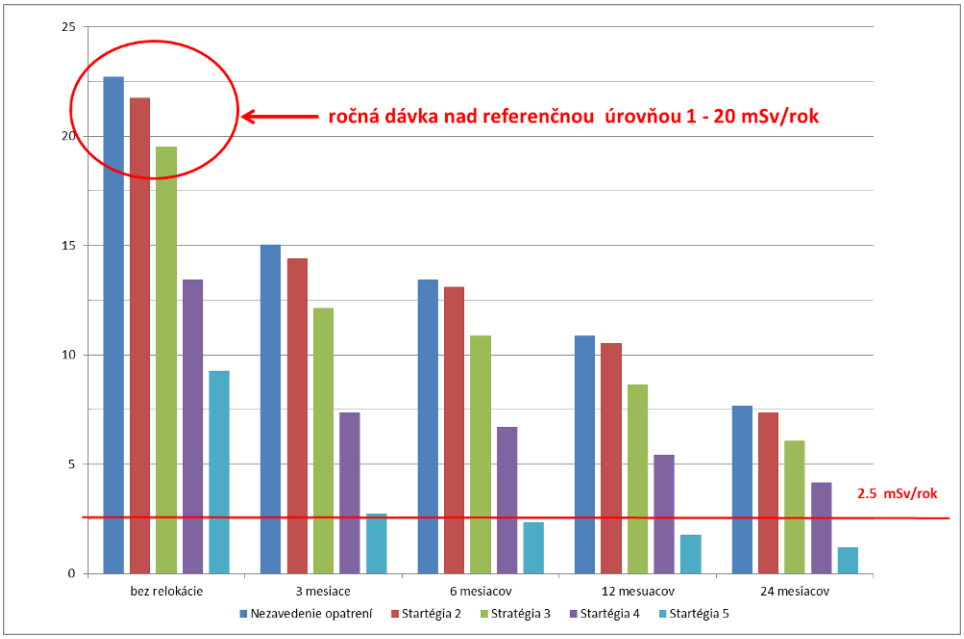


Figure 7: First year dose, mSv: without relocation; 3, 6, 12 and 24 months of relocation

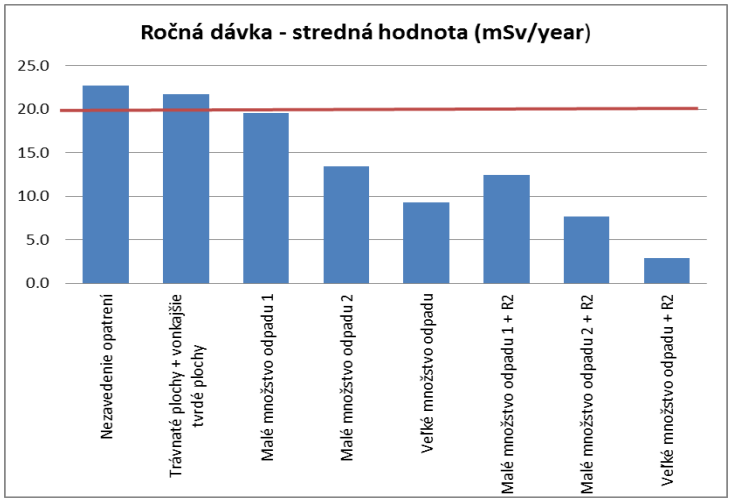


Figure 8: Annual dose, mean value, mSv/year

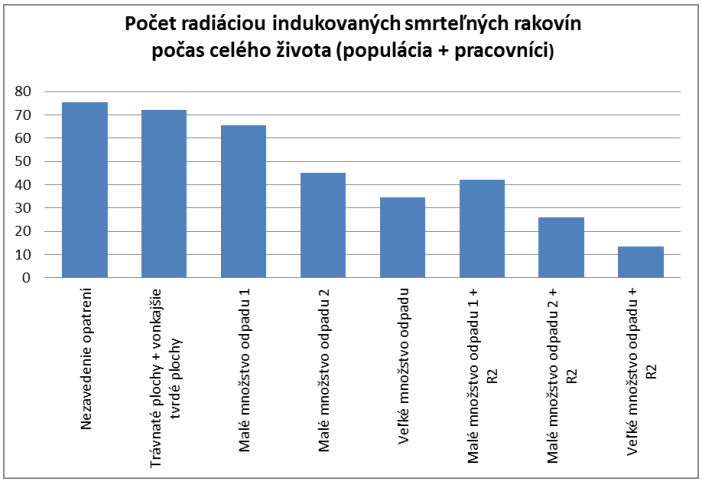


Figure 9: Number of cancer incidences during 50 years, attributed to the exposure (population and workers)

Figure 10: Radioactive waste amount, kg

Costs of countermeasures taken into account during the discussions included following items: accommodation during relocation, compensation of loss of productivity during relocation, clan-up strategy implementation, waste transport and storage and cancer treatments.

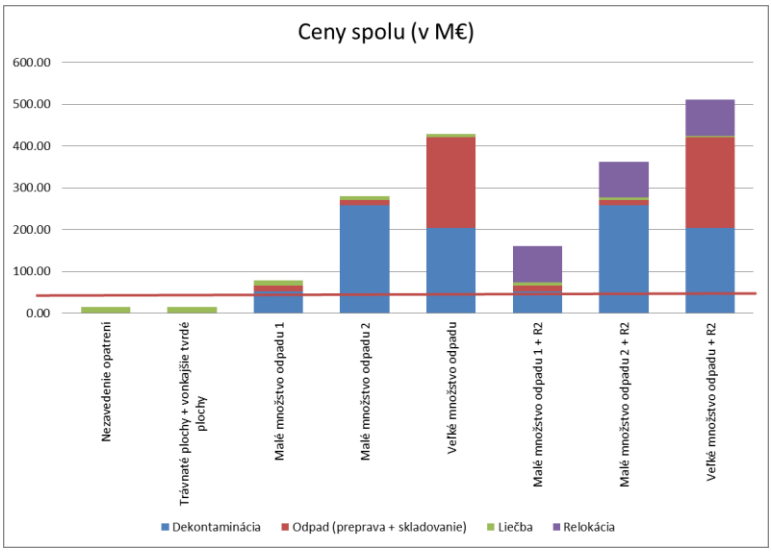


Figure 11: Overall costs for particular strategy

The following uncertainties have been included in generating the ERMIN outputs presented below: occupancy variability, deposition amount and composition to reference surface variability, shielding/environment variability, soil migration variability and countermeasure uncertainty (simply treated; time of application and whether or not effective).

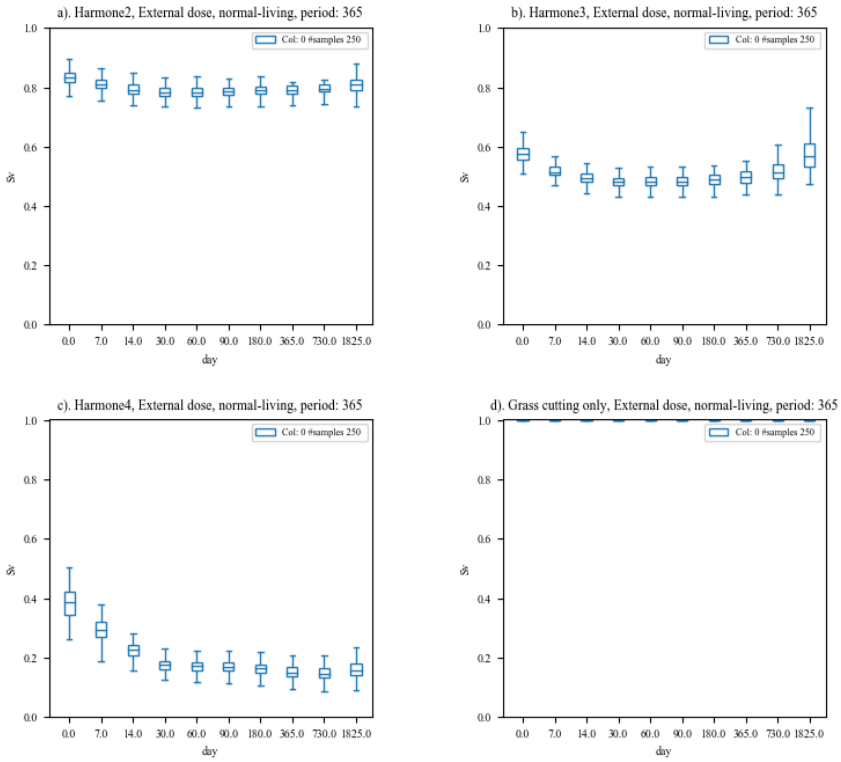


Figure 12: Dose reduction factors (Sv) for clean-up strategies (3, 4, 5, 2 - only grass cutting)

Uncertainties not included have been following: retention on other surfaces (e.g. because of different materials), variations in relative deposition to other surface (e.g. because of different materials), particle groups (e.g. varying proportions of fuel particles present) this can be expected to be correlated with distance.

2.1.4 Topic addressed

The addressed topics for discussion were following:

1. What do we understand by "the transition phase"
2. Main concerns during the transition phase
3. Issues to be addressed during the transition phase:
    a. Relocation of people and restoration of living conditions
    b. Application of countermeasures
    c. Decontamination
    d. Radiological characterization of the contaminated areas
    e. Radioactivity surveillance/monitoring programs
    f. Waste management
    g. Information and risk communication to the population
    h. Public acceptance
    i. Public trust in experts and authorities
    j. Stigmatization
4. Objectives and criteria of the restoration plan
5. Alternative restoration actions
6. Key criteria for the selection of management options
7. Stakeholders engagement
8. International cooperation

2.2 Organization and schedule of the meetings

The Slovak stakeholder panel took place in December 10-11, 2018 in VUJE premises in Modra-Harmonia. The participants have been accommodated in the VUJE resort.

Framework programme of the workshop was following:

10.12.2018 (Monday)

- Participants arrival, registration, accommodation, coffee, tea, refreshment
- Introduction - project CONFIDENCE (main goal, WP4 objectives, participation in the surveys, Delphi study), BSS requirements, management of contaminated inhabited areas (EURANOS Handbooks), the main goal of the workshop, programme and agreement on way of work (*Tatiana Duranova*)
- Requirements and criteria on protective measures under the valid legislation (the new radiation protection law related to BSS requirements) with focus on transition from emergency to existing exposure situation after the nuclear accident, discussion (*Public Health Authority representative*)
- Facilitated discussion (*Tatiana Duranova*) - warming up, inherent uncertainties on the knowledge of the real consequences:
  Radiation protection of population in the transition phase of nuclear accident
    - What do we understand by "the transition phase",
    - Main concerns and most important difficulties during the transition phase,

- Issues to be addressed during the transition phase (evacuation, relocation, application of countermeasures, monitoring - health and radiological characterisation o the contaminated area, decontamination, waste management, information and work with population - risk communication, public acceptance and public trust in experts and authorities and other),

- Introduction to the workshop scenario (*Jarmila Bohunova*)

- Scenario: Case study - Countermeasures in Spa city Piestany after the NPP Bohunice accident (*presentation - Jarmila Bohunova and follow up discussion facilitated by Tatiana Duranova*)
  - Objectives of the recovery/restoration plan: Which objective do we need to achieve? (Dose levels restored, minimum impacts in the population, public confidence, minimum economic costs, minimum environmental impacts, etc.)
  - Alternative restoration actions: relocation, do nothing, strategies - low waste, high waste, simple and quick to apply and difficult and slow)
  - Key criteria for selection of strategy (evaluate management options, discuss possible decisions, prepare input for MCDA)
  - Stakeholders engagement (Is it necessary? Preferred role - in decision-making, other? What kind of stakeholders need to be involved? How to involve? Roles and responsibilities? Are they clear? Coordination?
  - International cooperation (Is it well established?)

11.12.2018 (Tuesday)

- Summary of key findings from the discussions at previous day (*Tatiana Duranova*)
  - Objectives of the recovery/restoration plan,
  - Alternative strategies,
  - Key criteria for the selection of strategy
- Introduction to the MCDA and taking into consideration uncertainties in decision-making about protective measures within the transition phase (*Tim Mueller, simultaneous translation by Tatiana Duranova*)
- Discussion about choosing/prioritise the strategy (use of MCDA) and taking into account the inherent uncertainties on:
  - the knowledge of the real consequences of an accident based on exercise scenario,
  - goal and criteria during the development of strategies on protective actions and their implementation
  - the strategies to be implemented, and
  - the potential socioeconomic impact on the affected population)

- There are many uncertainties involved in topics discussed. Examples of uncertainties are those associated with:
  - The radiological situation of the scenario contributing to the overall uncertainty associated with the estimated impact:
    - Space-time evolution of the contamination and the prediction of the radiological situation in the long term
    - Results of the monitoring
    - Possible changes in the future use of the scenario
  - The goals and criteria used in the design of the protection strategy:
    - Objectives pursued
    - Radiological criteria: reference levels

    - Indicator Units (time to carry out the implementation of the strategy, area affected, nº of persons affected…..)
  - The protection strategy regarding:
    - Effectiveness
    - Side-effects
    - Generated wastes and their disposal
    - Costs
    - The design of the recovery strategy, is sufficiently flexible and adaptable to take into account the evolution of the radiological situation?
  - The social pressure regarding:
    - Trust and confidence: Will the protection strategy really allow the resumption of social and economic activities; stigmatization of the affected area
    - Acceptability of the recovery actions
    - Conflicting interests among the affected population and/or affected economic activities of the affected area

- Continue in discussions about preferences while choosing of strategies and uncertainties.
- Presentation of the results of the first round of Delphi study: identification of critical aspects of transition phase of an accident with experts and stakeholders (*Tatiana Duranova*).
- Finishing of workshop.

3 Composition of panel (participants)

19 members of Slovak national panel took part in the workshop. They represented following organizations:

- Nuclear Regulatory Authority (NRA SR)
- Public Health Authority (PHA SR)
- Civil Protection and Crisis Management Offices at national (Ministry of Interior – Civil Protection and Crisis Management Division) and regional level (Trnava region - Bohunice NPP, Nitra Region - Mochovce NPP)
- Slovak Medical University in Bratislava (monitoring network and education)
- Police Academy (Public Administration and Crisis Management)
- Slovak Hydrometeorological Institute (monitoring network)
- Mayor and Chief of self-government (Prefect) of village Kalna nad Hronom (member of GMF – Group of European Municipalities with Nuclear Facilities and national Association of Municipalities and local/regional Civic Information Commissions, Mochovce NPP area)

The panel was composed of usual decision-makers involved at different levels of the emergency preparedness, response and recovery management activities.

4 Results analysis and main issues identified

4.1 Concerns, difficulties and uncertainties during the transition phase

Requirements and criteria on protective measures under the valid legislation (the new radiation protection law related to BSS requirements) with focus on transition from emergency to existing exposure situation after the nuclear accident have been presented by Public health Authority as an introduction to the discussion.

The transition phase is defined in the Decree of the NRA about the emergency planning details and it is characterised by terminating of radioactive release from the nuclear installation. Population is affected in that phase of an accident primarily by external exposure from the contaminated surfaces or by internal exposure due to inhalation or consumption of contaminated food and water.

The main concerns and most important difficulties during the transition phase have been discussed as well as issues to be addressed during the transition phase with focus on: evacuation, relocation application of countermeasures, monitoring - health and radiological characterisation of the contaminated area, decontamination, waste management, information and with population - risk communication, public acceptance and public trust in experts and authorities and other.

The discussion could be summarized to following items with the source of uncertainty identified at the end of each item.

- Under the new radiation protection law the corresponding Regional Public Health Authority (RPHA) in cooperation with other Ministries has competence to order the protective measures in the emergency situation; territorially the corresponding regional authority within the territorial district of Trnava and Trencin region is PHA SR (national level), therefore representatives of the Division of health protection against irradiation from PHA SR are sent to be part of the Regional Crisis Staff during the radiological accident.

  Uncertainty: Is personal resources of trained and prepared professional at PHA SR sufficient?

- As the PHA SR has no their own tools and decision support systems they are collaborating with NRA SR which has Decision support systems (JRODOS, RTARC) for the independent assessment of the accident consequences and preparation of advice for the urgent countermeasures. The complex decision support system JRODOS provide tools and support for the assessment of the countermeasures in the later phases of a radiological accident.

  Uncertainty: Is competence in use of complex decision support system for preparation of later phases of accident countermeasure advice adequate?

- Among others the iodine prophylaxis is one of the urgent countermeasures. The KI tablets are pre-distributed within the emergency planning zones in Slovakia. There was a problem during the last exchange campaign which was caused by change in the KI tablets supplier by NPP (change from Slovak supplier to the Austrian one), their distribution (6 tablets in a box instead of 4 as usual) and also by discrepancy of instructions in a leaflet in relation to the legislation and procedures in the Slovak Republic (who has to take KI tablets, age limit, dosage). This brought additional demand on Ministry of Interior representatives at all level participating in tablets distribution via Civil Protection offices to population and brought additional uncertainty and doubt in population regarding taking KI tablets.

Uncertainty: Are KI tablets taken by all members of population within the emergency planning zone during the pre-distribution campaign?

Uncertainty: Is information on iodine prophylaxis and its effectiveness sufficient?

- Radiation monitoring competences are given under the radiation protection law. Current situation of radiation monitoring network is characterized by break-up of resources (personal and technical) and require taking immediate decision. There is insufficient capacity of radiation monitoring network. The change in legislation which caused changes in the mode of operation from permanent to an emergency of many of radiation monitoring units under different Ministries caused the shortness to the unacceptable minimum in resources required for the maintenance and operation of the radiation monitoring.

Uncertainty: Is radiation monitoring network sustainable?

Uncertainty: Is there a gap between legislation and reality?

The decision on implementation of advised countermeasures is made by the authority/body at the Civil Protection Division at different level and it is taken into account not only the level of radiation but also feasibility of countermeasure, countermeasure implementation impact and other economic, social and other factors. The ordered countermeasures could not be implemented taking into account insufficient personal and technical resources.

Uncertainty: Are the available resources (personal and technical) adequate?

- The reference levels are given as a range of levels in the new legislation (1-20 mSv/year for existing exposure situation and 20-100 mSv/year for the emergency exposure situation. The value in particular emergency situation could be lower as it is given. How much is ”less than 100 mSv/year”? PHA is responsible to determine the particular reference level during the emergency situation for optimalisation of radiation protection. The analyses of possible emergency situations are part of the strategies of accident management where reference levels have to be established for each type of emergency situation. PHA should precise reference levels and includes them in the National emergency plan for the nuclear or radiological accidents which is under development and responsibility of the Ministry of Interior.

Uncertainty: Are reference levels well established?

Uncertainty: Is National emergency plan available and up-to-date?

- Evacuation has been discussed from the point of view of its ensuring and time when it has to be implemented in relation to the recommendation on sheltering lasting not longer than 48 hours. The planned evacuation with the evacuation speed 3000 people for hour is not possible to manage. The term of “immediate evacuation” has been discussed from the point of view of criteria for decision-making on countermeasures with the main goal to avoid or minimize deterministic effects of radiation. Additional discussions and consultations between NRA SR and PHA SR are needed to further precise the definition and criteria for immediate/early/timely evacuation. It was stated, that today anybody will guarantee that evacuation will be implemented up to the 24 hours after its ordering.

Uncertainty: Is immediate evacuation ensured and feasible?

- The flexible change of the evacuation routs due to change in the meteorological conditions is not adequately ensured. The competences of particular region or district are their exclusive competence. It is not possible to intervene to those competences appointed and determined in advance. It is not possible to plan flexible use of evacuation routs under the changes in meteorological conditions what could lead to the needless exposure of evacuees during the evacuation using contaminated roads.

  Uncertainty: Is change in meteorological situation appropriately taken into account?

  Uncertainty: Are competences of regions/districts flexible in using of the evacuation routs?

  Uncertainty: Is there preparedness on flexible change of evacuation plans at place?

  Uncertainty: Are there backup office places of the Crisis Staff at regional or District level available?

- Food ban countermeasure dealing with food, milk, drinking water and food chain and water supply are implemented when clean substitute food, milk, drinking water or other alternatives are available.

  Uncertainty: Are food security measures ensured adequately?

- Transition phase determination or its exact definition is not given in the law on radiation protection. The transition phase could be understood as when prevailing existing exposure is in place as a consequence of emergency exposure situation. For the existing exposure situation the reference levels 1-20 mSv/year are valid. Withdrawal of the urgent protective measures such as sheltering, evacuation and relocation is justified when effective dose for the time of follow-up 12 months after the withdrawal of countermeasure will be lower than 20 mSv. These terms and criteria should be precise taking into account the phases of an accident from the point of view its time development.

  Uncertainty: Is the period of time identifying the transition phase after an accident unequivocal?

  Uncertainty: Are the criteria for implementation and withdrawal of countermeasures in transition phase unequivocal?

4.2 Case study discussion: alternative strategies, key criteria for strategy selection, uncertainties, stakeholder preferences

The presentation of case study focusing on Piestany presented in the Chapter 2 of the current report prepared the floor for the thorough discussion of the objectives of the restoration plan, alternative restoration actions and key criteria for selection of strategy.

The uncertainties identified in the general discussion have appeared again and have been specified in more details taking into account information available from scenario.

Figure 13: Discussion on alternative restoration actions and key criteria for strategy selection

The particular issues to be addressed during the transition phase and alternative restoration actions have been discussed as follows:

- All actions in Piestany (planned, prepared and scheduled) will be cancelled as minimum for the period of two months. Further operation of Spa Piestany is conditioned by return of population back to Piestany. While citizens will not return home any Spa guests will not come. While infrastructure will not be ensured in the city, the return of citizens back will not be possible.
- Information of population is a key issue. The information campaign should be focused on the situation development, decision-making and procedure how to deal with the situation. The explanation of the situation (what happened) and communication with population should avoid rumors and baseless information. Trustworthy information should be provided taken from the unified information center to avoid contradictory and conflicting information. The information should be provided at different levels by entrusted persons. The secretary of Crisis Staffs at different levels should collect and share information with all involved and entrusted stakeholders. The communication should be open, based on facts and verified information and should not be excessively optimistic and giving false hope. In case of break of their promise the loss of trust could come.
- During the evacuation the mayors and prefects as well as members of self-government offices of villages/towns/cities receiving coming evacuees will take care of them. Part of evacuees will be received by relatives living out of the affected area. Evacuation could last 7 days under the law and will persist up to the withdrawal. The question is how long it could be. Temporary relocation should be justified and communicated with the mayor of village/town/city.
- Temporary relocation will ensure District Office in cooperation with Central Crisis Staff (national level) in relation to the organizational, technical and also financial aspects. Financial security will be very demanding.
- During temporary relocation but also during the evacuation the maintenance and operation of factories/objects which could not be closed. The mayor or prefect is responsible in cooperation with PHA as the shift changes should be monitored.

- The areas where evacuation or temporary relocation will take place should be secured by police; the area should be defined and closed to avoid plundering. Will there be enough of personal and technical resources?
- The issue of the animals left after the evacuation is complex and should be in the competence of the veterinary administration. In case of animals death the place for their burial should be established. The question of valuable animals and what to do with them is open. Uncertainty is also in the responsibility, who will do it.
- Monitoring of the environment, its complexity and ensuring is the key issue in the course of all actions. It is necessary to know the level of contamination, effectivity of countermeasure implementation and in answering question if citizens could come back home.
- Population should be informed about advised countermeasures, about possibilities and procedures of decontamination. The goal is the health of population and that they can return home as soon as possible.
- Regarding the decontamination the major issue will be availability of personal and technical resources. If volunteers will take part in decontamination they should be instructed and informed also have particular skills, Workers participating in the decontamination should give informed consent taking into account risks which can occur during the decontamination. It should be taken into account that they can refuse to perform the work. In case of technically demanding measures and procedures there will be again the question of availability of personal and technical resources. Will army cooperate with their resources? Who will pay?
- The financial security of implementation of all measures and actions is the key issue. Who will pay? Will insurance of population valid? What about the insurance of NPP?
- The role of Central Crisis Staff (national level) and Division of Crisis Management and Civil Protection at Ministry of Interior is crucial and irreplaceable as they have access to concrete information about availability of resources (personal and technical) from the whole Slovak Republic. They will prepare decisions on return of population back home in collaboration with PHA.

Based on this discussion which identified particular factors and uncertainties influencing strategy preferences participants ranked strategies as follows:

1. Strategy 2
2. Strategy 4
3. Strategy 3
4. Strategy 1
5. Strategy 6 + 7
6. Strategy 5 + 8

4.3 MCDA inputs: key criteria for strategy selection, stakeholder preferences

At the second day of the panel the criteria for selection of strategy have been summarized by facilitator.

Participants further discussed and identified key criteria for selection of strategy as follows:

- **Public health (health effects)** expressed in terms of doses or number of averted cancers caused by radiation from accident
- **Costs (economical effect)** expressed as a sum of costs on accommodation during relocation, compensation of loss of productivity during relocation, clan-up strategy implementation, waste transport and storage and cancer treatments
- **Personal and technical resources** subdivided into the number of workers needed for the realization of countermeasures, personal resources expressed by **"How difficult is to allocate the workers"** for particular restoration strategy implementation and technical resources needed for particular restoration strategy implementation
- **Wastes** expressed by availability of storage places which is conditioned by the **amount of waste**
- **Population acceptance and willingness to cooperate in realization of options of particular restoration strategies (self-help)**, attitude to the property and home, relation to receiving society during the relocation (stigmatization) and to certain degree indifference of people in peace time and during the emergency preparedness process,
- Political decisions, the role of the state, education and professionalism,
- Infrastructure - drinking water, education (school system), services, what wil be provided and what is the timing.

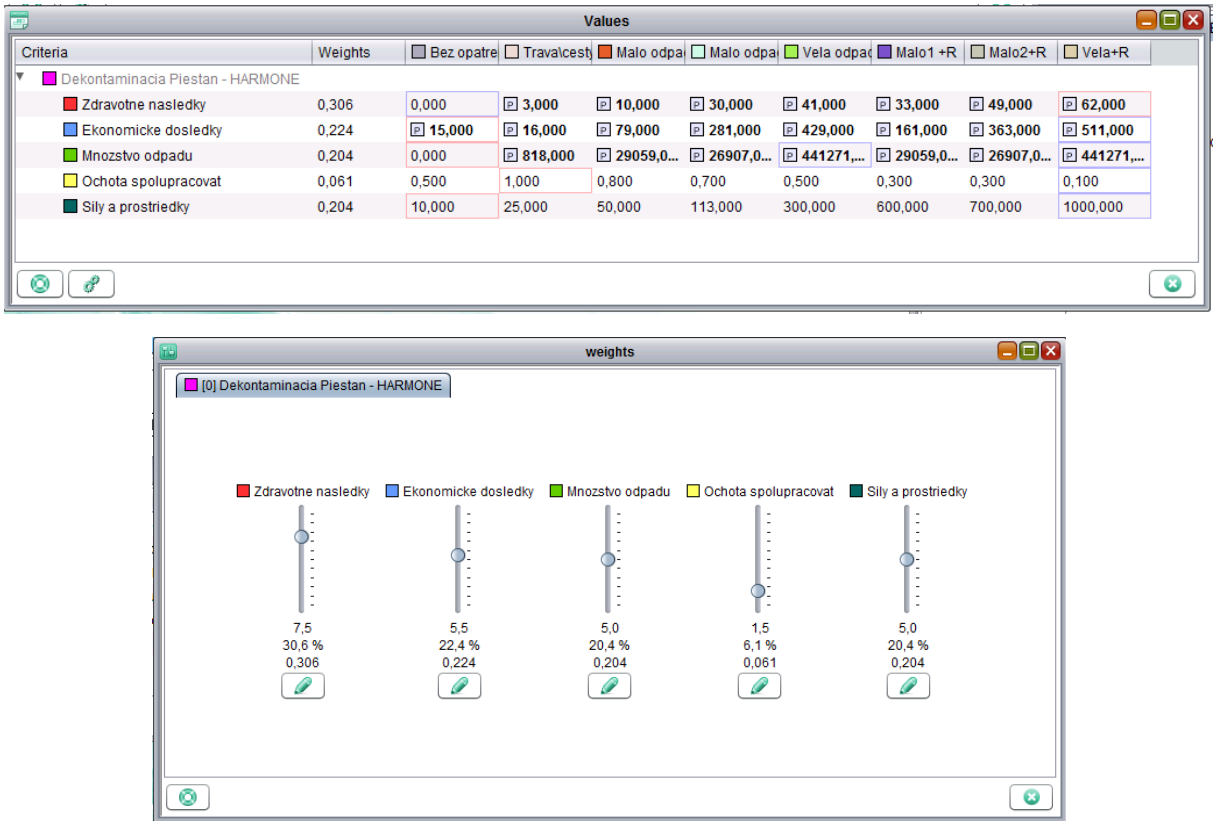
The MCDA system has been presented by Tim Mueller (KIT, Germany).

Participants agreed to choose the key criteria which will be used by MCDA which are presented in bold in previous paragraph.

Such criteria as health effects, costs and amount of waste have been used from the JRODOS results as an output of ERMIN calculations.

Soft criteria - expressed as "How difficult is to allocate the workers" and "Is population willing to cooperate in implementation" were widely discussed, precisely specified and expressed by empirical functions under the MCDA requirements.

The weights of particular criteria have been discussed and it was agreed that it is very subjective and responsible attitude is needed in their assessment. MCDA tool provide interface suitable to follow influence of the weights on the overall ranking of particular strategies and their preferences.



Criteria	Weights	Bez opatre	Trava\cest	Malo odpa	Malo odpa	Vela odpa	Malo1 +R	Malo2+R	Vela+R
Dekontaminacia Piestan - HARMONE									
Zdravotne nasledky	0,306	0,000	3,000	10,000	30,000	41,000	33,000	49,000	62,000
Ekonomicke dosledky	0,224	15,000	16,000	79,000	281,000	429,000	161,000	363,000	511,000
Mnozstvo odpadu	0,204	0,000	818,000	29059,0...	26907,0...	441271,...	29059,0...	26907,0...	441271,...
Ochota spolupracovat	0,061	0,500	1,000	0,800	0,700	0,500	0,300	0,300	0,100
Sily a prostriedky	0,204	10,000	25,000	50,000	113,000	300,000	600,000	700,000	1000,000

Figure 14: Criteria and their weights in MCDA

Taking into account all inputs the MCDA tool provided the output with strategies presented in a form of bars with contribution of particular criterion expressed by different color. The most acceptable strategy has the higher bar, the less acceptable strategy has the lowest bar.

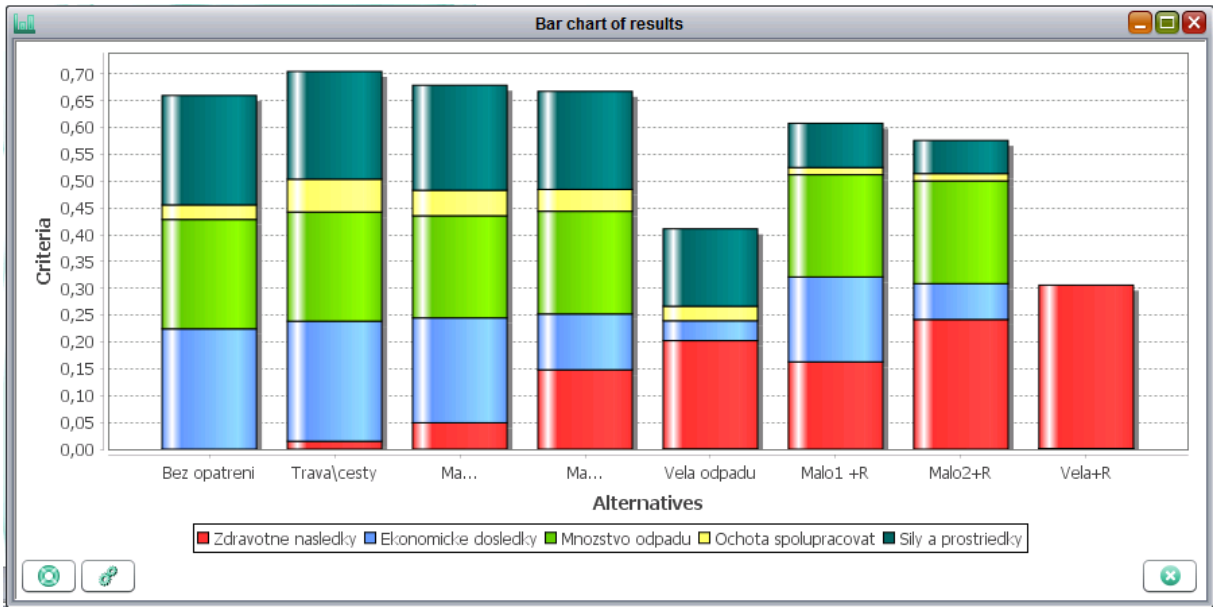


Figure 15: Preferences of particular restoration strategies by - MCDA output

It was stressed that MCDA tool is the aiding tool and its output has to be taken as supporting and it will not substitute final decision.

The different possibilities of outputs visualization have been presented and discussed.

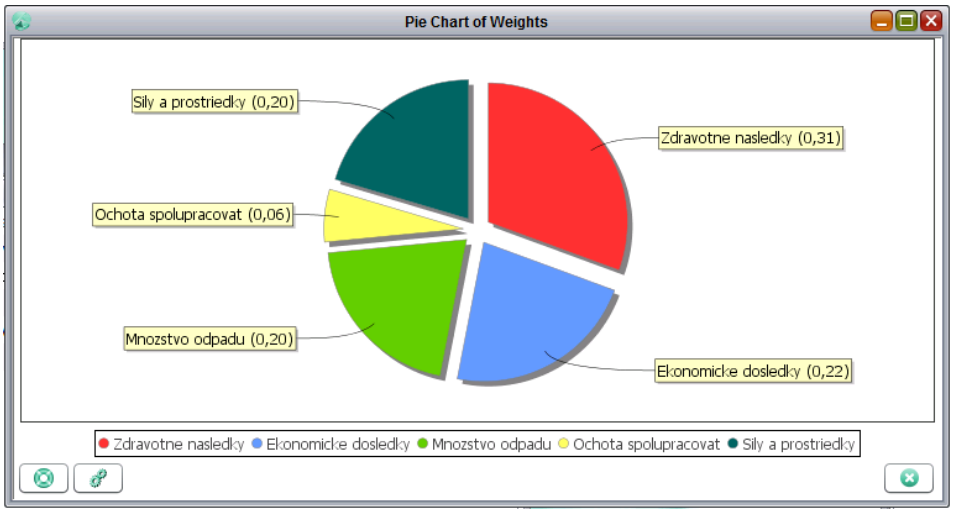


Figure 16: Weights presented as a pie chart

The presentation of outputs in a form of text report has been discussed and appreciated by participants. The report provide summary of information taken into account in strategies preferences and could be used as well as graphical outputs as supporting and transparent materials within the decision-making process.

Regarding the visualization of uncertainties taken into account by the ERMIN module of the JRODOS DSS they are incorporated within the MCDA tool and one of the possible outputs accepted and appreciated by panel members is given below.

Figure 17: Uncertainties visualization

5 Conclusions and Perspectives

Stakeholder discussion panel in Slovakia has been focussed on what to do and how to proceed in presented contamination scenario and how to evaluate the potential impacts of decisions on achieving acceptable living conditions. These discussions were mindful of the inherent uncertainties associated with the real consequences of the contamination scenario, the strategies to be implemented and the potential socio-economic impacts on the affected population. Preferences collected within WP4 panel discussion served the inputs to the MCDA by WP6. The appropriate means of visualisation in terms of information for decision-making when based on an MCDA tool have been discussed and evaluated.

Participants identified main areas of concern and uncertainties related to the availability of adequate personal resources of trained and prepared professionals at all levels (national, regional and local), sufficient technical resources especially related to the radiological monitoring, availability of National emergency plan with specified competences and responsibilities od stakeholders as well as reference levels and other criteria for preparation of advice, implementation and withdrawal of countermeasures. The influence of successful and sustainable preparedness process was stressed as well as advice and implementation of urgent protective measures which influence development and implementation of later countermeasures during the transition phase. The information provided to population also during the exchange of KI tablets campaign is essential.

The key criteria for selection of reconstruction strategy under the contamination scenario presented have been identified as follows: public health (health effects); costs (economical effects); personal and technical resources; wastes; population acceptance and willingness to cooperate on realisation of options of particular restoration strategies (self-help); attitude to property and home; relation to receiving society during the relocation and to certain degree indifference of people in peace time and during the emergency preparedness process; political decisions; role of state, education and professionalism; infrastructure.

The formal decision aiding tool such as multi-criteria decision-making (MCDA) have been presented and tested during the stakeholder panel to see how it can be adapted and used for uncertainty handling and “robust” decision-making for radiological emergency. The tool was helpful in identifying of weights of particular criteria influencing selection of restoration strategies and giving the preferences by different stakeholders. The participating stakeholders effectively used the decision aiding tool MCDA which was helpful in thorough discussions and supportive in making decisions.

B-09. Report of Spanish National panel

Authors: M. Montero; C. Trueba R.; Sala (CIEMAT)

Ref. Report: CONFIDENCE-WP4/T4.2.1-R10 / CONCERT D 9.22 Part B-09. v2.0 Final

Summary

This document reports the main findings and conclusions obtained from the Spanish stakeholder panel, organized by CIEMAT in the framework of the European project CONFIDENCE. Two sessions have been finally conducted and the present report updates the previous report that only included the results from the first session.

The main goal of the Spanish panel has been to facilitate the engagement of relevant stakeholders to this national post-accident preparedness process, and obtain their contribution in terms of their understanding of the critical aspects and uncertainties that arise during the transition phase (to manage the consequences of the accident and plan the recovery).

The discussions have been focused, mainly, to the issues in the agricultural contaminated areas and the pathway exposure through food-chain. In addition, a roughly view on the issues in the inhabited areas have been also addressed.

The first session was directed to understand the meaning and scope of the transition phase, to identify the critical aspects to be taken into account, as well as the most important objectives and criteria to guide recovery planning during this phase. Discussions have been directed to find what the Spanish panel considers of priority. The second session, more structured, was focussed to assess the uncertainties and dilemmas that play a central role in the dynamics of the decision and the criteria that would be used to evaluate the application and success of recovery strategies.

The methodology and organisation of the panel and main findings and conclusions from discussions are detailed below.

Table of Contents

1 Objectives and Scope

Different participatory exercises with stakeholders, under the umbrella of recent European projects, as EURANOS[8], NERIS-TP[9] or PREPARE[10], have been accomplished in Spain as part of the national preparedness for post-accident management process and response. Recently, the current legal framework for Emergency Plans in Spain is under revision to deal with the challenges associated with the management of the end of an emergency and the transition to a possible existing exposure situation, according to the requirements from the new European Basic Safety Standards (BSS) [1].

A Spanish stakeholder panel has been organized taking advantage of the WP4 framework in the CONFIDENCE[11] project to exchange views, experiences and opinions related to the decision-making process during the transition phase.

The main goal has been to facilitate the engagement of relevant stakeholders to this national post-accident preparedness process and obtain their contribution in terms of their understanding of the critical aspects and uncertainties that arise during the transition phase (to manage the consequences of the accident and plan the recovery).

The specific objectives of the Spanish panel to accomplish this goal are:

- Understand the transition phase, timeline and challenges in the decision-making process
- Identify the critical aspects in the preparedness and response for the recovery during the transition phase
- Approach to dealing with the uncertainties arisen in the transition phase, to prepare plans for subsequent recovery
- Explore how and at what level to engage the stakeholders in the decision-making process.
- Contribute to obtain and prioritise the preferences of the stakeholders that could be incorporated in a multi-criteria decision-making analysis (MCDA) by WP6.

The discussions have been focused, mainly, to the issues in agricultural areas contaminated and the pathway exposure through food-chain. In addition, a rough view of the issues in the inhabited areas has been also addressed.

2 Methodology

The Spanish stakeholder panel has been organized by CIEMAT, based on the general guidelines for the organization of the national panels, prepared in the framework of the CONFIDENCE-WP4 [2].

---

8 EURANOS. EURopean Approach to Nuclear and radiological emergency management and rehabilitatiOn Strategies. FP6-EURATOM-RADPROT, FI6R-CT-2004-508843, https://euranos.iket.kit.edu/

9 NERIS-TP. Towards a self-sustaining European Technology Platform on Preparedness for Nuclear and Radiological Emergency Response and Recovery. FP7-fission-2010, EC GA 269718. http://resy5.fzk.de/NERIS-TP/index.php

10 PREPARE. Innovative integrative tools and Platforms to be prepared for Radiological Emergencies and Post-Accident Response in Europe. FP7-Fission-2012, EC GA 323287. https://prepare-eu.org/index.php

11 CONFIDENCE. COping with uNcertainties For Improved modelling and DEcision making in Nuclear emergenCiEs. HORIZON 2020 EJP-CONCERT, EC GA 662287. https://portal.iket.kit.edu/CONFIDENCE/index.php

The general approach to engage the stakeholders in the national panels is:

- A "question-driven" tabletop exercise, facilitated by the CIEMAT (by the Emergency Preparedness and Recovery group, of the Department of the Environment, together with the Social Sciences and Humanities in Radiological Protection team, from CISOT).
- Simulating an intervention scenario from an accidental release in a Nuclear Power Plant (NPP), based in the contamination pattern monitored after the source term has been controlled and all the contamination has been deposited.
- Focussed in the consequence management and the post-emergency preparedness for the long term recovery to carry on during the transition phase.

Work has been planned to be carried out in 2 sessions:

- The first session, with open discussions, to understand the meaning and scope of the transition phase, and to identify the critical aspects to be taken into account, as well as the most important objectives and criteria to guide recovery planning during this phase.
- The second session, more structured, to assess the uncertainties and dilemmas that play a central role in the dynamics of the decision and the criteria that would be used to evaluate the application and success of recovery strategies.

The structure of each meeting includes thematic and introductory general presentations and moderated discussions based on the issues of the scenario.

According to the general guidelines for National panel discussions [2], the following topics for discussion have been considered in the selection of questions to address in the panel:

1. What do we understand by "the transition phase"
2. Main concerns during the transition phase
3. Issues to be addressed during the transition phase:
   a. Food and water control
   b. Other goods control
   c. Relocation of people and restoration of living conditions
   d. Health monitoring of people and providing health care to the affected population
   e. Application of countermeasures (e.g. food and agricultural protective actions, the closing of the area)
   f. Classification of zones and land use
   g. Decontamination
   h. Radiological characterization of the contaminated areas
   i. Radioactivity surveillance/monitoring programs
   j. Waste management
   k. Information and risk communication to the population
   l. Public acceptance
   m. Public trust in experts and authorities
   n. Stigmatization
   o. Compensate/indemnify affected persons
   p. Allocation of adequate resources
4. Objectives and criteria of the restoration plan:
   a. Which objective do we need to achieve? (Minimise dose levels, minimise impacts in the population, maximise public confidence, minimise economic costs, minimise environmental impacts, etc.)

   b. Criteria to assess the recovery strategy (costs, time, effectiveness,…)

5. Alternative restoration actions: monitored non-intervention, containment, removal, change of use,…):
   a. Is the best strategy the one that results in the lowest dose for individuals?
   b. What other factors dominate in the decision for the preferred strategy?.

6. Stakeholders engagement:
   a. Is it necessary?
   b. What would be the role of stakeholders in decision-making?
   c. Other preferred roles?
   d. What kind of stakeholders need to be involved?
   e. How to involve them?
   f. Roles and responsibilities: are they clear?
   g. Coordination

7. International cooperation
   a. What type of cooperation would be desirable?
   b. How it be established?
   c. Other…

The participation of stakeholders in panels has been combined with a transnational stakeholder Delphi survey, carried out in each participant country. A first questionnaire was launched before the first panel session, in view of preparing questions and issues to be used as a basis for the panel discussions; the second will be delivered during the second panel meeting. A last questionnaire at the end will allow the prioritisation of stakeholders 'concerns and preferences regarding the issues during the transition phase of a nuclear emergency. The joint results and conclusions from this Delphi study will be the subject of the next deliverable (CONFIDENCE D4.6 / CONCERT D9.23)

2.1 Scenario and timeframe of interest

A hypothetical severe nuclear accident with a large radioactive release occurred in a Spanish NPP that results in a broad contaminated area affecting both inhabited areas and relevant agricultural areas. The time frame is situated at the intermediate phase of the emergency when the release has ceased, urgent protective measures have been implemented and the control over the source has been taken. The radioactive contamination has spread in the surroundings of the damaged NPP and transported and dispersed through near regions affecting both inhabited areas and relevant agricultural and farming systems. At this point, the actions must be focused "on mitigating the consequences of the emergency on populations, infrastructure, environment and socio-economic structures and on returning to normal social and economic activity", as far as possible [3].

The planning area of the Trillo NPP, corresponding to the Nuclear Emergency Plan of Guadalajara - Castilla La Mancha (PENGUA) [4] (see Figure 1) and the surrounding regions have been selected to develop the scenario of actuation. A release caused by a severe accident with damage to the reactor core, which contaminates the territory with long-lived radioactive products has been simulated.

Figure 1. Geographical scope selected to develop the generic scenario of actions.

The release date of July 6th 2017 was selected because it is close to the dates of the harvest season resulting in significant radiological contamination in large agricultural and grazing areas and with potential to affect to the population through the food-chain along several years. The source term from the accident was estimated by applying to the NPP inventory, the release fractions for the ISLOCA accident defined in the SOARCA study [5]. This type of accident causes the off-site emission of a significantly high fraction of radionuclides, which is considered the worst case possible, although is very unlikely to occur.

JRODOS system [6] has been used for both the dispersion and deposition calculations with a set of reanalysis meteorological data obtained from the Global Forecast System Model (GFS-ANL) provided by the National Oceanic and Atmospheric Administrations (NOAA's) National Operational Model Archive and Distributions System (NOMADS)[12] for July 2017, and the radiological impact assessments in the environment and population. Also, an assay with the module AgriCP [7] was made to evaluate the agricultural countermeasures, but it was not friendly to obtain understandable results with complex strategies including the soil as the source of the contamination and the possible pathways through food-chain.

The assessment of the scenario has been made as follows:

- Initial situation of the contaminated area regarding the radiological impact:
  - Zoning of contaminated territories, based on the post-deposition dose criteria, deposition level or the EURATOM food intervention levels (CFILS).
  - Estimation of the radiological impact in the long term through the relevant pathways.
- Estimation of the affected population.
- Socioeconomic and environmental situation.
- Space-time evolution of the scenario.

In Table 1 some of the main indicators considered to evaluate the impact and the consequences of the contamination are shown.

Table 1. Indicators to evaluate the radiological impact and the consequences of the contamination.

Indicators to consider:
• Total deposit of aerosols and iodine. • Contributions from each surface to the average effective external dose due to gamma

[12] Links: ftp://nomads.ncdc.noaa.gov/GFS/analysis_only/; https://nomads.ncdc.noaa.gov/data/gfsanl/

emitters during the first year.

- Concentrations of activity in food and feed and space-time evolution.
- Contribution of each food to the effective annual dose for ingestion.
- Affected area.
- Affected population.
- Environmental, social and economic impacts

Figure 2 shows a picture of the Cs-137 deposition after the end of the release, ranked according to the severity defined by the Nordic recommendations [8]. This scenario presents initial zoning representing a monitoring map made when the source has been controlled and the release and deposition have ceased.

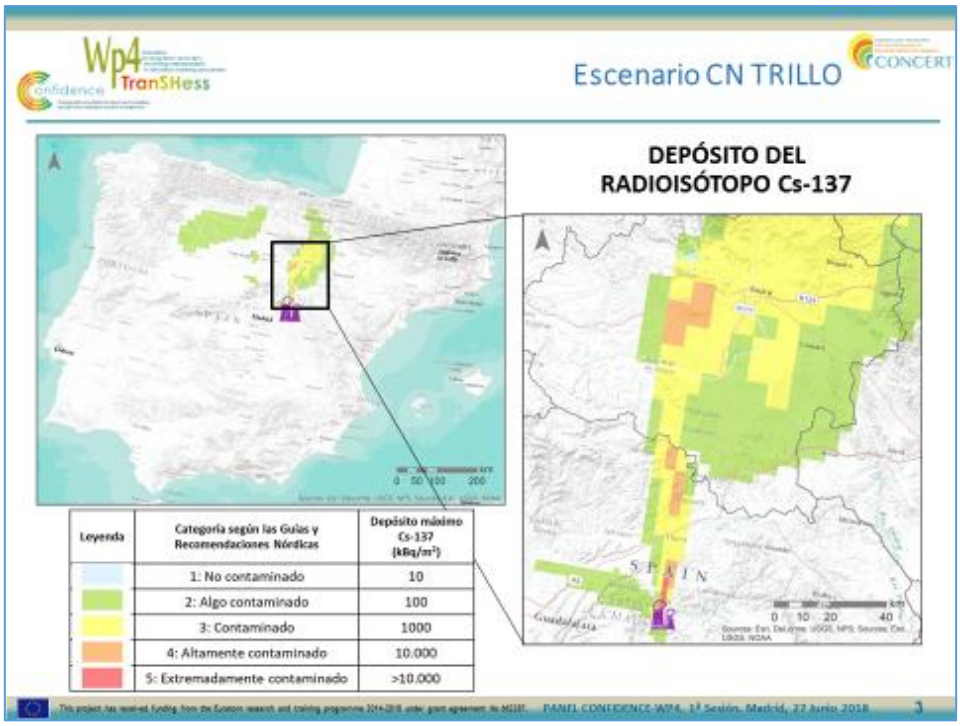


Figure 2. Map of the total deposition of Cs-137, after the end of the accidental release, ranked according the Nordic Guidelines and Recommendations (NRG) [8]. Presentation to Spanish panel (in Spanish)

From this map, the radiological and socioeconomic implications in the different affected sectors are identified and presented, to facilitate the discussion (see Figure 3).

Regarding the agricultural/farming areas, the next relevant pathways have been identified:

- Pasture-lamb-milk-cheese
- Pasture-cow-milk-cheese
- Pasture-cow-beef
- Wheat-flour

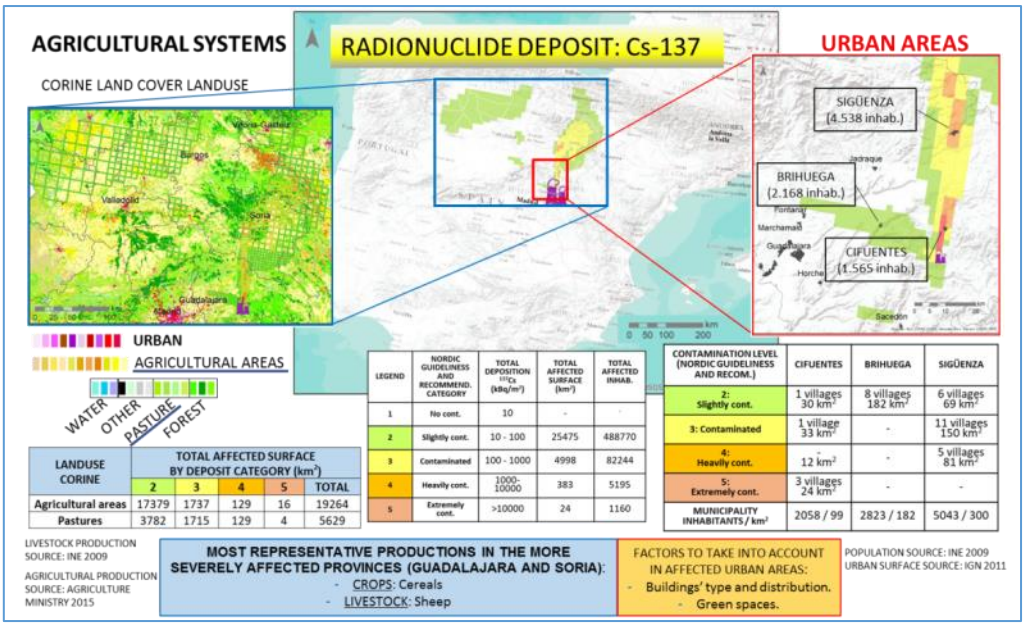


Figure 3. Agricultural and urban areas affected by the radiological contamination in the Trillo scenario, characterised by some relevant socio-economic indicators.

Possible actions are presented about the control and management of food and feed at end of the emergency phase (emergency exposure situation) and in the recovery phase (existing exposure situation), emphasizing the planning that must be carried out during the transition phase to achieve an adequate management of the production systems affected in the long term. The main points to consider are compiled in Table 2 and Table 3.

Table 2. Actions to take place at the beginning of the management of the post-accident.

Actions to take place at the beginning of the management of the post-accident
• Temporary relocation of people outside the restricted areas • Ban the consumption and distribution of food produced locally and coming from the protected areas. • Immobilization of materials and manufactured products; to analyze the possible contamination. • Ban the movement of livestock, animal products and fodder • Determine and implement an initial screening program for contaminated production • How to implement the management according to the areas of action. • Sampling protocol; infrastructure needed • Information to the affected population, and the general public

Table 3. Points to consider in the management of the transition phase.

Management of the Transition Phase

• Detailed characterization of the radiological situation, delimitation of actions
  ○ Identification of affected products, location of farms.
  ○ Determine a specific sampling and analysis plan.
  ○ Engagement of stakeholders

- Effects on the production chain
  - Possible actions to reduce the contamination of the product
  - Waste management
  - Compensation schemes and assistance mechanisms
- Coordination and management structure of the recovery phase
- Comunication management

Figure 4 shows an example of the different recovery actions that can be taken in urban and agricultural areas, to reduce the radiological impact on the population. They are designed to be used on the source, on a medium or at specific points of the exposure pathways.

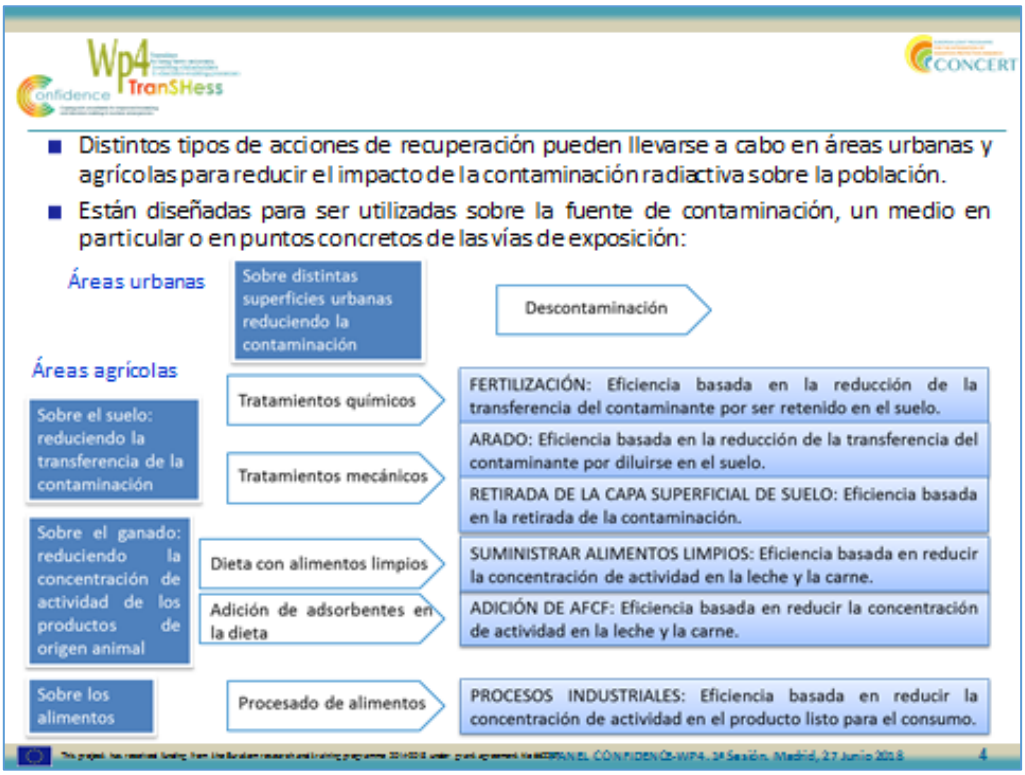


Figure 4. Mitigation and recovery actions that could be used to plan different recovery strategies in the scenario. Presentation in the Spanish panel [In Spanish]

As complementary support material, a document with the main radiological criteria used to assess the different exposure situations and a shortlist with the countermeasures of concern and their evaluation factors was provided to the panellists to facilitate the understanding of the scenario.

2.2 Organization and schedule of the meetings

An initial Work Plan was prepared and sent to all participants. The schedule was the following:

Date	Milestone
29 January 2018	Recruitment and call to national stakeholders
January – February 2018	Initial Open Questionnaire – Compilation of ideas
June – October 2018	First European Delphi round
27 June 2018	1st Spanish panel session
February – April 2019	Second European Delphi round
22 February 2019	2nd Spanish panel session
April - May 2019	Third (conclusion) European Delphi round
December 2019	Presentation of results in the CONFIDENCE forum

Finally, the two sessions were conducted accordingly on the schedule. Previous to start each panel session, the panellists were invited to answer the respective questionnaire of the first and second Delphi round. The third round has been ruled out because of time constraints. This report includes the findings and conclusions from both sessions and it updates the previously released with the definitive results.

2.2.1 Agenda of 1st session

The first session of the Spanish panel was conducted according to the following agenda:

Table 4. Agenda of the first session of the Spanish panel

Panel on the articulation of stakeholder participation in the process of preparation for nuclear or radiological post-accident recovery. **First National Panel Session** **Final Agenda** 27th June 2018, 9:00 to 17:30h CIEMAT. Av. Complutense 40, 28040-Madrid	
9:00 - 9:30	Welcome – Milagros Montero (CIEMAT)
9:30 - 10:15	Introduction to the transition phase after a nuclear emergency: framework and challenges – Cristina Trueba (CIEMAT)
10:15 - 10:45	Results of the first questionnaire: Identification of critical aspects of the transition phase by experts and stakeholders – Roser Sala (CIEMAT-CISOT)
10:45 - 11:15	Coffee break
11:15 - 13:30	Trillo NPP (Guadalajara) as generic contaminated scenario (First Part). Objectives for the recovery plan and issues to consider Milagros Montero, and Blanca García-Puerta (CIEMAT
13:30 - 14:30	Lunch
14:30 - 16:00	Establishment of a recovery strategy in the generic scenario (Second Part) - Cristina Trueba and Milagros Montero (CIEMAT)
14:30 - 16:00	Coffee break
16:30 - 17:30	General overview of SHAMISEN SINGS & ENGAGE EU projects – Liudmila Liutsko (ISGlobal). Stakeholder Involvement discussion – Roser Sala

The meeting was introduced by Milagros Montero, with a general overview of the CONFIDENCE project, focussing on the methodology, objectives and schedule of the activities into the WP4 involving stakeholders. The first half of the session was dedicated to introduce the transition phase, challenges and framework of action, by Cristina Trueba, followed by the presentation of the results of the preliminary survey among stakeholders and experts, by Roser Sala. In the second half of the morning and early afternoon, the overview of the scenario, highlighting the agricultural and urban areas affected by the radioactive contamination and the issues associated to the establishment of the recovery strategies in the scenario prepared for discussion, were presented to the attendees. The temporal magnitude and spatial extension of the indicators to evaluate the radiological impact, as well as the consequences of the agricultural and food countermeasures on the environment and population, were presented with the support of the JRODOS system. The third part of the session was dedicated to discuss the particular issues related to the involvement of the stakeholders in the decision-making process. Before this, the participant of ISGlobal, that attended the meeting, representing also the CONCERT - ENGAGE project, took advantage of this meeting to make a presentation on the SHAMISEN SINGS & ENGAGE EU projects and to contribute to discussions with some questions of common interest for both projects, about the role of stakeholders and their engagement in the decision-making process.

The main discussion topics in the first panel session were:

- Understanding the transition phase, their main concerns, training and education.
- Critical aspects around the preparedness and response during the transition phase.
- Scenario-based stakeholder engagement in the decision-making process.
- Selection of protective actions in urban and agricultural areas.
- Radiological, social and economic aspects related to the strategies of recovery.
- Engagement of stakeholders.

Findings and conclusions regarding these topics are summarised in point 4.1 of this document.

2.2.2 Agenda of 2nd session

The second session of the Spanish panel was conducted according to the following agenda:

Table 5. Agenda of the second session of the Spanish panel

Panel on the articulation of stakeholder participation in the process of preparation for nuclear or radiological post-accident recovery. **Second National Panel Session** **Final Agenda** 22nd February 2019, 9:00 to 16:30h CIEMAT. Av. Complutense 40, 28040-Madrid	
9:00 - 9:30	Welcome – Milagros Montero (CIEMAT)
9:30 - 10:00	Introduction. Summary of the 1st session of the Panel. Objectives of the second session.– Cristina Trueba (CIEMAT)
10:00 - 10:30	Results of the first round of the transnational study Delphi between interested parties. – Roser Sala (CIEMAT-CISOT)
10:30 - 11:00	Coffee break

11:00 - 11:30	Generic contamination scenario: Introduction to the discussion. - Milagros Montero (CIEMAT)
11:30 - 13:30	Brainstorming exercise and subsequent discussion (I): Identification and list of uncertainties in the decision-making – Roser Sala (CIEMAT-CISOT), Milagros Montero, Cristina Trueba (CIEMAT)
13:30 - 14:30	Lunch
14:30 - 16:30	Brainstorming exercise and subsequent discussion (II): Evaluation of criteria and prioritization of preferences in decision-making – Roser Sala, Milagros Montero, Cristina Trueba (CIEMAT)

After the welcome, by Milagros Montero and a round of presentation of the assistants, the second Delphi questionnaire was distributed so that they could answer it right there, in situ.

During the answer, there arose some doubts related to the writing of some of the questions, as well as conceptual doubts, which were solved on the fly. This was considered as a quality test of this second questionnaire, previous to dissemination to other participant countries.

The first half of the session was dedicated to remind the findings and main conclusions obtained in the previous session. It was introduced by Cristina Trueba with a summary of the first session and the objectives pursued for the second one. She reminded the framework in which the Spanish Panel was established and the methodology for its establishment including what is the transition phase after the nuclear emergency. During the presentation, there were reviewed the main discussion points and the main conclusions. Then, Roser Sala of CISOT-CIEMAT presented an overview of the results of the first Delphi round. After a brief reminder of what this type of technique is and the objectives it pursues, it focused on the procedure and the main results obtained. Among others, the high agreement found among the participants in the different countries was highlighted.

The second half of the session, introduced with the presentation by Milagros Montero of the summary of the Spanish generic contamination scenario, was dedicated to a participatory brainstorming exercise for each of them to identify, individually, the uncertain matters they believe to be the most important in the case of proposed in the scenario. The results were grouped according to the next categories:

- Social / Health
- Economic / resources
- Environmental
- Radiologic
- Communication

The second part of the brainstorming exercise was focussed to discuss the criteria and prioritisation of preferences during the decision-making. Here, a short presentation of other criteria founded in the European panels was made to stimulate the discussion.

In point 4.2, a summary of the main findings and conclusions from this second session is presented.

3 Composition of the panel (participants)

Invitations to the national stakeholders who had already participated in other previous panels related to the preparedness and response in a nuclear emergency were sent. Finally, without taking

into account the CIEMAT members (4), 11 participants representing 10 Institutions responded to the call, and attended both sessions:

- Ministry of Home Affairs. General Directorate for Civil Protection and Emergencies (DGPCE), (1).
- Nuclear Safety Council (CSN), (2).
- Ministry of Agriculture, Fisheries and Food (MAPA), (1).
- Spanish Agency for Food Safety and Nutrition (AESAN), (1).
- Research Health Institute: Carlos III (ISCiii), (1).
- Institute of Global Health of Barcelona (ISGlobal), (1).
- Spanish Federation of Food Industries (FIAB), (1).
- Farmers Association (Young Farmers Agricultural and Livestock Association -ASAJA), (1).
- Universidad Politécnica de Madrid. Technical High School of Industrial Engineering (UPM - ETSII), (1).
- Spanish Radiological Protection Society (SEPR), (1).

Although the meeting was under the CONFIDENCE project, in the first session, it was agreed that the representative of ISGlobal, as a partner also of the ENGAGE project, could take advantage, in the framework of a cordial collaboration among the CONCERT's projects, of the findings of the meeting for purposes of her project.

4 Results analysis and main issues identified

4.1 Findings from the first session

From the presentations, an active debate emerged that covered all the topics proposed for the discussion. According to such main points under discussion, the following topics of concern were addressed:

1. Discussion on the transition phase
   - Understanding the Transition phase:
     - Definition, timing, coherence among different international organisms
   - Main concerns:
     - The protection of the public. The health is a top priority
     - Establishment of roles and responsibilities of different stakeholders
     - Change or displacement of leadership from national to local levels
     - Preparedness for recovery. Procedures, flexible plans, adaptation to actual situations.
   - Importance of education and training of the actors involved
2. Critical aspects around the preparedness and response during the transition phase.
   - Quantification of radiation impact - environment and public, before planning the action strategies:
     - Combination of modelling and measurements is recommended
   - Designing and implementation of monitoring plans
   - Food control – local consume and external trade
   - Adequation of the legislation to implement the recovery actions.

- The flexibility of the recovery strategy, meaning the importance to take into account the potential contamination evolution in the affected area, to determine the best actions accordingly.
- Communication for recommendations to secure health and food consumption. The media are crucial to contribute to people can feel safe.

3. The scenario analysis in the decision-making process.
   - Selection of scenario: Needed to cope with the complexity, several different environments/systems to protect, several sources of uncertainties.
   - Handicaps of the scenarios:
     - Selection of the source term / representative accident to develop appropriated scenarios.
     - Modelling is not enough to define precisely all issues.
     - Regionalisation of models – e.g., JRODOS is not adapted to Mediterranean data
   - Involvement of stakeholders:
     - It is important to give proper relevance to the issue, regarding personal or collective preferences.
4. Selection of protective actions in urban and agricultural areas.
   - Urban areas.
     - Typology and spatial distribution of the houses and green spaces location
     - "Hot spots" contaminated areas
     - Moving and relocation of the population – critical logistic issue
   - Agricultural areas.
     - Main agricultural contaminated systems
     - Management of the husbandry during the first months
     - Availability of the contaminated processed food
     - Actions to be taken on the primary contamination source: soils.
     - Access / use restrictions
   - General:
     - Focussing on the main indicators of each area to establish the priorities in the design of the action strategy. These will change consistent with the importance given to social aspects (population density, health…), environmental, or economic (e.g., preserve the industry, etc.)
     - The best strategy will be the one that reduces the most in the least time
     - The infrastructures necessary to implement the action: machinery, consumables, personnel, waste management, etc.
5. Radiological, social and economic aspects related to the strategies of recovery.
   - Radiological aspects:
     - Environmental radiological characterisation
     - Radiological criteria – dosimetric levels, operational levels
     - Radiological impact on the population
   - Socio-economic aspects:
     - Resilience and psychological recovery capacity
     - Stress of displaced people
     - Population density
     - Capacity to provide essential basic services to the affected population

- Identification of main concerns and requirements of the affected population
- Access Control/restriction of land use
- Lack of employment, business, growth opportunities
- The confidence of the population
- Destigmatize and demystify nuclear energy
- Communication

6. Involvement of stakeholders.

- Who, How, when, why?
- All type of stakeholders could be involved
- Different type of implication - major involvement in the decisions
  - As a more local level,
  - As more affected
  - As more nearby to the management of day to day
- From the early moment, stakeholders should engage with the situation
- To maintain or increase the trust

4.2 Findings from the second session

4.2.1 Identifying uncertainties

From the brainstorming exercise, and taking in to account the findings from the first session, a range of uncertainties were identified and discussed, and grouped according to a range of categories, as the Table 6 shows.

Table 6. List of the uncertainties identified and grouped in categories by the panellists, according their point of view

Category	Individual contributions
Communication	- How are we going to communicate this event? - Who communicates it? - Through whom?
	- Communication with the authorities to receive and disseminate reliable information.
	- Information to the consumer of the types of products that he has acquired. - Traceability and security thereof.
	- Official information of the responsible body to be able to get involved and act accordingly.
	- Is there a communication plan for the media that will address the population?
	- Information to the population involved.
	- Communication to the affected population of the evolution of the radiological impact. Knowing as far as possible the duration of the actions and their possible lifting or not.
	- Adequate information on the consumption of food products from the affected areas. Redundant sanitary control by food control laboratories and the private sector for the same commercial establishment. Transparency, availability of mobile measurements devices in the markets.
	- Adequate communication by social networks and mass media of

	the situation dynamic (pollution, problems in the affected areas, health risks, etc.)
Social	- Health surveillance by populations. Recommended controls (not mandatory).
	- How is the population going to be relocated?
	- Timely information and countermeasures taken. Notices of affected populations and tourists from the affected areas (e.g. Camino de Santiago, tourism in general). Recommendations of preventive measures for health if they visit affected areas.
	- Support of the affected population. Informative, social, psychological and economic.
	- How do we ensure the "obedience" of the population?
	- Where the displaced people would be relocated? How would they be integrated into their new residence locations?
	- Redistribution of the population in the long term.
	- How is the affected population controlled including tourism? Is it planned?
	- Communication of advice/warnings to citizens. - Relocation. Where? How?
	- I am worried about the uncertainty of lifting the measure of temporary or permanent shelter. The period time that can be considered as temporary.
	- How is the affected population motivated to follow the instructions of the Authorities?
	- Social impact of the measures taken. Do people understand them? Are they enough? Are they accepted?
Health	- Surveillance of the health of the population
	- Monitoring of the affected population. From the point of view of health as psychosocial or logistical support.
	- How are the psychological, social and economic effects suffered by the population affected by the emergency?
Policies/authorities	- Trust in public powers.
	- Will it be possible to achieve political support agreed by the parties with parliamentary representation? Without it, everything becomes much more difficult ...
	- Urgent measures to be taken by the authorities.
	- Whose data is it? - How to report information to international organizations?
	- Who prepares and coordinates the Recovery Plan and the Transition Plan?
	- Coordination of competent authorities to implement measures.
	- Who will be responsible for the management?
Economic	- Budget? How will it be financed?
	- Waste management capacity.
	- Financial resources to implement sufficient measures.
	- Measurements of contamination. - Measurement equipment´s: Are enough? Do devices measure properly? - Sampling: is it correct?
	- Do we have sufficient resources to deploy a quickly and reliably plan of field measures?

	- Viability of countermeasures? Is there a capacity to decontaminate the affected populations? And to manage the waste generated?
	- Affected population. - Quantify affected foods. (Supplies, what to do with contaminated food).
	- Where the funds come from to respond to the needs of the transition phase.
	- Regarding agriculture: what will be done with the harvest already collected? Is there capacity to check thousands of tons of cereal, grapes, etc.?
	- Organization: sampling; laboratory results; how much time, when?
	- How many laboratories are available to give results in time? Should they know each other a priori?
Radiologic	- Can we consider the simulation data as reliable?
	- Level, magnitude of affectation.
	- Availability: access to environmental monitoring data to improve the simulations with tools such as JRODOS-MOIRA-ERMIN.
	- Models used for decision-making.
	- Who and how will you carry out the measures? (to contrast observed data)
	- Immobilization of pollution. Water, food and other various products.
	- Continuous and constant radiation monitoring in the affected areas (air, water, land/soil, etc.).
Environmental	- To assess the radiological impact, the affected areas must be well characterized.
	- Study in-depth the characteristics of the area (pastures, crops, seasonal stoppages, harvests,...) to select and model countermeasures.
	- Zoning of affected areas.

	- Time period for the recovery of the land:
	  ○ For its unrestricted cultivation.
	  ○ Feeding and raising of livestock.
	- Safety level of raw materials that enter the industry.
	- What processing of raw material or product reduces pollution?
	- How it could affect the contamination of aquifers, groundwater.

	- Changes and environmental factors that modify the contamination scenario.
Other uncertainties	- Is there training in the taking of samples?
	- How have other countries acted in similar situations?
	- International assistance to solve the problem.

Following, some remarks from panellist arose from the discussion in each uncertainty category are highlighted.

Communication

Main points under discussion: What, Whom, How and When communicate?; How will the population react or respond to the messages issued?

Discussions dealt mainly around the need of having communications plans in advance at different levels:

- Among administrative levels.
- Among experts
- To population

Points to consider that would help to reduce uncertainties regarding in both the message and the possible reactions or responses from population:

- A rapid channel of data exchange and sharing information between experts and decision-makers to facilitate their interaction with media and population providing accurate and up-to-date information.
- A reliable communication plan, aimed at stakeholders, with unique, homogeneous, clear, and concise messages, through a unique communicator or mediator, organism or public figure, respected and transparent.
- To arrange fluid coordination along with the administrative information network identifying roles and responsibility into all the administrative levels involved, national, regional and local, to provide the different instructions, directives, guidelines or recommendations to population. Such a network is not yet implemented in Spain for the transition phase and recovery phase.

The objective would be to provide confidence to the citizens, to neutralize spontaneous, unreliable or interested messages from social networks and to avoid undesirable reactions or uncontrolled responses.

Policies/authorities

Main points under discussion: Who is in charge and how do address the preparedness and coordination of the actions during the transition phase and for long term recovery?

The Spanish panellists place great importance to these issues. They considered the need of the preparedness in advanced; identify the roles of the different public authorities and other bodies involved in the process and their coordination; promoting the ability to reach and develop consensual policies to facilitate the implementation of the actions and to build trust among the population.

Economic aspects/resources

Main points under discussion: Will there be enough resources - material or technology, people and funding - to face the recovery actions, the collection and analysis of environmental samples and the monitoring of the affected people?

Regarding the environmental and human monitoring, although Spain has sufficient resources, it is necessary to reinforce the related administrative infrastructure (assessment bodies and analysis laboratories), ensure proper co-ordination and effectiveness of national surveillance bodies. Some ideas: arranging a national capacities register, harmonizing procedures and maintaining homologated control of the quality of the measurement's equipment. Also, introducing direct measurement equipment's to make a rapid screening of contaminated zones or people.

Other aspects of concern influencing on the availability and distribution of the resources:

- Provision of funding and compensations mechanisms in the national legislation.

- The training and formation of the persons required acting.
- Coordination among the different State levels: national, regional and local.

Social aspects

Main points under discussion: What will be the impact and reaction of the population to the measures that are taken?

In general, the panellists felt that the population would react positively to the recommendations, better than is generally thought. Nevertheless, they find the necessity of having an effective control plan of both local and tourist people; verifying the compliance of recommendations given; monitoring the health of the population; identifying and managing the psychological, social and economic effects on the population; addressing the problems in relocation and integration in their new places of residence.

Therefore, they find the necessity to reinforce the operational roles of the civil guard, civil protection, and general practitioners and social workers in the assistance and interventions at the local level. Also, relevant social referents or leaders must be identified and engaged from the beginning.

Human health

Main points under discussion: How it could be designed and implemented a successful health surveillance plan that avoids negative reactions among the population?

Specifically, in addition to what is shown in the previous point, the panellists stressed the importance of a health surveillance programme, checking at the regional or local level, taking into account their particularities. The health test would be mainly offered as voluntary, including psychological risks. Also, the affected population would be engaged with implementing self-care programs and their involving in the decision -making on health issues that affect them.

Radiologic aspects

Main points under discussion: to what extent are the models adapted to reality?; Are reliable the environmental measurements?; Who will be in charge and how will be taken the measurements?

It is needed to improve the predictive models in adapting to the national reality. Also, methods, equipment and measurements in the environmental monitoring should be tried and tested. The uncertainties from both the calculations of models and the measurements should be considered in the decision-making. However, the panellists believe that it is more complex to convey uncertainty to the population. It would be desirable to have a public information system responsive and oriented to the different levels of understanding in population.

Environmental aspects

Main points under discussion: How to identify and zoning the affected areas?; How does the contamination change along the time and what factors could be implicated in?

Panellists give great importance to a good characterisation of the affected zones identifying land uses, agricultural and husbandry productions, and so on; identifying hot-points; and a reliable estimation and consideration of environmental factors influencing changes in the contamination scenario.

4.2.2 Selecting criteria and prioritising preferences

The last part of the meeting focuses on the selection of criteria and prioritisation of preferences in decision-making. In this part, a small presentation was made about some criteria that emerged from the discussions of other European panels involved in the project. Summing up the main discussion points and findings:

As a first observation, the panellists found that in the results of other panels, criteria to assess the effectiveness of the recovery actions, the environmental implications or the personal doses of those acting are lacking. They agreed with taking into account radiological criteria to assess the reduction of the impact in the people (in terms of doses), or/and in foodstuffs (in terms of activity concentration). Also, they highlighted that it is important to look for the optimisation of the action strategies in the affected areas.

Therefore, all agreed that the **residual dose** is a relevant criterion to quantify the indicator of human health when a protective or recovery strategy is implemented.

The participants in the panel did not agree with taking into account criteria such as **political** and **public acceptance**. They advocate for effective **engagement and involvement of stakeholders** in the decision-making as the best manner to obtain such compliance.

In the other hand, the panellists considered that the following criteria should be included:

- Economic costs (direct and indirect costs, including from wastes management, acting people, surveillance and environmental monitoring, and so on)
- Feasibility in terms of technical and personal resources.
- Radiological surveillance of people.
- Effects on the quality of life (e.g. maintenance of both employment, service delivery and the way of life of people; generating alternatives ways of responding to needs of affected persons; the integrity and sustainability of the community; regrouping of displaced persons; and so on).

Other criteria should take into account:

- Public participation
- Development of infrastructures
- Maintenance of land use to assess some environmental effects.
- Pet and husbandry management
- Reduction of stigmatization/build trust in the future of the affected areas (e.g. density of population, investments, economic incentives, ...)
- Characterisation and changes in zoning along time.

When we asked participants to rank the main criteria, they established the following prioritization:

- Radiological criteria
- The effects on the local population
- Economic stability

The attendees highlighted the importance of taking advantage of the strong social and community fabric actually around the nuclear municipalities so that this type of contamination situation have the least impact possible on the quality of life of the population. This would be achieved through incentives or tax exemptions.

Finally, the importance of increasing preventive medicine plans in these areas is highlighted.

5 Conclusions and Perspectives

This first session of the Spanish panel has been directed to understand the meaning and scope of the transition phase, to identify the critical aspects to be taken into account, as well as the most important objectives and criteria to guide recovery planning during this phase. Discussions have been directed to find what the Spanish panel considers a priority.

One of the challenges encountered has been the difficulty of focusing the debate around the preparedness of the post-accidental recovery and how to approach the planning of the environmental recovery and the rehabilitation of the normal living conditions, with the help of the stakeholders. The experience of most of the participants, especially at the highest levels of the decision, focuses on the problem of the very occurrence of a nuclear accident and the management of the emergency phase with urgent and early responses and actions, such as confinement, evacuation or treatment with iodine pillows. Given our legal framework, there is still no consolidated culture or doctrine to address the post-accidental. However, all participants are interested in deepening these issues and express their willingness to continue participating in these forums.

As a main result of this debate, the panellists highlighted that the main objective of the transition phase is to preserve the public health first, no matter the cost and the time used to reach it.

It is important to highlight, that among the panellists, their interaction and engagement has been an enriching task as well as a good introduction to the Transition Phase and the challenges of its implementation.

Some items were specifically stressed such as the need to be prepared in terms of:

- Identification of stakeholders, its organisation and establishment of roles and responsibilities
- A proper radiological characterisation
- The infrastructures needed to act

All aspects highlighted in the first session present uncertainties in one or other manner. The second session was focussed on identifying and assessing these uncertainties and the dilemmas that play a central role in the dynamics of the decision, as well as the criteria that would be used to evaluate the application and success of recovery strategies. The uncertainties identified were grouped mainly under the categories: economic, social and communication, although also were discussed relevant uncertainties regarding the policies and authorities, human health, and radiologic and environmental aspects.

For each one, several actions were considered to reduce or tackle them during the decision-making or in the preparedness for recovery during the transition phase. Specifically, the panellists gave great importance to the need of preparedness in advance, having predictive and monitoring tools adapted, tried and tested for the national reality, communication plans in advanced at different levels, considering the development of consensual policies, identifying the roles of the different public authorities and other bodies and their coordination, the provision of adequate resources and infrastructures for the personal surveillance and environmental monitoring, reinforcing operational roles of the acting people and promoting social leadership to facilitate the implementing of the actions and to build trust among the population.

Finally, Spanish panellists selected the relevant criteria to assess the effectiveness of the recovery actions, where the residual dose occupies a prominent place in the assessment of human health. To assess the effects on the local population and to quantify the costs and economic stability were highlighted as very important as well. It is foreseeable that this prioritisation of the preferences of Spanish stakeholders can be taken into account in a multi-criteria decision-making analysis.

6 References

1. Council Directive 2013/59/EURATOM, of 5 December, Laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation. https://ec.europa.eu/energy/sites/ener/files/documents/CELEX-32013L0059-EN-TXT.pdf
2. Montero, M; Trueba, C.; Sala, R. Scenario-based Stakeholders Engagement. Guidelines for national discussions. (HORIZON 2020 EJP-CONCERT, EC GA 662287). Internal Technical Document CONFIDENCE-WP4/T4.2.1-R01, v1.0 Final, CIEMAT, Madrid, Spain. 2018.
3. OECD/NEA. "Strategic Aspects of Nuclear and Radiological Emergency Management". Radiological Protection NEA Nº 6387. OECD Publications, France. 2010. Available online at: http://www.oecd-nea.org/rp/pubs/2010/6387-strategic-aspects-of-nuclear.pdf
4. Spanish Ministry of Interior. Master Plan corresponding to the Nuclear Emergency Plan outside the nuclear power plants of José Cabrera and Trillo, Guadalajara (PENGUA). Resolution of 20 October 2009. BOE, num 271, 10 November 2009. [In Spanish]
5. U. S. Nuclear Regulatory Commission. State-of-the-Art Reactor. Consequence Analyses Project (SOARCA) Volume 2: Surry Integrated Analysis. NUREG/CR-7110, Vol. 2. Sandia National Laboratories, Albuquerque, New Mexico 87185. Operated for the U.S. Department of Energy. NRC Job Code N6306. 2013
6. Karlsruhe Institute of Technology (KIT), March 2017 JRodos: An off-site emergency management system for nuclear accidents. (https://resy5.iket.kit.edu/JRODOS/documents/JRodos_Report_forHomepage.pdf)
7. Gering, F.; Raskob, W.; Charnock, T. New model for agricultural countermeasures in RODOS and ARGOS. Radioprotection, vol. 45, Nº 5, pages S63 – S76. 2010
8. Nordic Guidelines and Recommendations (NGR). Protective Measures in Early and Intermediate Phases of a Nuclear or Radiological Emergency. Beredskabsstyrelsen (Denmark), Sundhedsstyrelsen (Denmark), Geislavarnir Rikisins (Iceland), Stuk (Finland), Statens Stralevern (Norway), Stral Sakerhets Myndigheten (Sweden). 2014.

REFERENCES

1. Council Directive 2013/59/EURATOM, of 5 December, Laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation. https://ec.europa.eu/energy/sites/ener/files/documents/CELEX-32013L0059-EN-TXT.pdf
2. Montero, M; Trueba, C. Methodology design of the multi-method consultation process. HORIZON 2020 EJP-CONCERT, EC GA 662287, Technical Deliverable CONCERT D9.18, CONFIDENCE-WP4/D4.1 v1.0 Final. (2017).
3. Charnock T; Andersson K. (2018). Addressing the uncertainties in urban/inhabited scenarios. Deliverable D9.20 of the HORIZON 2020 EJP-CONCERT, EC GA 662287. CONFIDENCE-WP4/D4.3 v1.2 Final
4. Montero M; Trueba C.; García-Puerta B.; Sala R.; Andresz S.; Schneider T.; Maître M.; Croüail P.; Durand V.; Charron S. (2018). Addressing the uncertainties in agricultural scenarios. Technical Deliverable D9.21 of the HORIZON 2020 EJP-CONCERT, EC GA 662287. CONFIDENCE-WP4/D4.4 v1.0 Final, CIEMAT, Madrid, Spain
5. Montero, M; Trueba, C. (2017). Scenarios and issues to address with stakeholders. Structured communication technique results. Technical deliverable D9.19 of the HORIZON 2020 EJP-CONCERT, EC GA 662287. CONFIDENCE-WP4/D4.2 v1.0 Final, CIEMAT, Madrid, Spain
6. Montero, M; Trueba, C.; Sala, R. (2018). Scenario-based Stakeholders Engagement. Guidelines for national discussions. (HORIZON 2020 EJP-CONCERT, EC GA 662287). Internal Technical Document CONFIDENCE-WP4/T4.2.1-R01 v1.0 Final, CIEMAT, Madrid, Spain.