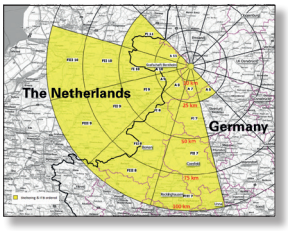
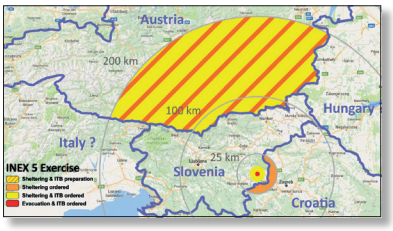
Radiological Protection
2018

Experience from the Fifth International Nuclear Emergency Exercise (INEX-5)

Notification, Communication and Interfaces Related to Catastrophic Events Involving Ionising Radiation and/or Radioactive Materials





OECD
BETTER POLICIES FOR BETTER LIVES

anniversary 60th NEA
NUCLEAR ENERGY AGENCY

Radiological Protection

Experience from the Fifth International Nuclear Emergency Exercise (INEX-5)

Notification, Communication and Interfaces Related to Catastrophic Events Involving Ionising Radiation and/or Radioactive Materials

© OECD 2018
NEA No. 7379

NUCLEAR ENERGY AGENCY
ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

The OECD is a unique forum where the governments of 36 democracies work together to address the economic, social and environmental challenges of globalisation. The OECD is also at the forefront of efforts to understand and to help governments respond to new developments and concerns, such as corporate governance, the information economy and the challenges of an ageing population. The Organisation provides a setting where governments can compare policy experiences, seek answers to common problems, identify good practice and work to co-ordinate domestic and international policies.

The OECD member countries are: Australia, Austria, Belgium, Canada, Chile, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The European Commission takes part in the work of the OECD.

OECD Publishing disseminates widely the results of the Organisation's statistics gathering and research on economic, social and environmental issues, as well as the conventions, guidelines and standards agreed by its members.

This work is published under the responsibility of the Secretary-General of the OECD.

NUCLEAR ENERGY AGENCY

The OECD Nuclear Energy Agency (NEA) was established on 1 February 1958. Current NEA membership consists of 33 countries: Argentina, Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, Norway, Poland, Portugal, Romania, Russia, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The European Commission and the International Atomic Energy Agency also take part in the work of the Agency.

The mission of the NEA is:

- to assist its member countries in maintaining and further developing, through international co-operation, the scientific, technological and legal bases required for a safe, environmentally sound and economical use of nuclear energy for peaceful purposes;
- to provide authoritative assessments and to forge common understandings on key issues as input to government decisions on nuclear energy policy and to broader OECD analyses in areas such as energy and the sustainable development of low-carbon economies.

Specific areas of competence of the NEA include the safety and regulation of nuclear activities, radioactive waste management and decommissioning, radiological protection, nuclear science, economic and technical analyses of the nuclear fuel cycle, nuclear law and liability, and public information. The NEA Data Bank provides nuclear data and computer program services for participating countries.

This document, as well as any data and map included herein, are without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Corrigenda to OECD publications may be found online at: *www.oecd.org/publishing/corrigenda*.

© OECD 2018

You can copy, download or print OECD content for your own use, and you can include excerpts from OECD publications, databases and multimedia products in your own documents, presentations, blogs, websites and teaching materials, provided that suitable acknowledgement of the OECD as source and copyright owner is given. All requests for public or commercial use and translation rights should be submitted to *neapub@oecd-nea.org*. Requests for permission to photocopy portions of this material for public or commercial use shall be addressed directly to the Copyright Clearance Center (CCC) at *info@copyright.com* or the Centre français d'exploitation du droit de copie (CFC) *contact@cfcopies.com*.

Cover photos: Protective actions in Germany and the Netherlands (BfS, Germany); Protective actions in Austria, Croatia, Hungary, Italy and Slovenia (SNSA, Slovenia).

Foreword

Matters related to nuclear emergencies have long been a focus of the OECD Nuclear Energy Agency (NEA). The Agency's efforts have aimed to highlight the importance and improve the effectiveness of the international aspects of nuclear emergency preparedness and management. A key aspect of these efforts has centred on preparing, conducting and evaluating the International Nuclear Emergency Exercise (INEX) series, which the NEA has organised since 1993. The experiences and lessons learnt from these exercises have substantially contributed to building robust emergency management systems in NEA member countries.

The lessons learnt are derived not just from exercises, but also from accidents – which are extremely rare. In the aftermath of the Fukushima Daiichi nuclear power plant (NPP) accident, for example, countries implemented changes to enhance their capabilities to face unexpected events with potentially severe consequences. Once in place, NEA member countries wished to test the implementation of these changes to assess both their value and to identify further possible improvements. In response, the NEA developed INEX-5 with a focus on the international emergency management aspects of notification, communication and interfaces following a catastrophic event involving ionising radiation and/or the release of radioactive material (i.e. similar to the Fukushima Daiichi accident).

The INEX-5 preparedness and early response exercise, part of the ongoing NEA INEX series, was developed by the NEA in response to member countries' desires to test and demonstrate the value of the changes implemented following the Fukushima Daiichi NPP accident. The exercise was developed between 2014 and 2015, and conducted during 2015 and 2016 by 22 participating countries.

Building on the lessons learnt from the Fukushima Daiichi NPP accident, INEX-5 has contributed to identifying what might be done to improve international communication and co-ordination, to better prepare for the mid- and longer-term phases of an accident and to further improve the exercises developed to address these phases.

Key needs identified during the exercise and workshop include real-time communication and information sharing with other countries and international partners; cross-border and international co-ordination of protective measures; preparing for the mid- and long-term aspects of recovery; addressing the mental health impacts on populations when implementing protective measures; and linking technical experts with decision makers at all levels.

The NEA is working to provide useful input into the resolution of these needs by making such information available to national authorities and international organisations, as well as testing new approaches for future international exercises.

This report summarises the development of INEX-5, the major outcomes from the national and regional exercises and their key policy implications, recommendations and follow-up activities that have emerged from the exercise, the Working Party on Nuclear Emergency Matters Topical Session on INEX-5 in January 2017 and the INEX-5 International Workshop in October 2017.

Table of contents

List of abbreviations and acronyms 7

Executive summary 9

Acknowledgements 11

Chapter 1. **Introduction** 13

Chapter 2. **INEX-5 planning and preparation** 17
- INEX-5 objectives and scope 17
- Scenarios 18
- Regional exercise 19
- Topical Session on INEX-5 19
- Exercise evaluation 19

Chapter 3. **Summary of the INEX-5 evaluation questionnaires** 21
- Decision making 22
- Public information and communication 35
- National and international support 37
- Post-Fukushima actions/measures in emergency preparedness and response 39
- INEX-5 and proposals 41

Chapter 4. **INEX-5 International Workshop outcomes** 43
- Key issues on communication and information sharing with other countries and international partners: A focus on real-time communication platforms 43
- Key issues on cross-border and international co-ordination for protective measures 45
- Key issues on how to better prepare for the mid- and long-term aspects of recovery 46
- Working with other international organisations, platforms and networks 47

Chapter 5. **INEX-5 follow-up** 49

Chapter 6. **Conclusions** 51

List of annexes

1. Selected bibliography 53
2. INEX-5 Preparation Group Membership 55
3. List of participants: The Topical Session on INEX-5 57
4. List of participants: The INEX-5 International Workshop 59

List of figures

3.1. Recipients of the emergency notification notified by the NPP 22
3.2. Means for reaching decisions when multiple bodies are involved....23
3.3. Judgement factors considered to evaluate the situation and for decision making under uncertain or unknown situations 24
3.4. Elements of international interfaces included in national plans 25
3.5. Do national plans involve resources for active communication with other countries and international organisations? 27
3.6. Organisations providing information versus organisations provided with information during a nuclear emergency 28
3.7. Adoption of the principle "We do the same as the accident country" versus "Follow local advice" 29
3.8. Protective actions in Germany and the Netherlands during INEX-5 30
3.9. Protective actions in Slovenia and Croatia during INEX-5 31
3.10. Protective actions in the region of the five-country regional exercise....31
3.11. Basis for alteration of pre-planned actions (given the uncertainties during the early phase of the exercise)....33
3.12. Organisations with responsibilities for providing information to the public in case of nuclear emergency....35
3.13. Use of social media during INEX-5 36
3.14. Evolution in the planning for the simultaneous management of radiological and non-radiological events before and after the Fukushima Daichi NPP accident....38
3.15. Degree of post-Fukushima actions tested during INEX-5 39

List of tables

1.1. Evolution of objectives throughout the International Nuclear Emergency Exercise (INEX) series....15
1.2. Selected key outcomes during the International Nuclear Emergency Exercise (INEX) series....16
2.1. INEX-5 timeline 17
3.1. Post-Fukushima actions tested (fully or partially) during INEX-5 40

List of abbreviations and acronyms

BfS	German Federal Office For Radiation Protection
CRPPH	Committee on Radiological Protection and Public Health (NEA)
EC	European Commission
ECURIE	European Community Urgent Radiological Information Exchange
ELAN	German system for electronic situation reports concerning nuclear power plants
EPR	Emergency preparedness and response
EU	European Union
HERCA	Heads of the European Radiological Protection Competent Authorities
HWA	HERCA-WENRA approach
IAEA	International Atomic Energy Agency
INEX	International Nuclear Emergency Exercise (NEA)
ITB	Iodine thyroid blocking
MKSID	The Slovenian national communication platform for radiation emergencies
NEA	Nuclear Energy Agency
NPP	Nuclear power plant
OECD	Organisation for Economic Co-operation and Development
SNSA	Slovenian Nuclear Safety Administration
USIE	Unified System for Information Exchange in Incidents and Emergencies (IAEA)
WENRA	Western European Nuclear Regulators Association
WHO	World Health Organization
WPNEM	Working Party on Nuclear Emergency Matters (NEA)

Executive summary

The fifth International Nuclear Emergency Exercise (INEX), part of the Nuclear Energy Agency's (NEA) ongoing series of INEX, was developed under the auspices of the NEA Committee on Radiological Protection and Public Health (CRPPH) Working Party on Nuclear Emergency Matters (WPNEM). INEX-5 addressed the specific needs of member countries to test and provide a basis for enhancing national and international emergency management arrangements. The primary focus of the exercise was related to notification, communication and the interfaces between countries when challenged by catastrophic events involving releases of radioactive material.

Following the Fukushima Daiichi nuclear power plant (NPP) accident in 2011, a consensus developed in international fora concerning the need to enhance international communication and information exchange on national emergency management decisions. At the regional level, in particular, it was suggested that there could be value added from the harmonisation and co-ordination of protective measures in order to avoid inconsistencies in responses. Since the Fukushima Daiichi NPP accident, many actions have been undertaken at both the national and international levels regarding emergency preparedness, response and recovery plans. INEX-5 has provided an opportunity for participating countries to test and demonstrate the value of the changes put in place as a result of the Fukushima Daiichi accident.

INEX-5 was developed in 2014 and 2015, and the exercises were conducted by 22 participating countries throughout 2015 and 2016. Seven countries in two groups played INEX-5 regionally. The exercise evaluation questionnaires completed by each country have provided detailed information on the national approaches adopted for each of the exercise objectives, as well as issues relating to the international interfaces between countries. The regional exercises have, in particular, provided valuable outcomes regarding international co-ordination and information on where further work may deliver additional benefits. The key issues identified were captured through the analysis of these questionnaires and during the Topical Session on INEX-5, held during the 41st meeting of the WPNEM on 24-25 January 2017. These data were the main inputs into the follow-up INEX-5 International Workshop, held in Boulogne-Billancourt, France, in October 2017.

The workshop, attended by about 50 participants from 22 countries and 2 international organisations, was convened with the objective of allowing participants to share their national and regional INEX-5 experiences. The workshop provided an opportunity to exchange exercise outcomes and experiences on areas of international communication and information sharing, with a focus on real-time exchanges, cross-border and international co-ordination of protective measures and mid- and long-term aspects of recovery. In addition to providing a valuable discussion forum for participants, the workshop identified key needs in areas such as communication and information sharing with other countries and international partners with a focus on real-time information sharing, improving cross-border and international co-ordination of protective measures, better preparing for mid- and long-term aspects of recovery, and taking into account mental health impacts on populations when implementing protective measures, as well as more closely linking technical experts with decision makers at all levels.

Following the workshop, these key needs were reviewed by the WPNEM and developed for consideration as part of its INEX-5 follow-up activities. A session during the workshop was devoted to activities by international organisations and potential communication platforms for use by member states. The workshop focused on identifying synergies and avoiding duplication of efforts. Ten suggestions for further consideration were made during the international workshop. These suggestions were further delineated by the WPNEM into six areas for future work. As a result, the WPNEM has launched a series of initiatives to facilitate improvements in the areas of:

- real-time communications;
- non-radiological public health aspects of radiation planning and response, including psychosocial and other societal impacts of evacuation, sheltering and relocation;
- recommendations for building nationally adapted frameworks for recovery in NEA member countries;
- benchmarking of dose projection code outputs based on same (or very similar) inputs;
- WPNEM member country updates of Protective Measures Handbooks;
- involvement of decision makers in the planning and implementation of protective action strategy.

The outcomes from these initiatives will be made available to all interested national authorities and international organisations as a contribution towards improving emergency management both nationally and internationally.

Acknowledgements

This report was prepared under the programme of work of the Working Party on Nuclear Emergency Matters (WPNEM) of the NEA Committee on Radiological Protection and Public Health (CRPPH). Drafting of the report was ensured by Olvido Guzmán, WPNEM Secretariat. The report benefited from the substantial inputs of Mike Griffiths, workshop facilitator and former WPNEM Chair and from the substantive support of Emilia Kopeć, intern at the NEA Division on Radiological Protection and Human Aspects of Nuclear Safety..

The Secretariat would like to thank all members of the INEX-5 Preparation Group (see Annex 2) and all participants of the WPNEM-41 Topical Session on INEX-5 (see Annex 3) and the participants in the INEX-5 International Workshop (see Annex 4). Particular thanks also go to all of the 22 national INEX-5 co-ordinators and to all organisations and their staff who participated in conducting the exercise. The Secretariat also thanks the different WPNEM Chairs during the development, conduction and evaluation of the exercise for their instrumental support: Mike Griffiths (2014-2015), Patricia Milligan (2016-2017) and Matthias Zähringer (2017-2018).

Chapter 1. Introduction

Responding to member countries' post-Chernobyl concerns, in 1990 the Nuclear Energy Agency (NEA) created the Expert Group on Emergency Exercises (today the Working Party on Nuclear Emergency Matters) to initiate and co-ordinate International Nuclear Emergency Exercise (INEX) in order to improve the quality and co-ordination of emergency response systems and facilitate consensus on nuclear emergency management approaches among countries. The INEX series of international emergency preparedness exercises has proven to be successful in testing and developing the arrangements for responding to nuclear emergencies (see table 1.1 and 1.2).

The first series, the INEX-1 tabletop exercise (1993), brought together participants from across the world to separately consider the issues raised by a simulated emergency at a fictitious nuclear power plant affecting fictitious countries. A follow-up workshop to INEX-1 was hosted by the NEA to address common experiences and issues, and identify areas for future development work. The second series of exercises, INEX-2, built upon the foundations laid by INEX-1. INEX-2 was conducted as a "command-post" type exercise designed to use real-time communications with actual equipment and procedures. In the case of INEX-2, four specific exercises were arranged between 1996-1999, each hosted by a designated country simulating the "accident country", and involving a number of other countries playing simultaneously as near-field or far-field countries in order to test specific aspects of both national and international arrangements. The INEX-2 series of exercises culminated in INEX-2000 (2001), which focused on the important outcomes and work of the INEX-2 series. INEX-2000 was also the first international exercise to be jointly organised by several international agencies through the Inter-Agency Committee for the Response to Nuclear Accidents (currently Inter-Agency Committee on Radiological and Nuclear Emergencies – IACRNE). Many important issues were identified from the INEX-1, INEX-2 and INEX-2000 programmes, and subsequently valuable lessons have been learnt regarding the early phase response to nuclear emergencies (see Annex 1: Selected bibliography).

Starting with INEX-3 (2005-2006), the international community began looking at the issues involved in longer-term consequence management. This third series of exercises focused on consequence management issues that would likely arise as a result of a nuclear or radiological emergency that led to significant contamination of the populated environment. INEX-3 was designed to deliver tangible benefits to participant countries in the form of greater understanding of the challenges to be faced after the emergency phase of an incident has passed, the ability to compare national practices with other countries, and the opportunity to identify areas for improvement in consequence management that could be usefully addressed by the international community. In order to build on the momentum of INEX-3 and the work of various INEX-3 follow-up activities, in 2008, the NEA Working Party on Nuclear Emergency Matters (WPNEM) launched the development cycle for a new international emergency exercise INEX-4. INEX-4 focused on issues arising from consequence management and transition to recovery during the response to malicious acts involving the release of radioactive materials in an urban setting. Recognising that the arrangements for managing these events may vary between countries, the goal of INEX-4 was to provide a basis for enhancing emergency management through the exchange of exercise experiences from participating countries and the identification of good practices and common issues.

Many countries participating in these exercises used the experiences and lessons identified to modify and improve national procedures for nuclear emergency preparedness and management. The data management strategy is implemented currently in several NEA member countries, as well as elsewhere in the international community in general.

After the 2011 Fukushima Daiichi nuclear power plant (NPP) accident, it was recognised that notification, communication and identification, as well as obtaining resources during catastrophic events, can prove to be difficult. A proposal was made for protocols, policies and procedures to be established both among and between countries with the aim of minimising negative impacts.

It was important therefore to design an exercise that provided a basis for highlighting enhancements to national and international emergency management arrangements related to those issues. This would be delivered through the exchange of exercise outcomes and experiences by participating countries, identifying good practices and common issues to be addressed.

In order to address the identified needs, the WPNEM began the development of the INEX-5 preparedness and early response exercises in 2013. This fifth series of exercises is based on an escalating scenario involving a release of ionising radiation and/or radioactive material that coincides with a natural disaster exacerbating the original incident into a catastrophic event with international implications. As an exercise of notification, communication and interface in relation to catastrophic events, the INEX-5 design specifically excluded the intermediate and late phases, except for appropriate notification and communication activities within the scenario questions, although issues arising during this phase were addressed by some countries.

The INEX-5 series, conducted in 2015-2016, provided an opportunity for participating countries to test and demonstrate the value of changes made to their arrangements as a result of the lessons learnt from the Fukushima Daiichi NPP accident. INEX-5 was also designed to test new arrangements developed at regional and international levels in order to enhance communication and information exchange, and cross-border co-ordination. The INEX-5 series allowed both national and regional play in each country, or as a group in a region, with the exercise hosted by one of the participants.

INEX-5 was a tabletop exercise. The exercise was not a real-time exercise and it was neither intended nor designed to test any international conventions. As in the case of previous exercises, INEX-5 was a “no fault” exercise, with the evaluation focusing on plans, procedures, organisational structures and supporting systems, rather than on individual performance.

The INEX-5 series and its evaluation involved three distinct parts. Firstly, 22 countries chose to conduct either a national- or a regional-level exercise. Exercise evaluation questionnaires were completed by each participating country and provided information on the approaches adopted for each of the exercise objectives. Secondly, following the completion of all the exercises, a dedicated Topical Session on INEX-5 was held on 24-25 January 2017 in order to allow participants to share the main outcomes of their respective exercises. The preliminary analysis of the evaluation questionnaires by the NEA, together with the presentations and outcomes of the topical session, constituted the core inputs for the preparation of the third and final aspect of INEX-5, an international workshop. The INEX-5 International Workshop was held on 24-25 October 2017 and resulted in ten suggestions for WPNEM members to further consider in areas such as communication and information sharing with other countries and international partners, with a focus on real-time information sharing, improving cross-border and international co-ordination of protective measures, better preparing for the mid- and long-term aspects of recovery, as well as taking into account mental health impacts on populations when implementing protective measures and more closely linking technical experts with decision makers at all levels.

This report discusses the history of the INEX-5 development, and provides the major outcomes and recommendations from INEX-5, the topical session and the evaluation workshop.

For a better overview of the INEX series, Table 1.1 presents the evolution of objectives throughout the International Nuclear Emergency Exercise (INEX) series and Table 1.2 summarises selected key outcomes during the (INEX) series.

Table 1.1. **Evolution of objectives throughout the International Nuclear Emergency Exercise (INEX) series**

INEX-1 (1993) objectives:

- to examine the process for alerting and communicating with neighbouring countries and the international community in case of a nuclear accident, taking into consideration bilateral/multilateral agreements and international obligations;
- to examine the process for reaching conclusions on the need for national interventions or protective measures;
- to examine actions proposed in relation to the export and import of contaminated food and foodstuffs;
- to examine the process for identifying the need for, and requesting, assistance to cope with a radiological emergency.

INEX-2 (1996-1999) objectives:

- decision making based on limited information and uncertain plant conditions;
- use of real-time communications with the actual equipment and procedures;
- public information and interaction with media;
- use of real weather for real-time forecasts.

INEX-2000 (2001) objectives:

- to test features of the "Monitoring and Data Management Strategies for Nuclear Emergencies" such as:
  - the effectiveness of the developed data matrix;
  - the effectiveness of proposed communication strategies employing new technologies.
- to test the co-ordination of media information between various participants;
- to test the mechanisms for the implementation of the Conventions on Third Party Liability;
- to identify how participants incorporated the lessons learnt from INEX-2.

INEX-3 (2005-2006) objectives:

- to investigate decision-making processes in the medium to longer term following a nuclear or radiological emergency, focusing on the areas of:
  - agricultural countermeasures and food restrictions;
  - soft countermeasures, such as travel, trade and tourism;
  - recovery management;
  - public information.

INEX-4 (2011-2012) objectives:

- to address the issues arising in consequence management and transition to recovery from a malicious act involving a radiological dispersion device in an urban environment:
- to continue an investigation of the themes first addressed in INEX-3 by conducting a series of national exercises;
- to facilitate an investigation of post-crisis emergency management;
- to allow countries to exchange their experiences.

INEX-5 (2015-2016) objectives:

- to test and investigate the adequacy of national arrangements (including national co-ordination and communication), and where appropriate, international arrangements, for notification, communication and obtaining and managing international resource support to respond to a severe contamination event;
- to review and share information on approaches to notification and communication processes in order to identify good practices and to allow reviews and improvements of local, national and international arrangements;

- to identify key areas and approaches to international co-ordination and communication in order to provide a basis for improvements in international emergency management systems.

Table 1.2. **Selected key outcomes during the International Nuclear Emergency Exercise (INEX) series**

INEX-1 (1993) selected key outcomes:

- need for improvement of the co-ordination of communications and short-term countermeasures;
- need for harmonisation of the responses in neighbouring countries;
- a good principle for emergency planning and decision making is: "As normal as possible, as extraordinary as necessary" or "As simple as possible, as good as necessary";
- need for a more realistic exercise.

INEX-2 (1996-1999) selected key outcomes:

- co-ordination of countermeasures;
- timeliness and completeness of data for decisions;
- provision of information to the public;
- clarification of the roles and responsibilities of international organisations;
- creation of an international database for frequently asked questions from real events and exercises;
- NEA report on *Monitoring and Data Management Strategies for Nuclear Emergencies*.

INEX-2000 (2001) selected key outcomes:

- need for information exchange using new technologies;
- information retrieval using internet technology as a part of emergency management procedures;
- decision at national level whether internet technology should be used for information dissemination;
- implementation of new procedures for posting information on a website;
- one official platform for the exchange of emergency information.

INEX-3 (2005-2006) selected key outcomes:

- importance of stakeholder involvement in later phases of consequence management;
- decision making and approaches to stakeholder communication interaction and interdependency;
- deeper insight on liability/compensation issues;
- establishment of three expert groups within the NEA.

INEX-4 (2011-2012) outcomes:

- radiological dispersal device scenario similarities to large-scale nuclear emergencies;
- improvement/development of contingency plans, mass casualty;
- decision making in the face of professional differing opinion;
- optimisation strategies;
- exposure/contamination control processes;
- handling of the technological resources, public communication;
- costs handling;
- transition to recovery processes.

INEX-5 (2015-2016) outcomes:

- real-time information sharing;
- improvement of cross-border and international co-ordination of protective measures;
- better preparing for the mid- and long-term aspects of recovery;
- non-radiological public health aspects of radiation planning and response including psychosocial and other societal impacts of evacuation, sheltering and relocation;
- more closely linking technical experts with decision makers at all levels.

Chapter 2. INEX-5 planning and preparation

The INEX-5 tabletop concept, scope and scenario were approved by the NEA Working Party on Nuclear Emergency Matters (WPNEM) in October 2014 and announced in November 2014 with a deadline for exercise participation at the end of March 2015. INEX-5 and its evaluation were concluded in 2017 (see table 2.1). The main milestones for the exercise are described below.

Official participants in the exercise were: Austria, Belgium, Chinese Taipei, Croatia, the Czech Republic, France, Germany, Hungary, Ireland, Italy, Japan, Korea, the Netherlands, Norway, Poland, Portugal, Russia, the Slovak Republic, Slovenia, Spain, Sweden and the United States (22 in total) and one international organisation – the International Atomic Energy Agency (IAEA).

Table 2.1. **INEX-5 timeline**

Time	Action
November 2014	Official invitation and distribution of the INEX-5 general information
31 March 2015	Deadline to notify the NEA of intention to participate
16-17 June 2015	INEX-5 participating countries meeting (NEA, Paris)
September 2015 to June 2016	Official time window to conduct INEX-5
End of October 2016	Completed INEX-5 evaluation questionnaire sent to the NEA
24-25 January 2017	Topical Session on INEX-5 (NEA, Paris)
24-25 October 2017	INEX-5 International Workshop (NEA, Boulogne-Billancourt)
2018	Publication of INEX-5 summary report (the present report)

INEX-5 objectives and scope

The main goals of INEX-5 were to allow participating countries to i) test or identify elements for improving their emergency management arrangements for notification, communication and interfaces related to catastrophic events involving radiation or radiological materials, and ii) exchange experiences with other countries that have conducted and evaluated INEX-5. To meet these goals, the following common key objectives were set:

- test and investigate the adequacy of national arrangements (including national co-ordination and communication), and where appropriate, international arrangements for notification, communication, and obtaining and managing international resource support to respond to a severe contamination event;
- review and share information on approaches to notification and communication processes in order to identify good practices and allow reviews and improvements of local, national and international arrangements;

- identify key areas and approaches to international co-ordination and communication in order to provide a basis for improvements in international emergency management systems.

Based on the key objectives, the following specific topical areas, which form the basis of the generic exercise play, were established:

- decision making on notification and communication strategies, including issues in optimisation (technical, economic and social factors), and international communication and co-ordination;
- public information and communication;
- national and international support (personnel, equipment, etc.).

In order to meet specific national requirements, the National Planning Committees were allowed to introduce additional objectives to their exercises. However, they were encouraged to ensure that these could be adequately evaluated within the common scope of the exercises. It was recommended that any additional objectives be established in a manner consistent with the common INEX-5 framework.

Scenarios

INEX-5 was a question-driven tabletop exercise focusing on emergency management aspects of notification, communication and interfaces related to catastrophic events involving ionising radiation and/or release of radioactive material. As such, the INEX-5 scenario began as a potential nuclear or radiological event and included the notification and communication processes. During the course of the exercise, it then escalated into a nuclear or radiological event and included the notification and communication processes associated with that level of event. It coincided with a natural disaster that led to a catastrophic event and that involved international notification, communication and interactions associated with the needs likely to be beyond those available within the country.

The basic design characteristics of the scenario are described below:

- Based on a nuclear power plant (NPP) event, exacerbated by a natural disaster and giving rise to ionising radiation or release of radioactive material of significant levels, and likely to affect transboundary locations.
- The scenario timeline did not include specific times or specific events because an objective of this tabletop exercise was to identify and clarify the response needs for countries both with and without NPPs, but which may be impacted by a radioactive material release from another country's NPP event.
- A credible outline "narrative" describing the initiating incident, generic meteorology and incident impact (exercise start).
- Defined source data, an outline contamination "footprint" and description of the radioactive contamination arising from the accident. The footprint determined the extent of the consequences to be assessed by the exercise players.
- A series of "overlays" that could be used over mapping of a participating country.
- A master scenario event list with examples of driving questions/inputs.

Regional exercise

The INEX-5 series allowed for national and regional play in each participating country or as a group in a region hosted by one of the participant countries. Two groups of countries decided to play the exercise at the regional level. The first group was formed by Austria, Croatia, Italy, Hungary and Slovenia, with Slovenia acting as the accident country. The IAEA participated in the Slovenia regional exercise by acknowledging receipt of messages posted on the IAEA Unified System for Information Exchange in Incidents and Emergencies (USIE) and posting the messages to be available for those countries specified by the playing states. The second group involved Germany and the Netherlands.

Topical Session on INEX-5

The Topical Session on INEX-5 took place on 24-25 January 2017 and coincided with the 41st WPNEM Meeting. The goal of the topical session was to provide a forum for participants to share the main results and outcomes of each of their exercises. The findings of the topical session would be collated and form the basis for more detailed investigation during the final INEX-5 International Workshop. The full list of the participants of the topical session is available in Annex 2.

Exercise evaluation

The basis of the evaluation of INEX-5 is by analysis of the responses contained in the exercise evaluation questionnaires received and the presentations and information shared during the Topical Session on INEX-5 held in January 2017. For the first time in the history of INEX, the possibility of completing the exercise evaluation questionnaire online was provided. Although the take up of the online questionnaire by the participating countries was limited, the introduction by the NEA of online capability has allowed the analysis features of the online tool to be exploited, which has in turn facilitated the ease with which the analysis can be undertaken.

The questionnaire was divided into four parts:

- information on the participating country – including information on organisation and description of the national emergency management structure of INEX-5;
- information on the scenario and exercise format – including information on any changes in the scenario, actions taken prior to the exercise, involvement of other countries or institutions and introduction of additional national objectives to the exercise;
- information on national practices – in particular on decision making, public information and communication, and national and international support;
- other information – additional aspects, related to the conduct of the exercise itself and to the post-Fukushima improvements tested during the exercise.

Chapter 3. Summary of the INEX-5 evaluation questionnaires

The INEX-5 series of exercises was conducted between July 2015 and May 2017 by 22 countries in Europe, North America and Asia. The countries were comprised of a mix of OECD and non-OECD member countries, both with and without nuclear power programmes. The INEX-5 participating countries included 15 countries that played individually – i.e. Belgium, Chinese Taipei, the Czech Republic, France, Ireland, Japan, Korea, Norway, Poland, Portugal, Russia, the Slovak Republic, Spain, Sweden, the United States – and two groups of countries that played regionally – i.e. Austria, Croatia, Hungary, Italy, Slovenia, and Germany with the Netherlands. The International Atomic Energy Agency (IAEA) participated in the regional exercise hosted by Slovenia by acknowledging receipt of messages posted on the IAEA Unified System for Information Exchange in Incidents and Emergencies (USIE) and posting the messages for those countries that were specified by the playing states.

The exercises were based on the exercise scenarios corresponding to the INEX-5 general objectives, and also – if introduced – to the specific national objectives. This section summarises the outcomes of these national exercises based on the feedback provided by the participating countries in their individual exercise evaluation questionnaires. While the content of the questionnaires received by the NEA was somewhat unbalanced, the presentations made during the topical session provided very useful and complementary details to the answers in the questionnaires for some countries.

The means by which the different participating countries conducted INEX-5 varied greatly, from tabletop exercises to full-scale national exercises. The number of organisations involved ranged from 2 to 28. Similarly, the number of individuals involved ranged from 2 to 2000. Four countries involved observers in their exercise. As in previous exercises, diverse types of organisations participated in the exercises, e.g. national authorities, technical support organisations, licensees, ministries of foreign affairs, civil protection, rescue services, emergency organisations, etc.

With regard to the scenarios used for each national exercise, the majority of countries used a scenario involving the occurrence of a natural disaster during a nuclear emergency resulting from an incident at a nuclear power plant. Nuclear power plants were located either on their own territory (for nuclear countries) or on the neighbouring state's territory (for non-nuclear countries) with slight variations in the source terms or in the sequence of the natural and nuclear events. One national scenario was based on a radiological emergency rather than on an incident at a nuclear power plant (NPP). In most cases, however, the generic exercise scenarios were modified by the participants to meet specific national or regional needs.

The evaluation of the exercises followed the key objectives identified and described in the INEX-5 evaluation questionnaire, together with any national and/or regional objectives. The following major themes were considered:

- Decision making: With the main focus on the decision-making authority for notification and communication, decision making during uncertain or unknown situations, intermediate and longer-term aspects, international interfaces in the decision-making processes and optimisation of protection strategies (e.g. technical, economic and social factors).

- Public information and communication: With a focus on national information, and communication and co-ordination of communications activities with other countries and the international community.
- National and international support: With the focus on capability assessment, availability of communications systems, management of insufficient or incorrect information, simultaneous management of radiological and natural events, management of casualties and international assistance and support.

This evaluation and analysis does not aim to describe a comprehensive picture of current emergency, preparedness and response (EPR) measures in all participating countries. It is intended to identify areas for improvement, as well as good practices, which were discovered through the self-evaluation of the countries by their participation in INEX-5.

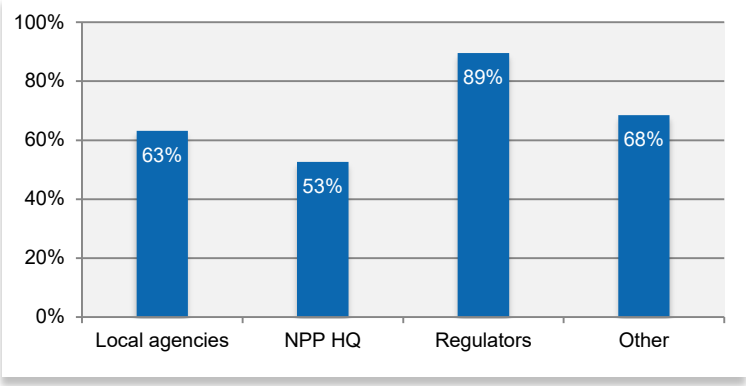
Decision making

Decision-making strategies for notification

For the countries that played the NPP accident-related scenario, the declaration of an emergency and subsequent notification is performed by the operator in all cases. The time allowed for notification to be completed is up to one hour as shown in the responses given in the questionnaires, and in all cases it is stated that notification shall be made without delay and as soon as possible.

The classification of an event is based upon predefined criteria, and it varies between countries. In all cases, the event is primarily notified both to the relevant services on-site and to the relevant authorities, i.e. safety authorities and/or emergency centres. The survey revealed the importance attached to the notification of local agencies. This was true for all accident country scenarios (the exceptions being where the accident occurs on the territory of another country, and therefore the national jurisdiction does not apply, as demonstrated by the countries that played regionally). The relevant national governmental authorities are also notified. It was noted that the specific authorities may vary between countries, with ministries that are in charge of defence, environment, internal affairs, etc., depending on each country. All players identified and established priorities of notification according to their national procedures, policies and protocols. Figure 3.1 shows schematically the recipients of the emergency notifications in INEX-5.

Figure 3.1. **Recipients of the emergency notification notified by the NPP**



Other: national or federal ministries crisis centres, rescue services, etc.

Upon receipt of the incident notification, most of the INEX-5 players (75% of 16 responses) focused on establishing an effective crisis centre, either by activation of their arrangements or by notification of other relevant bodies. Only five countries considered protective actions at this stage of the emergency.

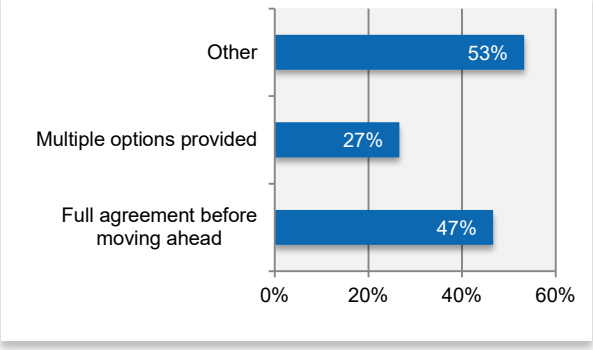
The decision-making processes that are part of the emergency arrangements for notification, communication and the interfaces, both among and between countries, are in the majority of cases established under the IAEA conventions, or EU (European Community Urgent Radiological Information Exchange – ECURIE) arrangements for European countries, and also under bilateral agreements. Slovenia and Croatia highlighted in their responses the importance of the implementation of the Heads of the European Radiological Protection Competent Authorities-Western European Nuclear Regulators Association (HERCA-WENRA) approach (HWA)[1] within their arrangements.

All of the respondents indicated that they would evaluate the decisions taken. The basis for such evaluations varies between countries. Only half of the INEX-5 players reported the existence of pre-established procedures. Two countries reported that they would engage stakeholders in the evaluation of their decision-making process.

Decision-making authority for notification and communication

In the majority of participating countries (77%), the responsibility for decision making regarding notification and communication resides with more than one organisation or post depending on the decision to be taken. In most cases, the organisations involved are national nuclear regulatory authorities (NRA) and crisis centres.

Figure 3.2. **Means for reaching decisions when multiple bodies are involved**



The INEX-5 players reported a variety of means for reaching decisions among multiple bodies. It was noted that almost half of the respondents require full agreement before moving ahead, although occasional exceptions were reported.

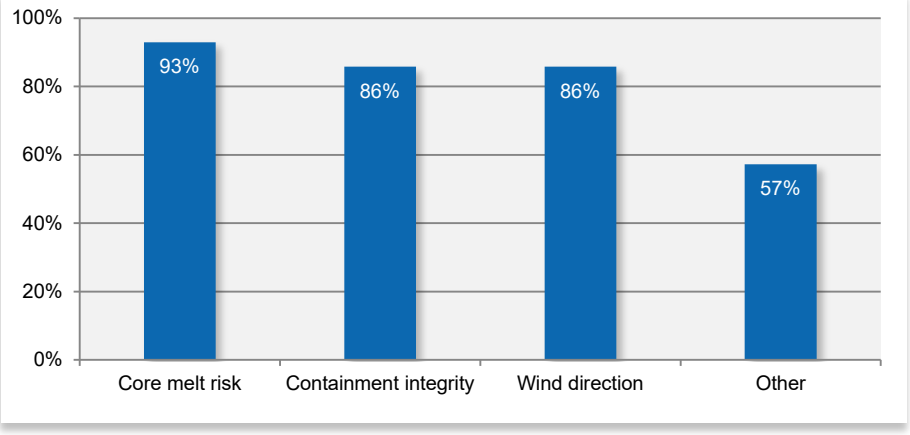
1. HERCA-WENRA (2014), "General Presentation of the HERCA-WENRA Approach for a Better Cross-border Coordination of Protective Actions during the Early Phase of a Nuclear Accident", www.herca.org.

Decision making under uncertain or unknown situations

The majority of INEX-5 players (75%) have reported that decision making under uncertain circumstances is included specifically within their national plans. When included in the national EPR plans, decision making under unknown circumstances is generally based on a pre-established approach.

Core melt risk, containment integrity and wind direction are considered as judgement factors by the majority of respondents. Examples given of other factors included: local context as population situation, weather conditions, day or night, availability of resources, dose rates, weather prognosis reliability and capacity to implement protective actions.

Figure 3.3. **Judgement factors considered to evaluate the situation and for decision making under uncertain or unknown situations**



In most cases, the pre-established approach to decision making under uncertain conditions is not shared with other countries. This reality has been reported by the majority of regional players. Many European countries referred to the ongoing implementation of the HWA to manage these situations. The Nordic countries (i.e. Denmark, Iceland, Finland, Norway and Sweden) stated that they would co-operate under the Flag Book.[2]

Intermediate and longer-term aspects

The INEX-5 design specifically excluded the consideration of intermediate and late phases, except for the appropriate notification and communication activities within the scenario questions. Nonetheless, the evaluation questionnaire included a few questions related to intermediate and longer-term aspects that needed to be considered. For example, which intermediate and longer-term aspects needed to be dealt with and at which level; what aspects and/or procedures were in place for determining recovery actions and at which point during the scenario were recovery actions to be taken into account? Many countries reported that several intermediate and long-term aspects were considered to different extents during the exercise, or they mentioned that they would be considered in a real

2. STUK (2014), "Protective Measures in Early and Intermediate Phases of a Nuclear or Radiological Emergency: Nordic Guidelines and Recommendations".

emergency. Food restrictions were the most commonly considered aspects. Others included medical and psychosocial follow-up of the population, radiation monitoring, decontamination, impact on tourism, etc. In the case of the United States, many of these aspects were studied as part of the Southern Exposure'15 Exercise, an exercise that identified issues and lessons learnt, which were shared during the INEX-5 workshop.

International interfaces in the decision-making process

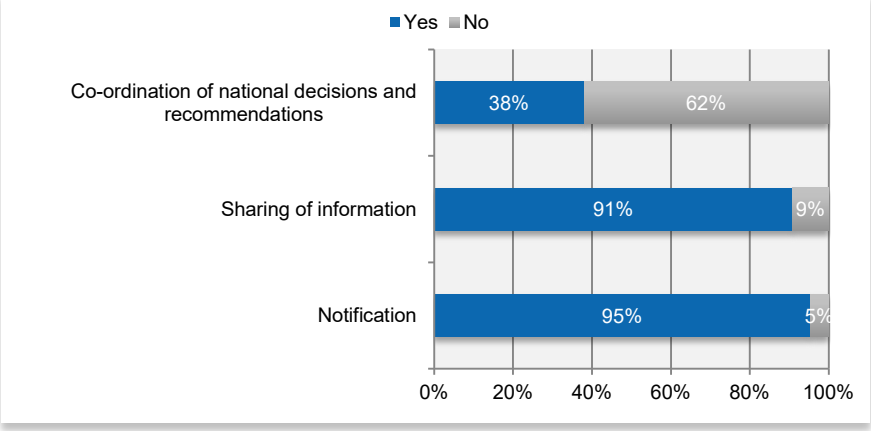
International interfaces, including communication and co-ordination of communications, was one of the key objectives for INEX-5. The majority of players have tested their international EPR arrangements during INEX-5 to some extent and this has proven to be a successful aspect of the exercise. Thirteen countries have tested their EPR arrangements with other countries during INEX-5. In all cases, the arrangements for either notification or information sharing were tested, namely at the bilateral level; and in the majority of cases, these activities were reported as successful (a common problem reported was the reliability of fax systems). International co-ordination was tested by the seven countries that have played the exercise regionally.

Notification and sharing of information

Figure 3.4 presents which elements of international interfaces are included in national plans.

Notification (21/22) and sharing of information (20/22) with other countries is included in practically all emergency plans of the participating countries. However, the co-ordination of national decisions and recommendations with other countries is only found in 38% of national plans. Many European countries reported that the co-ordination aspects will be strengthened after the full implementation of the EU Basic Safety Standards (BSS),[3] which includes explicit requirements on international co-ordination.

Figure 3.4. **Elements of international interfaces included in national plans**



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

All INEX-5 players reported that they have bilateral or multilateral arrangements on EPR established with other countries (109 agreements reported in total). The highest number of agreements was reported by Russia (13) followed by Germany and Norway (12) and Austria and the Slovak Republic (11). Interestingly, not all the bilateral agreements have been reciprocally mentioned by the concerned countries. Germany is the country most reciprocally mentioned (9 out of 11). The nature of the agreements is quite balanced between inter-governmental and bilateral agreements between nuclear regulators. Notification (86%) and information sharing (71%) are the processes most commonly reported under their international EPR arrangements. This is coherent with the responses received that relate to the aspects included in national EPR plans. Surprisingly, co-ordination is not mentioned in either of the bilateral agreements reported, which contrasts with the responses related to the EPR plans (see Figure 3.4).

Regarding formal procedures or processes that exist in participating countries to communicate with other countries on the collection and exchange of information about accident and emergency response, the majority of players reported they would use USIE (71% of responses) and ECURIE for European countries. Also, around half of the participants referred to bilateral agreements in their responses.

For the majority of INEX-5 participants, the processes and procedures for the collection, provision and exchange of information with other countries were considered to be resourced sufficiently. Problems were reported mainly with the communications by fax (difficulties reported by four countries). In the Germany-Netherlands regional exercise, the difference in the alarm levels in the two countries was reported as giving rise to some confusion or misunderstanding. Hence they suggested "the improvement of communication regarding the difference in classification systems used in both countries and the protective actions taken" and "to gain a deeper understanding of the administrative emergency structures implemented in the neighbouring country" as areas for further work.

All respondents reported the use of the IAEA USIE system for formal information sharing among countries. The European countries are also using ECURIE. Nevertheless, around half of the countries also reported having other arrangements in place: primarily due to the establishment of bilateral arrangements with other countries and secondly owing to the development of their own communication platforms. The use and sharing of real-time information between platforms in different countries was reported as very successful by the two groups of regional players. ELAN (a German system for electronic situation reports concerning nuclear power plants) provided a platform that was shared with the Netherlands and Slovenia provided Croatia with access to its real-time MKSID platform. Other countries expressed the view that having access to national protected websites would have been useful for cross-border co-ordination purposes. This prompted the inclusion of this area for further investigation during the INEX-5 International Workshop.

Eleven out of sixteen cases (69%) have reported the existence of informal arrangements (i.e. outside of pre-arranged agreements with other countries) for communication with other countries in order to collect and exchange information about the accident and emergency response information. Nevertheless, these arrangements were scarcely tested during INEX-5 (four countries). Among the informal procedures, the significance and importance of personal contacts between experts involved in EPR throughout the world has been highlighted by the majority of respondents. As reported by the INEX-5 players, such personal contacts are established mainly through participation in a variety of international fora and events (the view is captured by "*Since the community is rather small, you keep meeting the same people in working groups or the regular [annual] bilateral meetings. So it is an easy option to pick up the phone and ask someone you know for help or information*").

Eleven out of seventeen respondents (65%) have reported having a shared understanding of existing national emergency arrangements of other countries. The way

to become aware of these arrangements was either having bilateral regular meetings and exercises, or through examples such as the HERCA Country Fact Sheets used by all the countries for the five countries that played the regional INEX-5. This "awareness" and shared understanding of the arrangements in the other country has been unanimously accepted as very useful during the regional exercises. In the Germany-Netherlands regional exercise, this shared understanding has accelerated the information exchange (as reported by both countries). In the Krsko scenario in Slovenia, it facilitated identification of the points where the arrangements were not aligned, significantly contributing to recognition and understanding of discrepancies.

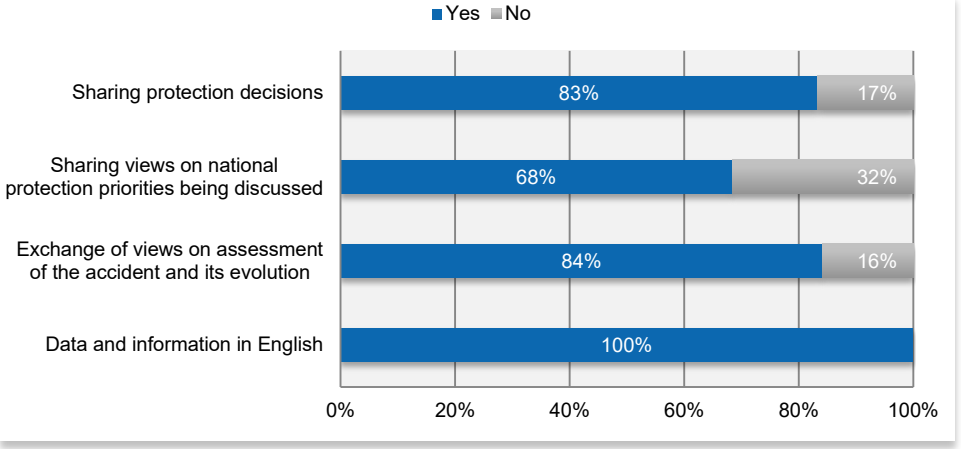
While the majority of respondents declared that the resources for information sharing with other countries were sufficient and addressed the national needs, some countries (all regional players) noted that handling a great number of requests for information may give rise to problems in terms of the human resources available.

Among the non-accident countries, international discussions with other regulatory authorities on the technical assessment of the accident in another country were reported by five countries. Despite the lack of inclusion of these aspects in national plans, respondents noted that they could be carried out under bilateral arrangements. For these purposes, the conventional means of communication would be used (i.e. telephone, video conference, e-mail exchange, etc.). Furthermore, the management of the significant differences in the national and accident country's technical assessments would be addressed through a variety of means, i.e. two countries (Italy and Austria) stated that they would treat the information coming from the accident country as more reliable. Ireland stated that they would use prior studies and evaluations of the worst case scenario as a benchmark. Discussion with the accident country was only mentioned explicitly by two countries.

Communication with other countries and the international community

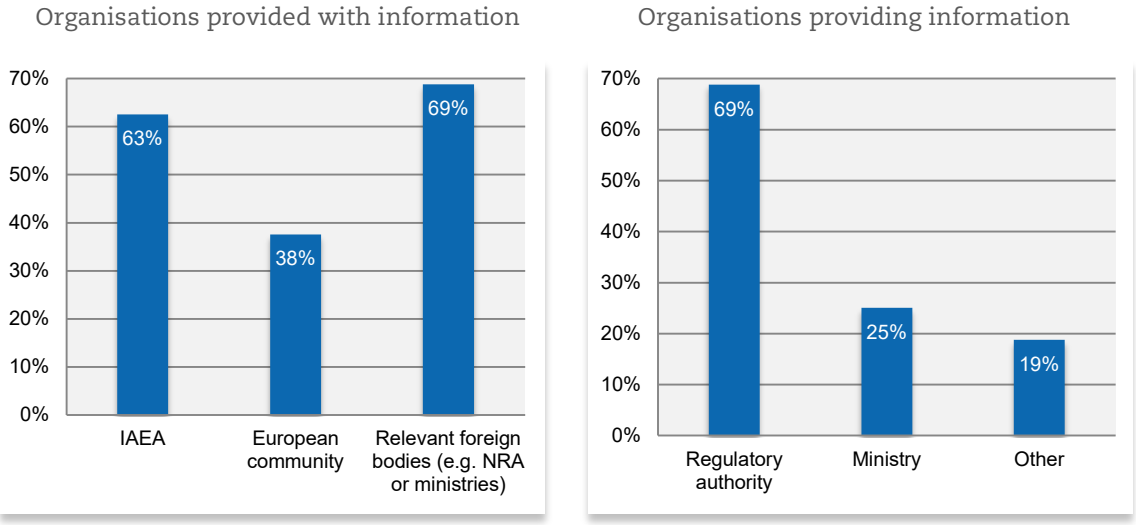
All respondents (20) have indicated that their national plans involve resources that are allocated for the communications needed to provide data and information in English. In the majority of cases, this function is performed via formal international communication platforms, such as USIE and ECURIE – or for example in the case of Slovenia and Croatia – MKSID. Moreover, countries are very likely to exchange views on assessment of the accident and its evolution (84%) and to share protection decisions (83%). On the other hand, only 68% (13 out of 19 responses) would share the views on national protection priorities under discussion (see table 3.5).

Figure 3.5. **Do national plans involve resources for active communication with other countries and with international organisations?**



The following Figure 3.6 show the organisations most commonly reported as being providers of information at the international level, as well as the international recipients.

Figure 3.6. **Organisations providing information versus organisations provided with information during a nuclear emergency**



Other: i.e. Emergency response centres, licensee, etc.

The exchange of liaison officers is foreseen only in 8 out of 17 cases (47%). The lack of human resources or the ongoing discussion on the topics is reported as issues by some of the countries and the conclusion drawn is that member countries do not foresee liaison officers.

International co-ordination

From the questionnaires, only seven countries answered the question whether they considered co-ordinating their response with respect to the response of the accident country, and only three did consider it. Only Croatia reported details of the contacts established with the accident countries reporting that *"With access to the Slovenian emergency communication system, we could follow their recommendations and actions in real time. Since our assessment was similar to theirs, we took the same actions in the Urgent Protective Action Planning Zone (UPZ) as Slovenia did shortly after them, and we had our press releases closely aligned with Slovenian press releases in a very short time. We also informed Slovenia of our actions in UPZ (better protocol is needed to regulate information we should post onto their communication system). Note: Croatian and Slovenian UPZs are of different sizes"*.

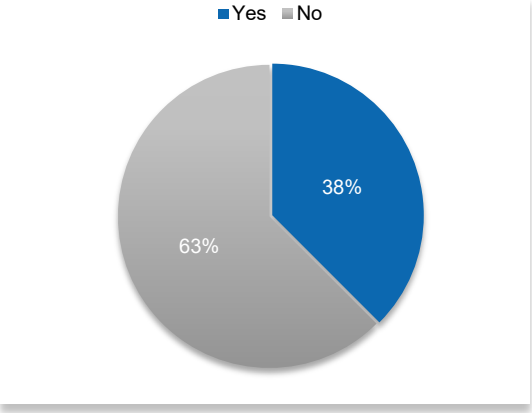
Again, only eight countries answered the question whether they would advise their governments to follow the recommendations of the country in which the accident take place, i.e. to adopt the principle "We do the same as the accident country" in the first hours of the accident. Only three out of these eight countries reported that they would follow the principle "We do the same as the accident country".

By contrast, six out of nine responding countries stated that they would advise their citizens in the accident country to follow the recommendations of the country in which the accident took place, i.e. to adopt the principle "follow local advice". Surprisingly, the countries that would not follow the principle "We do the same as the accident country" were prone to adopt the "Follow the local advice" principle for their citizens in the accident country. Only one country reported aligning with both principles. Figure 3.7.

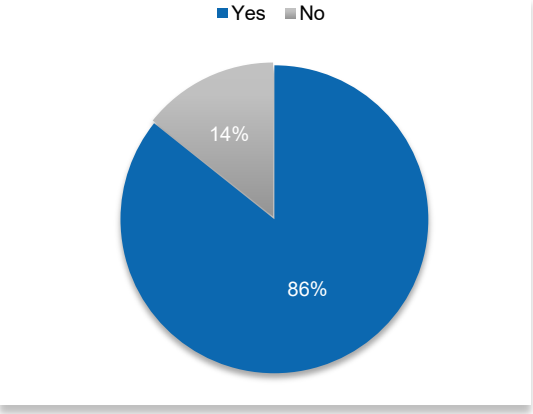
shows the contrast between the criteria to adopt the principle "We do the same as the accident country" versus the recommendation "Follow local advice" for their citizens in the accident country.

Figure 3.7. **Adoption of the principle "We do the same as the accident country" versus "Follow local advice"**

"We do the same as the accident country"



"Follow local advice"



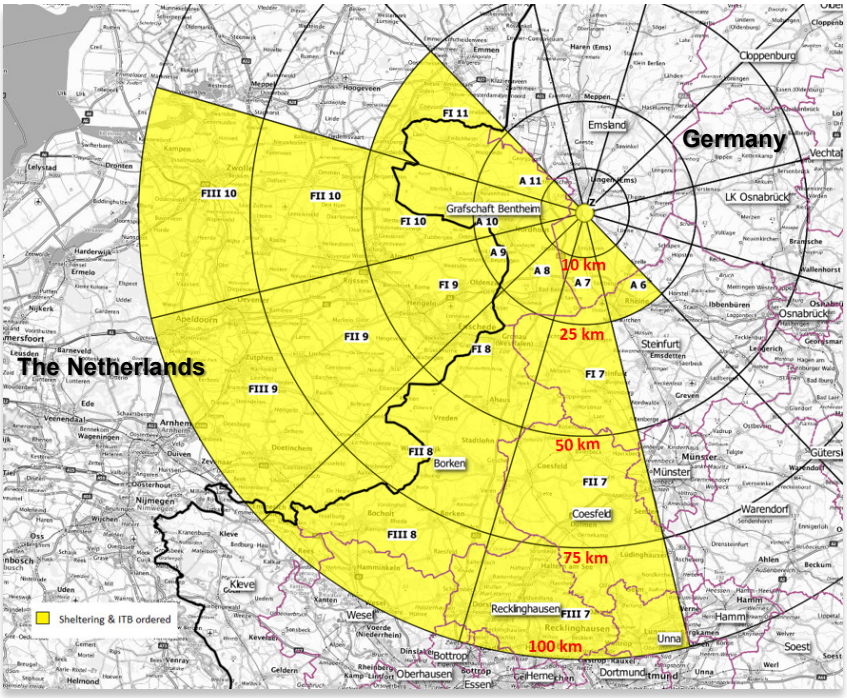
Only three out of eight responders stated that they would discuss and/or co-ordinate the recommendations given to their citizens in the accident country with other countries. The policy presented by one of the regional players for the first phase of the accident is to adopt the measures of the accident country as there might not be sufficient time to discuss; therefore they would adopt the measures of the accident country and only the countermeasures that have less time-pressure would be co-ordinated with the national and the international organisations (i.e. agricultural measures, controls of goods, etc.).

Cross-border co-ordination during the two regional exercises

Cross-border co-ordination was exercised by seven countries playing into two groups with very distinct results:

- Germany-Netherlands: These two countries played together on a tabletop format in the same location. They considered themselves well prepared: "Dutch/German actions will at least be affined" (see Figure 3.8). Additionally, the exercise format (tabletop exercise/*Planbesprechung*) was very useful for the objectives of the exercise. The access to ELAN by the Netherlands was identified as key for the outcomes obtained, as well as the flexibility of the emergency planning zones in the Netherlands. In the Netherlands, a harmonised approach was developed with the purpose to prepare and be ready to take the same measures during nuclear accidents in the Netherlands as in the neighbouring countries. In this approach, which was approved in 2014, in case of an emergency in a neighbouring country, the Netherlands will initially follow the protective actions of this country. To be able to do so, the preparation zones were harmonised with the zones in Belgium and Germany. Furthermore, a range of intervention levels was introduced, with a lower and upper value and a default value. In case of an accident with a nuclear installation in the Netherlands, the default value is used. Based on additional information in the Netherlands, it can be decided to use another value as long as it is within the range as stated in the table. In case of an incident in a neighbouring country, intervention levels within the range can be used to align with the neighbouring country.

Figure 3.8. **Protective actions in Germany and the Netherlands during INEX-5**



Source: BfS.

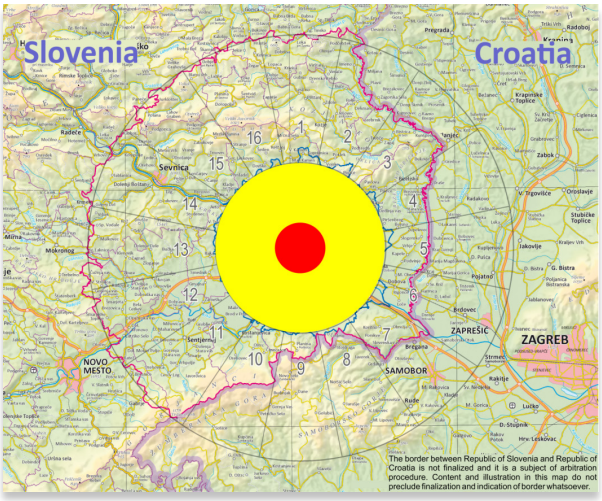
This result did not prevent the identification of areas for improvement such as optimisation of bilateral communication arrangements which should be exercised more frequently. Another relevant outcome of this exercise was that local authorities are not necessarily aware that measures might extend beyond planning zones.

- Austria-Croatia-Hungary-Italy-Slovenia-IAEA: These five countries conducted the exercise in real time, with each country participating from their national premises. As in the other regional exercises, the importance of exchanging operational information for national and international response was highlighted as being of major importance. In particular, Slovenia gave Croatia access to the real-time communication system MKSID, to test it during INEX-5 with excellent results reported. Following the exercise, Croatia is now a regular MKSID user. Despite the fact that efforts were made to harmonise protective measures across the borders, the result was as shown in Figure 3.9.

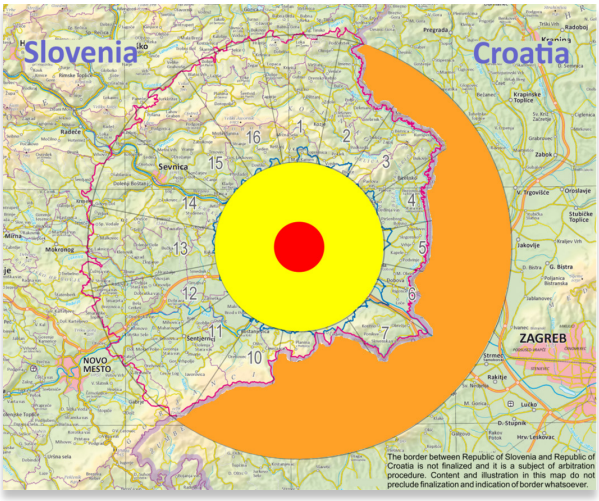
Additionally, owing to time pressure, which was partly caused by artificial time compression in the exercise scenario, Austria was unable to conduct any discussions with the accident state and the Austrian population was informed to prepare iodine pills (i.e. 100 km and 200 km for young people and pregnant women). The exercise scenario included historical weather conditions which were chosen because of the highly unstable weather conditions (continuously changing wind directions) in order to test the HERCA-WENRA approach Part II: "HERCA-WENRA Approach in case of a Severe Accident requiring Rapid Decisions for Protective Actions, while very little is known about the Situation". The result of the protective actions in the region is presented in Figure 3.10.

Figure 3.9. **Protective actions in Slovenia and Croatia during INEX-5**

Protective actions – Slovenia



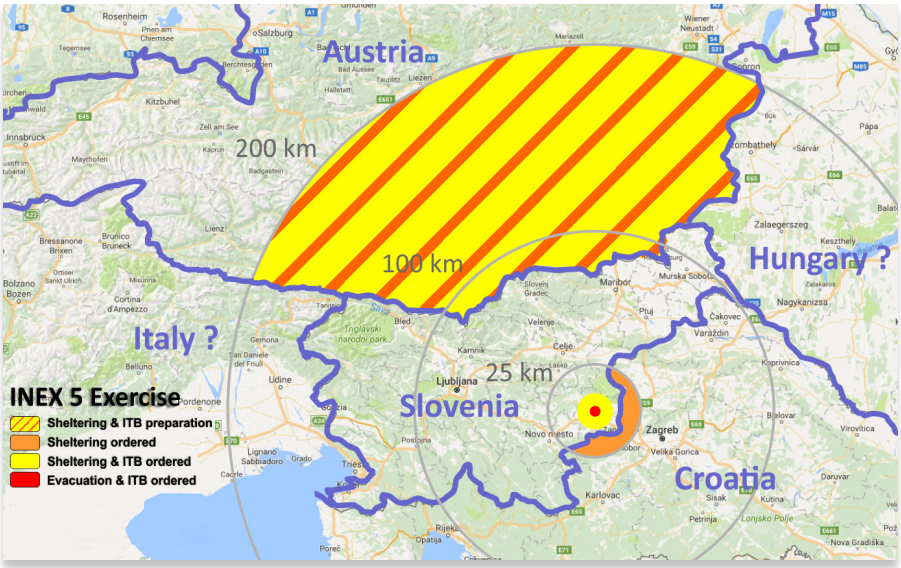
Protective actions – Slovenia and Croatia



Sheltering ordered
Sheltering and ITB ordered
Evacuation and ITB ordered

Source: Regional presentation by Slovenia during the Topical Session on INEX-5 in January 2017 (SNSA, Slovenia).

Figure 3.10. **Protective actions in the region of the five-country regional exercise**



Source: Regional presentation by Slovenia during the Topical Session on INEX-5 in January 2017 (SNSA, Slovenia).

In Austria, the response to severe NPP accidents with an impact on Austria is a two-phase response:

- First phase (warning phase): Preparation of urgent protective actions if necessary, including information to the probably affected population to prepare potassium iodine pills and/or to take them from the pharmacies if they are not available at home.

- Second phase (contamination phase): Implementation of urgent protective actions.

During the exercise urgent protective actions were not implemented in Austria, because based on information of the accident country implementation was not necessary. The real release in the scenario was much lower than the prognoses.

In Italy, the nuclear emergency national plan provides for a response to a nuclear accident in a foreign NPP close to the national border. Two different operational levels are defined:

- "Warning", which follows the notification of an accident in a foreign NPP within 200 km from the Italian borders; this condition requires the warning of national and regional authorities.
- "Alarm" in the case of a worsening situation, with the possibility that a radioactive release could affect the country; this level could entail the adoption of the protective actions.

During the exercise, the national plan was activated and the "warning" level was declared. It was considered that the conditions to declare an "alarm" level were not reached.

Preparation of protective actions is different in every country and not covered by the HWA up to now. Nevertheless, it should also be discussed across borders and, at the minimum, the neighbouring countries should be informed beforehand.

This figure illustrates dramatically the need for further work on improving cross-border co-ordination. This need was captured during the Topical Session on INEX-5 and a full-day session on this issue was held where participants played simple exercises together on this important issue. The five countries highlighted the need to use, implement and exercise the HERCA-WENRA approach. They also highlighted the need of playing more exercises at the regional level.

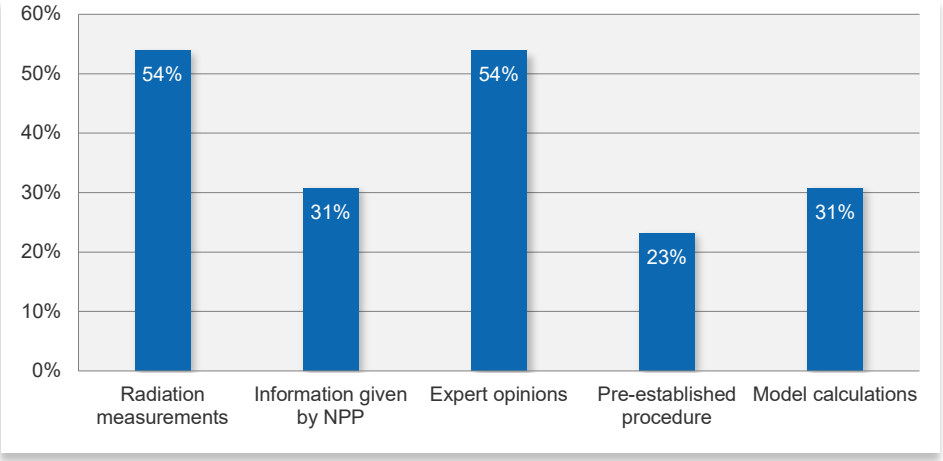
Optimisation of protection strategies (technical, economic and social factors)

The adaptation of pre-developed emergency plans to address the actual circumstances of the INEX-5 scenario as it progressed was influenced by the inputs to the particular scenario. Half of the players performed such adaptations and half did not. Players who performed such adaptations would begin with the adjustment of the national plans. These plans may be further adjusted to better respond to the development of the situation.

Different responses regarding optimisation of protection strategies were reported by France and the Netherlands. France would operate on a basis of eight generic situations, which "enable decision makers to quickly adapt the response on the basis of detailed planned actions and not to apply predefined patterns that will never fit the real crisis". The Netherlands stated that in addition to the execution of the regional nuclear emergency plan, they would perform an assessment of second best options (e.g. "sheltering instead of evacuation, inner ring first"). The other countries, which responded negatively to the question on optimisation, indicated that their view primarily was that there was no need to adapt, either owing to the given circumstances or to the INEX-5 scenario itself (in nine out of ten negative responses).

Given the uncertainties during the early phase of the exercise, the most common reason for altering the pre-planned actions reported by the 13 countries which exercised this aspect was either radiation measurements and/or expert opinions. Other common responses were modelling, calculations and evaluation, information given by the NPP and rarely (only in three cases) following a pre-established procedure. The questionnaires revealed that even if not explicitly expressed it also turns out that the prudence and conservatism were factors of great significance regardless of the particular action to be taken (see figure 3.11).

Figure 3.11. **Basis for alteration of pre-planned actions (given the uncertainties during the early phase of the exercise)**



In 6 out of 14 cases, the evacuation decision was subject to change as the exercise scenario progressed. Other measures which were reported as having to be altered were: sheltering (three responses) and iodine thyroid blocking (ITB) intake (two responses). The rest of the protective actions that were reported to be subject to change varied between countries and were scenario dependent. The basis for alteration of ongoing protective actions was the radiation monitoring results in the majority of cases reported (57%). Other common reasons indicated by the players were: general change in situation (36%), decision of the competent authorities (including expert bodies – three countries) and the actions taken by the accident country (in the case of two countries).

In 7 out of 13 cases, the organisation initiating the optimisation process during INEX-5 was clearly identified in the national procedures. If the optimisation process is continuous and performed by a variety of emergency response actors, then it was reported that its initiator cannot be indicated. In the majority of cases, the optimisation process is triggered by new information.

The responsibility for the management of the optimisation process lies, in most cases, with either one or a group of clearly identified organisations, which are involved in the emergency management process (78% of 18 responses in total). In four cases (i.e. 22% of responses), this responsibility lies with a number of bodies, mainly due to the fact that optimisation is considered as a continuous process (for example in Germany).

The prevailing factors considered for the development of the optimisation process among INEX-5 players were technical factors (71% of 17 responses), mainly related to radiation measurements. Moreover, the predefined guidance levels take priority over the ad hoc guidance (six and two responses, respectively). Other factors considered by the players were: economic (29%) and social (35%). Germany and Ireland also reported taking into account psychological factors, and the United States would take into account the psycho-sociological impact in the longer term. Poland and the Slovak Republic would assess the technical and financial resources for the effective application of the protective measures.

The factors determined as relevant to the optimisation of protection strategies were described as being a part of the general decision-making process (in the case of five countries, i.e. 45% of responses). Another common response indicated that the procedural nature of the optimisation process had been developed, i.e. there were arrangements in

place for handling this process in 4 out of 11 cases (36% of responses). Significantly, the Netherlands would assess these factors through technical experts.

The process of optimisation of protection strategies is, in principle a collective endeavour. Only two countries performed it on an individual basis. Finally, only one country indicated that they would perform both a national and a collaborative approach.

Evaluation of decisions for the implementation of protective actions

The evaluation of the decisions regarding the implementation of protective actions was reported by 64% of players. However, not all of them have actually implemented these actions during INEX-5.

Among those countries that have performed an evaluation of the decisions for the implementation of protective actions:

- Some 75% of the countries addressed the current and future movement of people in and out of the contaminated area (i.e. six out of eight respondents). The most common preventive measure used to address this issue is access control at the borders of the potentially affected area. Other protective actions included prohibited entry, decontamination of people, warning of population, controls at the airport and distribution of personal dosimeters for emergency workers entering the affected area.
- Some 88% of the countries addressed materials, goods and/or products used, consumed, stored, produced, processed, etc., in the potentially contaminated area, including their movement in/out of the area. Actions reported concern monitoring the movement of goods, sampling water and foodstuffs, decontamination of people and goods, environmental monitoring, radioactive waste management, resources used for the implementation of protection measures, monitoring of movement of foodstuffs, radiation monitoring at the airports and piers, advice to avoid the contaminated areas by flag carriers, prohibition of consumption of unprotected foodstuffs, water and feed, control of intake of contaminated food, water and feed water for the animals and recovery of contaminated area and food chain monitoring.

The actions, approaches or criteria for travel and tourism were implemented in the same manner or time period as for local residents, businesses, etc., in the majority of the INEX-5 players responses. Only in two cases was it considered that the information provided was not consistent and that improvements on this issue would be addressed in the next revision of the national plan.

With regard to protective actions being implemented, only 50% of players have reported such implementation. The complete list of protective actions that were reported as implemented during the INEX-5 exercises is presented below, in order of frequency:

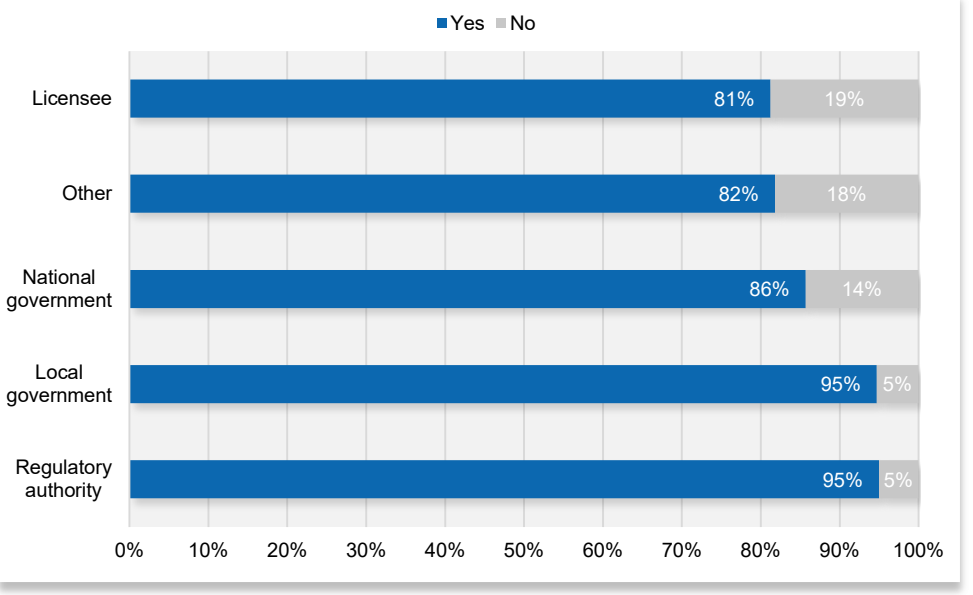
- evacuation;
- sheltering;
- monitoring of people;
- monitoring of food;
- monitoring of goods;
- ITB;
- personnel protective actions;
- on-site radiation monitoring;
- implementation of the action plan;
- preparation of shelters at NPP territory;
- agricultural protective actions;
- food bans;
- travel recommendations;
- following the advice of local authorities;
- information sharing;
- monitoring of movements of populations.

Public information and communication

National information and communications

The responsibility for providing information to the public is shared between different organisations, depending on their competences and their governance level (see figure 3.12). Regulatory authorities and local governments were reported by the respondents as responsible in 95% of cases, followed by the national government, the licensee and other bodies.

Figure 3.12. **Organisations with responsibilities for providing information to the public in case of nuclear emergency**



Other: civil protection and rescue organisations, different ministries, etc.

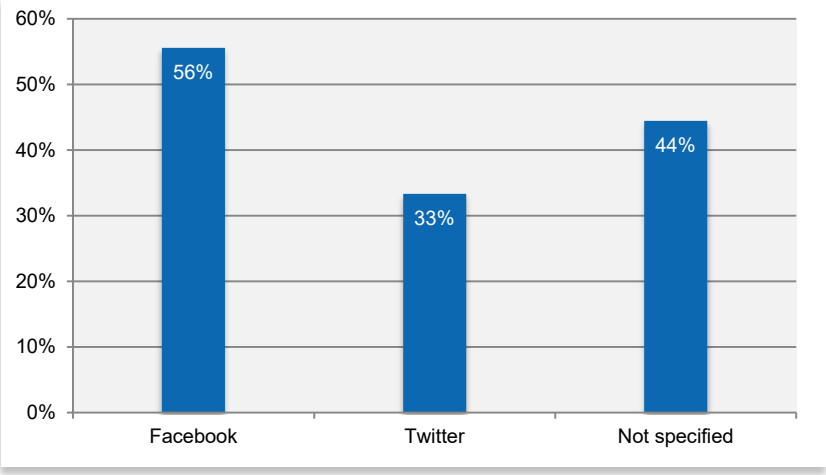
The information to be provided to the public was presented in various levels of detail, but in the majority of cases it contained a description of the event (information about the accident itself, physical event description, protective actions, where to look for any further information on how to proceed, risks explanation, dose predictions, etc.) and recommendations for the public.

Players reported a wide variety of means of communication with the public. Traditional media (i.e. radio and television broadcasts) were the most frequently used channels reported by 71% of players. Press releases were also widely reported (62%). Half of the players considered publication of the information through Internet sites as one of the primary communication channels. The websites mentioned were not only the institutional platforms, but also special event dedicated platforms. Other mentioned channels included the use (or potential use) of sirens, mobile phones or emergency hotlines.

The use of social media was only mentioned by 9 out of 22 players and it was scarcely tested. The most popular social media platform for public communication was Facebook (55% responses) followed by Twitter (33% responses) (see Figure 3.13). Only three countries would perform social media monitoring. The Netherlands have a social

media strategy implemented at national and regional levels regarding the use of text messaging and monitoring social media.

Figure 3.13. **Use of social media during INEX-5**



Reassuring the public would be achieved mainly by means of transparency and keeping the public regularly updated. The media used were the same as for the general public communication in the given country (with a noted dominance of press releases).

Political aspects are usually not taken into consideration when formulating messages (14 out of 16 respondents). In the majority of cases, the public communication plan is integrated into the national EPR plan (17 out of 19 responses). Only two countries – Austria and the Netherlands – have separate national plans for this purpose.

Communication with other stakeholders was reported by nine players. Stakeholders commonly mentioned included: the public, local institutions and national bodies involved in emergency response (as indicated by 38% of the respondents, who communicated with other stakeholders during INEX-5). Other stakeholders reported were: the IAEA, the industry (both reported by two countries), the EU and the accident country (both indicated by one country).

The means of communication depends on the recipient of the information – when informing other institutions, the dedicated official communication channels were most common, and for the public, press releases and phone calls are the most frequently used options.

Among 19 respondents, all indicated the existence of an organisation or group of organisations with responsibility for co-ordinating the information given to the media, which was usually the organisation responsible for the nuclear emergency management. The responsibility for the accuracy of the information was barely evaluated by INEX-5 players, however if mentioned it usually stays with the same co-ordinating organisation.

Communication and co-ordination with other countries and the international community

The process for notification and management of international residents and tourists fell into three categories:

- No special procedures in place – 31% of responses reported this, nonetheless, it was noted that most of them declare that some arrangements are under development.

- Same procedures as for the national citizens – 50% of responses reported this. The public information in most cases would be translated into other languages (mainly English) to ensure its correct receipt and interpretation.
- Information to embassies – 19% of responses reported this.

The study of the content, timing and means of providing information to embassies revealed some good practices. Even though it is not a rule to have special procedures in place on this issue, the INEX-5 examples showed that such actions would result in obtaining comprehensive and accurate information.

National and international support

Capability assessment

The technical products used in the decision-making process that were reported by INEX-5 players included dispersion model calculations, estimation of the source term and impact of the release. Among the tools more frequently mentioned were: RODOS (Real-time On-line Decision Support System for Off-Site Emergency Management) (five), SW ESTE (Emergency Source Term Evaluation), RASCAL (Radiological Assessment System for Consequence Analysis code) (two), HYSPLIT (Hybrid Single-Particle Lagrangian Integrated Trajectory model) (two), FRMAC (US Federal Radiological Monitoring and Assessment Center) (one) and ADAMO (Accident Dose Assessment and Monitoring) (one). Simulators were used in a real-time exercise. Eight out of fifteen respondents believe that these products could be improved to better suit the needs of the decision makers.

Availability of communications systems

Thirteen countries have reported their deployment of redundant (5/13) and diverse (11/13) communication systems within the NPP and between the NPP and notification points.

In the event that normal communication systems fail, all of the 13 respondents have contingency plans in place with diverse and redundant communication systems. Moreover, the use of satellite phones was mentioned explicitly by six countries. One country deploys a dedicated pager-based communication system known as P2000.

In the case of a natural disaster, the most common means of communication were phones[1] and satellite phones (regardless of the level of communication). The means of communication vary depending on the users, i.e. within an NPP, phones and satellite phones are dominant (60% and 80%, respectively); similar means were observed for communications between NPPs and local agencies (both 71%). However, for the communications between local and state/national bodies, the majority of responses pointed to phones again (44%) and radio communications (38%). At the international level, the dominant communication channels used during a natural disaster are phone (60%), fax (50%) (however, it is indicated as a backup system in the majority of cases) and the Internet (50%). At this level, the communication through dedicated platforms such as USIE was also mentioned. The Internet was not mentioned by any player as a potential channel for the lower-level communications.

When communication systems become unreliable, the requests for fire, police and rescue are made using the backup systems (see previous paragraph). The radio and satellite transmission are the most often used systems under such circumstances.

1. Respondents did not specify the type of phones, i.e. landline or mobile.

Moreover, two countries would also set up portable antennas to communicate with the cut-off regions.

Management of insufficient or incorrect information

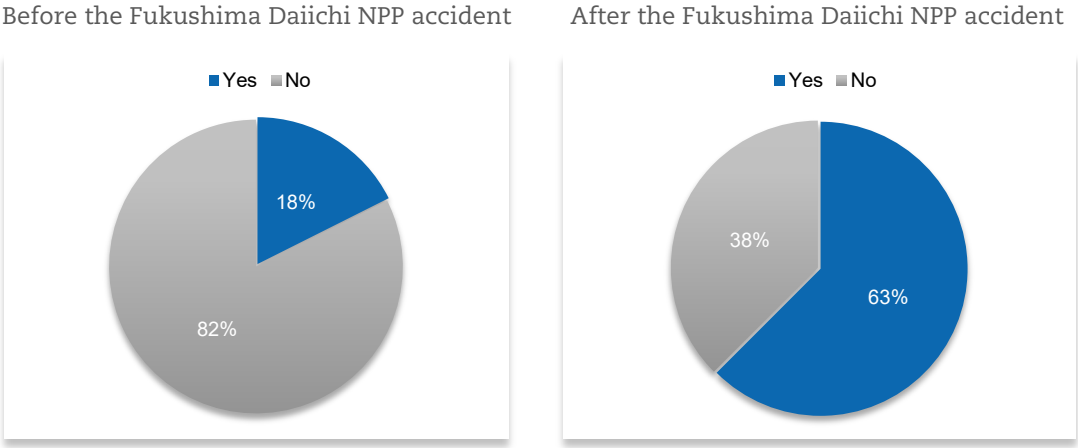
For nuclear countries, the identification of incorrect information at all levels (NPP, local and national agencies) was achieved through diverse means: information sharing – i.e. the structured information was received by many organisations, thereby facilitating peer review, helping to identify mistakes, rechecking the information provided, dispatching a liaison officer to the NPP, requesting a second assessment by the regulator. Actions that would be required to dispel rumours under such circumstances were mentioned by three countries.

Non-nuclear countries would monitor international information platforms (such as USIE) and request information from the IAEA. In one case, previous risk assessments on NPP accidents would be used as a benchmark.

Simultaneous management of nuclear/radiological and natural events

The effect of post-Fukushima safety enhancements was remarked upon regarding the planning for the simultaneous occurrence of a nuclear emergency and natural disaster. Before the Fukushima Daiichi NPP accident, this simultaneous occurrence was foreseen by three countries: France, Russia and the United States (18% of respondents). Currently 63% of INEX-5 players have established arrangements for such situations. Despite being one of the objectives of the exercise, this aspect was not tested to a great extent during INEX-5 (see Figure 3.14).

Figure 3.14. **Evolution in the planning for the simultaneous management of radiological and non-radiological events before and after the Fukushima Daichi NPP accident**



Management of casualties

Casualties would be handled by the local agencies (seven out of nine players) or the government (six out of nine players) and in five cases by the licensee. In around half of the cases, the contaminated employees and casualties would be handled by both the licensee and the local government. This was reported as a good example of co-operation between responsible organisations.

International assistance and support

Only five players reported that they considered the general offers of assistance received from other countries. Four countries decided to accept the assistance offered. All of these countries reported the existence of plans for accepting such assistance. The decision was made by national authorities (i.e. government with the assistance of the Nuclear Regulatory Authority, Atomic Energy Council, etc.). As the scenarios unfolded, 4 out of 12 respondents considered requesting additional international assistance, all of them European countries. Finally, only three of them proceeded to request it. The basis for their decisions was either the Convention on Assistance in case of a Nuclear Accident or Radiological Emergency or through bilateral agreements.

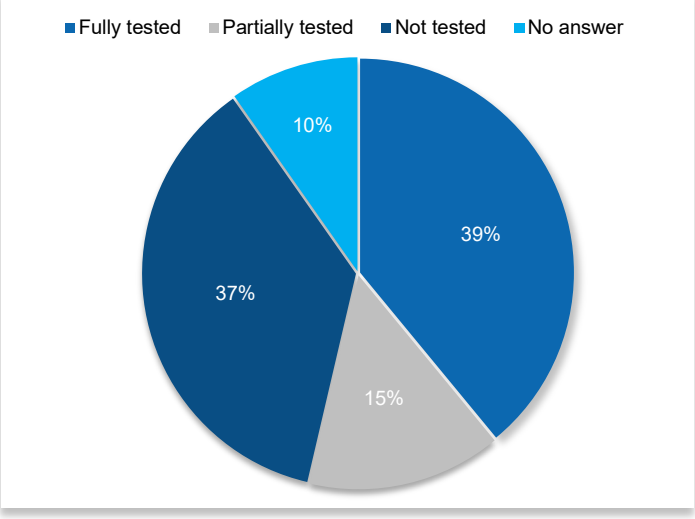
Six respondents shared information on the factors that triggered the request for international assistance. Insufficiency of their own capabilities/resources to handle the events was the major factor reported. Other factors concerned the possibility of receiving assistance, and the subsequent classification of the emergency. Japan reported experience of some issues regarding the dispatch of information abroad and also the acceptance of assistance from a foreign country.

Post-Fukushima actions/measures in emergency preparedness and response

Since the Fukushima Daiichi accident, many actions and measures have been taken at national and international levels regarding emergency response and recovery plans. INEX-5 was conceived as an opportunity for participating countries to share, test and demonstrate the value of the changes put in place as a result of the Fukushima Daiichi NPP accident. INEX-5 was also designed to test actions/measures and approaches developed at regional and the international level to enhance communication and information exchange, and cross-border co-ordination.

From 18 respondents, 41 different post-Fukushima actions have been reported. Over half of these reported actions (54%) have been fully or partially tested during INEX-5 (see figure 3.15).

Figure 3.15. **Degree of Post-Fukushima actions tested during INEX-5**



The list of the post-Fukushima actions tested (fully or partially) during INEX-5 may be found in Table 3.1.

Table 3.1. **Post-Fukushima actions tested (fully or partially) during INEX-5**

Country	Actions
Austria	Elaboration of the Crisis Communication Plan.
	"HERCA-WENRA Approach in case of a Severe Accident requiring Rapid Decisions for Protective Actions, while very little is known about the Situation".
Croatia	Croatia has started a complete reorganisation of its EPR system.
Czech Republic	New atomic legislative framework was adopted (rebuilding of the whole system).
France	Further safety assessment and strengthening of prevention and mitigation provisions.
	Elaboration of a dedicated national response plan.
Ireland	General review of the National Emergency Plan for Nuclear Accidents.
Japan	A new rule related to the dispatch of information abroad added to the Nuclear Emergency Response Manual.
	A new rule related to the acceptance of assistance from foreign countries found in the Basic Disaster Management Plan and the Nuclear Emergency Response Manual.
Korea	Frequency of environmental monitoring and number of sampling location increased.
Poland	Improvement of arrangements regarding public communication.
Portugal	Strengthened role of the National Commission for Radiological Emergencies.
Russia	Restoration of power supply to all units of the Leningrad NPP with cable installation and electricity supply from mobile diesel generator stations.
	Arrangement of cooling water supply to all units of the Leningrad NPP from mobile pump stations.
	Management of firefighting under conditions of increased radiation levels.
	Removal of blockage on the ways of movement of the mobile emergency response vehicles by forces of emergency response teams with use of special equipment.
Slovenia	On-site improvements: mobile emergency equipment, filtered venting system and passive hydrogen recombiners.
	Off-site improvements: Iodine pills pre-distribution, reassessing the basis for emergency preparedness and response, reorganisation of emergency management cycle of the Slovenian Nuclear Safety Authority emergency team, and ensuring the full access to the NPP processing parameters.
Spain	NPP licensees have analysed and reinforced their emergency response organisation, increasing the members of the shift staff and the on-call people. These improvements have been introduced in the on-site emergency plans.
	Safety areas have been implemented on each site to store mobile equipment (pumps, electrical generators, hoses, quickly connectors, etc.) in order to strengthen or supplement existing plant fixed safeguards systems in case of severe accidents.
	Some safeguard NPP systems have been equipped with electrical and hydraulic fast connections for the post-Fukushima emergency equipment to be able to quickly provide electric power and to supply water into the reactor cooling system and into the spent fuel pool.
	A new Support Emergency Centre (CAE) near Madrid has been implemented to service all NPP to store additional equipment diesel generators and additional pumps for boosting water at high and low pressure. This equipment could be shipped to the affected plant by road or by air. Each year a real exercise allows carrying the equipment from the CAE to the chosen plant.

All the players and respondents have referred to the effectiveness of testing of new actions/measures undertaken during INEX-5 have provided positive feedback. One of the objectives of INEX-5 has therefore been fulfilled.

INEX-5 and proposals

The INEX-5 Technical Materials were considered appropriate for planning the exercises according to 83% of respondents. Proposals for improvements concern: more appropriately addressing the variety of players' situations, i.e. countries playing NPP-related scenario, non-NPP countries and others. The majority of the critical comments concerned the questionnaire: too lengthy, too ambitious and somewhat unbalanced in terms of the exercise objectives, i.e. the questions did not always correspond to the needs of the adjusted scenarios (especially for non-nuclear countries) and did not take into account the organisational character of participating countries.

Specific proposals for future INEX exercises include:

- A dedicated non-nuclear country scenario.
- Regional exercise with the general objective of international co-operation/co-ordination with regard to the emergency response during intermediate phase.
- More flexibility: take into account the need for deviations from the original scenario or constraints.
- More realistic, instead of tabletop exercises.
- The use of the online survey tool has significantly improved the analysis of the questionnaires in practical terms. The use of these kinds of tools is strongly recommended for the analysis of future INEX exercises.

Overall, INEX-5 was evaluated by the players as a very valuable exercise. The INEX series of exercises has been pointed out as *"definitely an important tool to improve emergency response for many countries"*.

Reported needs for national and/or international guidance

Eighteen of the twenty-two players answered the question whether there were any topics or issues that arose during their exercise for which national or international guidance would have been useful. Half of them reported at least one of the following issues:

- economic and liability issues;
- international co-operation aimed at achieving coherent cross-border response, including long-distance, for which HWA is not applicable;
- dispatch of information abroad and the acceptance of assistance from foreign countries;
- legal authorities and funding for long-term clean-up activities;
- guidance for schools on arrangements to be put in place when emergencies require evacuation, sheltering or avoidance of unnecessary travel;
- national intervention levels for sheltering need to be reviewed and revised;
- exact situations when countries are supposed to define emergency zones significantly smaller than those recommended by the IAEA and HERCA/WENRA;
- practical guidance on implementation of the EU Basic Safety Standards (BSS) requirements of international co-operation (especially regarding the planning phase);
- harmonisation of bilateral co-operation (Austria).

International and cross-border co-ordination was pointed out as the most recurrent need. This need was identified for inclusion in the programme of the INEX-5 International Workshop.

Conclusions

The key questions and cross-cutting issues identified through the analysis of the INEX-5 working material provided the basis for the outline of the INEX-5 International Workshop sessions.

Chapter 4. INEX-5 International Workshop outcomes

The INEX-5 International Workshop was held in Paris, France on 24-25 October 2017 and was attended by around 40 technical experts, representatives from 22 member countries, the International Atomic Energy Agency (IAEA) and the European Commission (see the list of participants in Appendix 4). The workshop was directed at national authorities that had held an INEX-5 exercise; however, representatives from other countries were invited to attend the workshop to bring in other practical experience.

The objectives of the workshop were to allow participating countries to identify elements for improving their arrangements for notification, communication and interfaces related to catastrophic events involving radiation or radiological materials, and to exchange experience with other countries (that had conducted and evaluated an exercise) and other relevant international actors. In order to deliver its objectives, the workshop was an interactive experience structured around invited presentations, moderated discussions and breakout groups which followed up on the four broad topics identified by the programme committee: communication and information sharing with other countries and international partners; cross-border and international co-ordination of protective actions; mid- and long-term aspects of recovery; and connection to the work of other international organisations and networks. The workshop benefited from an independent facilitator.

A feature of the workshop was the inclusion in each session of presentations by international organisations on their current work. This approach was adopted in order to provide the participants with the best opportunity to avoid duplication of efforts and to look for synergies. Additionally, and in the same spirit of enhancing collaboration and co-ordination with other international fora, and thereby avoiding duplication of efforts, the programme also included a session on ongoing and future activities of other international organisations, platforms and networks related to the theme of the workshop.

In the final session of the workshop, the key findings, suggestions and recommendations were summarised in advance of the 42nd meeting of the NEA Working Party on Nuclear Emergency Matters (WPNEM). The outcomes of the workshop were designed to provide suggestions and recommendations for the programme of work to be delivered by the working party over the next three to five years. Each of the sessions were summarised in the proceedings of the workshop (NEA/CRPPH/R(2018)2/PROV) and are summarised below.

Key issues on communication and information sharing with other countries and international partners: A focus on real-time communication platforms

Session 1 of the workshop considered the communication and information sharing with other countries and international partners with a focus on real-time communication platforms. It sought to understand if there was a need or a desire for a new international real-time communication platform.

The majority of INEX-5 participants considered that the processes and procedures for the collection, provision and exchange of information with other countries were

sufficiently resourced. All respondents reported the use of the IAEA Unified System for Information Exchange in Incidents and Emergencies (USIE) for formal information sharing with other countries. Most of the European countries also used the European Community Urgent Radiological Information Exchange – ECURIE (72% of respondents). Nevertheless, most countries reported also having other arrangements in place, primarily due to the establishment of bilateral arrangements with other countries and secondly to the development of their own national communication platforms. The use and sharing of real-time information platforms between countries was reported as very successful by the two groups of regional players. Other countries have indicated that having access to national protected websites would have been useful for cross-border co-ordination purposes. It was also noted the validation or verification process when using real-time communication platforms might vary among countries and that its use should take this into account.

During the workshop, issues for discussion included the possible need for an international real-time communication platform and whether national real-time information platforms should be compatible with international official communication channels, i.e. USIE, ECURIE? And if so, what would be the requirements to make this possible? It was thought important not to create new platforms but to connect existing ones at both the national and international level. Based on the description of the features of the systems tested during INEX-5 (MKSID, ELAN) and the experience of existing similar systems in other countries (i.e. Nordic countries), what would be the "ideal" or "best" features of a unique real-time platform system?

It was agreed by the workshop participants that a new international communications platform/system is not desired. All member countries have invested in their own national systems that deliver their emergency preparedness and response (EPR) requirements and in practice, this is what is required by the decision makers under the national response arrangements. To that end, while a new universal system is not desired, if a common set of requirements/standard format can be derived to which national systems can connect or upload materials, this was considered to be of benefit to neighbouring states and regional partners. The IAEA expressed that such a system could use the IAEA International Radiological Information Exchange (IRIX) as the standard to exchange information among emergency response organisations at national and international levels during a nuclear or radiological emergency. It was noted that it would be useful to define the terms accident country, affected country, neighbouring country and/or other country. Some of these terms are defined in the IAEA EPR – IEComm 2012, "Operations Manual for Incident and Emergency Communication". Given that "An accident anywhere is an accident everywhere", it was noted that all countries would be seeking definitive and timely information, data, advice and guidance from the accident country. This was the motivation behind the development of the USIE platform.

There was a suggestion that the threshold for the sharing of information and data via the formal notification mechanisms could be too high for many states to utilise them for this purpose. It was noted by some participants that the USIE system has in some cases become unwieldy and cluttered e.g. during the ConvEx-3 exercise making it difficult to identify the key and important updates regarding the situation. The IAEA noted that a new version of USIE is to be released soon and that this will allow filtering and sorting of messages contained in the system.

As a result of exchanges, the following suggestions for the programme of work of the WPNEM were made:

Suggestion 1 – WPNEM to prepare a report describing the concept and use of real-time information platforms in member countries. The report would present the benefits that real-time information offers, including:

- builds and strengthens trust in the accident country;
- helps to inform the decision maker(s) in the affected country.

The report should also mention that this would not predetermine any decision(s) as well as discuss the need for not sharing with press or public the information provided. Other aspects to consider include the need to differentiate between: "Accident country", "affected countries", "neighbouring countries" and "other countries".

Suggestion 2 – WPNEM to report and assess how member countries interact with formal information exchange systems (i.e. USIE/ECURIE). What opportunities exist (if any) for additional information to be shared via these systems? Identify any barriers to the use of existing tools as far as is practicable within the context of national and international EPR strategies.

Suggestion 3 – WPNEM to benchmark dose projection code outputs based on the same (or very similar accident) inputs – understanding of why the results are or may be different – Defining what is considered to be good general agreement among the codes.

Key issues on cross-border and international co-ordination for protective measures

From the analysis of the INEX-5 evaluation questionnaires conducted by the Secretariat and jointly discussed during the Topical Session on INEX-5 in January 2017, it became clear that international co-ordination should be a major focus of the INEX-5 workshop, the experience of the two regional players being major inputs. In particular, approaches and mechanisms for discussing and co-ordinating protective action decisions, particularly among neighbouring countries, should be further investigated. In addition, also the different results from testing the implementation of the HERCA-WENRA approach (HWA) should be analysed, thus allowing identifying what aspects can facilitate and obstruct successful cross-border co-ordination. Different countermeasure approaches reported in the INEX-5 evaluation questionnaires should also be further investigated.

Session 2 sought to garner a great insight into the potential for co-ordination of protective actions between countries. It set out to explore the cross-border and international co-ordination of protective measures through the participation of the workshop participants in a short tabletop exercise. The workshop participants were arranged into four breakout groups of broadly the same size and by regional geography (between non-EU and EU countries):

- *Information from the accident country:* All the participants stated that the volume and detail of information received from the accident country was not adequate, it was not considered clear, consistent or timely. It was agreed that all countries would actively seek further information from the accident country. Bilateral agreements and informal contacts in the accident country would be used to seek additional updates.
- *Protective actions:* The INEX-5 regional exercises highlighted some interesting problems with protective action strategies across international borders (see Figure 3.10):
  - The potential for the application of inconsistent advice across neighbouring countries was evident. It was however unclear whether any co-ordination of protective actions has taken place in the past. It was acknowledged by the participants that the national strategies for protective actions are co-ordinated within each state and in all likelihood they are published or at least available for neighbouring states to make themselves familiar with the principles.
  - Many of the participants stated that while the technical experts may provide the advice regarding protective actions, it is the responsibility of the decision makers to order them to be applied. It was noted that the decision makers are somewhat apart from the technical experts and that the two groups do not routinely interact. It was suggested that this may be an area for WPNEM/NEA to look into further.

  - The benefits of considering these issues during the planning phase or "peacetime" was acknowledged however, the problem was considered to be twofold; both technical (in terms of the basis for "agreed" intervention levels) and political (in terms of enacting cross-border co-ordination). It was suggested that there would be benefits to be gained from protective actions being agreed in advance between neighbouring countries but that this will be likely to require political involvement. This was thought to be where the technical experts may require additional assistance.

- *Citizens in the accident country*: There was common consensus among the workshop participants that the guidance that they would give to their own citizens in the accident country would be to follow the local advice.
- *Assessment and prognosis*: The assessment and prognosis tools offered by the IAEA were considered helpful for decision makers as the statements generated through the use of these tools are clear and are presented in an easy-to-be-understood language. This aids the technical experts in their role with the comprehension of the output by the decision makers. It was noted that this set of tools might be particularly useful for non-nuclear countries. However, it was further noted that each country's technical support organisation would perform their own assessment and may compare the outputs with those from the IAEA.

Suggestion 4 – WPNEM to update the WPNEM member country Protective Measures Handbook considering implementation of GSR Part 7 and various post-Fukushima considerations. Consideration should be given to the use and usefulness of the IAEA EPR Information Management System (EPRIMS) as an implementation action for this suggestion. Proposal is for a deeper examination of the rationale for actions.

Suggestion 5 – WPNEM to consider mental health impacts on the population when implementing protective measures (i.e. evacuation has high psychosocial impact on individuals/families and can lead to health outcomes far more serious than the radiation exposure.

Suggestion 6 – WPNEM to work to include decision makers in the planning and implementation of protective action strategies. How might this be achieved? The OECD works at the ministerial-level, however the NEA generally does not. The NEA has links with the OECD Public Governance Directorate. WPNEM needs to explore with Public Governance the means of engaging with decision makers. Decision makers are seeking solutions from the experts and need end products that they can use. How can we best ensure collaboration between experts and decision makers?

Suggestion 7 – WPNEM to consider the practical means of implementing cross-border co-ordination of protective actions. WPNEM to review the feasibility of sharing information on planned cross-border actions during "peacetime"/planning and preparation. If a country can co-ordinate protective actions at the national level – what do we need to do – to do this at the international level?

Key issues on how to better prepare for the mid- and long-term aspects of recovery

Session 3 brought together experiences from both exercises and "the real world". The workshop participants appreciated greatly the candour with which the issues and actions regarding the recovery processes were discussed.

The discussions regarding planning for recovery and the potential benefits to be gained from attempting to exercise the longer-term aspects of the response were wide ranging and varied. There were a number of queries regarding the real costs involved including compensation for evacuees. It was acknowledged that the costs were substantial and that the Japanese government was addressing the costs through the issue

of government bonds. Decontamination of the environment was recognised as a significant factor in the "return to normal". It was acknowledged that people wish to return to their homes. Examples were provided where the decontamination practices had reduced the contamination and the ambient dose rates considerably. There were still issues regarding how low should decontamination be taken. It was agreed that it should not be taken to zero even if this were possible. Several perspectives were evident on the level to which decontamination should aim. It was noted that the majority of the workers involved in the decontamination/clean-up processes were contractors to the local and national governments.

The risk to hospital residents was also raised as an issue. It had been observed that a significant number of patients in hospital/care facilities had been subject to evacuation orders and had been required to be moved from their specialist care. This had even led to fatalities in some cases. The revisions to the arrangements now reflected that the potential harm to patients from being moved should be considered and if at all possible avoided if less than the risk of exposure to radioactive materials.

Market produce and other foodstuffs that had been potentially contaminated were discussed and the actions taken by the authorities to convince people that food is safe were reviewed. The scientific basis was the main argument used by the relevant authorities under a programme of monitoring and measurements in order to ensure compliance with the regulations. However, it was also noted that other factors can affect the public's opinion regarding the safety of their food.

Suggestion 8 – WPNEM to collaborate with other experts and groups regarding recovery issues. Emergency activities may have downstream implications for later recovery actions. Determine the useful data contained with existing guidance and handbooks. Resource requirements may also be affected by emergency actions. Waste management issues will be a key aspect during the recovery phase. An expert group can be established to highlight the best practice regarding recovery and prepare a short report detailing the current understanding, build on existing work and potential future developments?

Suggestion 9 – The NEA Committee on Radiological Protection and Public Health (CRPPH) has initiated a review of the psychosocial aspects of emergencies and protective action strategies. The WPNEM may be able to add further to these studies with regard to the potential effects of urgent protective actions, evacuation, sheltering and iodine thyroid blocking (ITB).

Working with other international organisations, platforms and networks

Session 4 sought to share and broaden the understanding of the work of other international organisations. The workshop participants were made aware of the developments and latest outputs from the IAEA, EU and HERCA. It was recognised that there are many "touch points" between the work of these organisations and the interests of the WPNEM.

The suggestions from the workshop participants reflected the desire for greater co-operation and co-ordination between national and international organisations. It was acknowledged that fora such as the WPNEM and specific workshops are valuable in terms of information sharing and exchange of ideas. It was noted that resources are under ever increasing pressure and are unlikely to be increasing any time soon. Therefore, it is important for national authorities and international organisations to make the best use of technical support and assistance where available and to contribute to the collective endeavours regarding future developments. The practical example of this effective and efficient approach is the recommendation by the workshop participants that they do not wish to "make" another new platform, but would rather collaborate on improving the "connectivity" between existing systems.

The terms of reference of the WPNEM specifically notes that the proposed programme of work for the group shall be mindful of the existing and future work by other international organisations and it was acknowledged that workshops such as the INEX-5 International Workshop contribute actively to the delivery of these requirements and promote the benefits of international collaborations.

Suggestion 10 – Potential overlaps with other working groups should be reviewed, the shared benefits of collaborations reported with a view to look for synergies avoiding any possible duplication of effort.

Chapter 5. INEX-5 follow-up

Following the INEX-5 International Workshop, the NEA Working Party on Nuclear Emergency Matters (WPNEM) reviewed the outcomes and identified key needs in notification, communications and international co-ordination, with a view towards developing a programme of work for the next three to five years. The NEA Secretariat had collated the ten suggestions into seven programme items to be discussed by the WPNEM.

Detailed discussion of these items, including possible ideas for further work, resulted in several additional issues being raised. The original ten suggestions from the workshop were restructured into six items (labelled a) to f) below) that were included in the proposed programme of work and follow-up activities.

a) Real-time communications: WPNEM report: Review of existing real-time platforms in NEA member countries to facilitate cross-border and regional information exchange and co-ordination of countermeasures. WPNEM to report on how member countries interact with formal information exchange systems (i.e. IAEA Unified System for Information Exchange in Incidents and Emergencies [USIE]/European Community Urgent Radiological Information Exchange [ECURIE]). What opportunities exist (if any) for additional information to be shared via these systems? Identify any barriers to the use of existing tools as far as is practicable within the context of national and international emergency preparedness and response (EPR) strategies.

b) Non-radiological public health aspects of radiation emergency planning and response, including psychosocial and other societal impacts of evacuation, sheltering and relocation: This will be carried out in collaboration with the World Health Organization (WHO). The objective is to develop practical solutions for mitigation of these aspects through developing a policy framework that adopts existing WHO guidance on mental health in emergencies to nuclear and radiological emergencies (WHO product), then proposing practical solutions/tools for support of the decision-making process, while planning for and responding to nuclear and radiological emergencies (WPNEM product).

c) Recommendations for building nationally adapted frameworks for recovery in NEA member countries: WPNEM report: Post-accident recovery actions should be planned in advance. A large range of countermeasures exist, but not all would be applicable in every country owing to national variations. In addition, emergency measures may have downstream implications for later recovery actions. Development of a recovery framework would also need a process of relevant stakeholder involvement with collaborative deliberation on the issues at stake. Consideration should be given to the IAEA Safety Standards on *Preparedness and Response for a Nuclear or Radiological Emergency*.

d) Dose projection code outputs benchmarking based on same (or very similar) inputs: WPNEM report: Develop and hold an exercise where member countries share dose projection code outputs based on same (or very similar accident) inputs – understanding of why the results are or may be different. Defining what is considered to be good general agreement among the codes.

e) Update WPNEM member country Protective Measures Handbooks: WPNEM report: Collate and update changes to WPNEM member country Protective Measures Handbook considering implementation of GSR Part 7 and other post-Fukushima considerations.

f) Involvement of decision makers in the planning and implementation of protective action strategy: The WPNEM mandated the WPNEM Secretariat to establish contacts with the OECD Public Governance Directorate with a view to include decision makers in the planning and implementation of protective action strategy.

The other suggestions made by the workshop were noted as being already contained in the terms of reference for the working party.

Chapter 6. Conclusions

Building on lessons learnt from the Fukushima Daiichi nuclear power plant (NPP) accident, the Fifth International Nuclear Emergency Exercise (INEX-5) on "Notification, Communication and Interfaces related to Catastrophic Events Involving Radiation or Radiological Materials" is an important step towards identifying key needs for improving international communication and co-ordination, as well as towards better preparing and exercising for the mid- and longer-term phases of an accident. INEX-5 has also provided an opportunity for participating countries to test and demonstrate the value of the changes put in place as a result of the Fukushima accident.

The exercises and evaluation workshop have clearly demonstrated a desire on the part of national authorities to share best practices, identify areas for improvement in international communication and co-ordination, and to prepare for longer-term response and recovery, as well as undertaking actions for their resolution as part of overall emergency preparedness programmes.

As a result of the exercises and workshop, a set of key needs were identified in areas such as communication and information sharing with other countries and international partners with a focus on real-time information sharing, improving cross-border and international co-ordination of protective measures and better preparing the mid- and long-term aspects of recovery. It has also underlined a clear recognition of the importance of considering the mental health impacts on populations when implementing protective measures and the need to more closely link technical experts with decision makers at all levels.

The NEA Working Party on Nuclear Emergency Matters will continue to work towards providing useful input into implementing and resolving issues associated with the identified needs so that they can be available to all interested national authorities and international organisations, and be further tested in future exercises.

Annex 1. **Selected bibliography**

INEX-5 technical materials

NEA (2018), *Proceedings of the Fifth International Nuclear Emergency Exercise (INEX-5) Workshop: 24-25 October 2017, Boulogne-Billancourt, France*, OECD, Paris.

NEA (2016a), "INEX-5 NEA Website", NEA/CRPPH/INEX(2016)1.

NEA (2016b), "Regional and International Aspects of the INEX-5 Exercise: Guide for National Planning Committees and Players", NEA/CRPPH/INEX(2016)2.

NEA (2015a), "INEX-5: Exercise Evaluation Questionnaire", NEA/CRPPH/INEX(2015)3.

NEA (2015b), "INEX-5: Guide for Exercise Players", NEA/CRPPH/INEX(2015)2.

NEA (2015c), "INEX-5: Guide for National Planning Committees", NEA/CRPPH/INEX(2015)1.

NEA (2015d), "Summary Record 40th WPNEM Meeting", NEA/CRPPH/INEX(2015)6).

NEA (2014), "INEX-5: General Information", NEA/CRPPH/INEX(2014)3.

INEX series documents

NEA (2013), "Summary of the Fourth International Nuclear Emergency Exercise (INEX-4) and Topical Session", NEA/CRPPH/INEX(2013)3.

NEA (2011), *Practices and Experience in Stakeholder Involvement for Post-nuclear Emergency Management*, OECD, Paris.

NEA (2010), *Strategic Aspects of Nuclear and Radiological Emergency Management: Planning for Effective Decision Making; Consequence Management and Transition to Recovery*, OECD, Paris.

NEA (2007a), *Experience from the Third International Nuclear Energy Exercise (INEX-3) on Consequence Management*, OECD, Paris.

NEA (2007b), *Strategy for Developing and Conducting Nuclear Emergency Exercises*, OECD, Paris.

NEA (2005), "INEX-2000 Exercise Evaluation Report", NEA/CRPPH/INEX(2005)10.

NEA (2003a), *Indemnification of Damage in the Event of a Nuclear Accident*, OECD, Paris.

NEA (2003b), *Short-term Countermeasures in Case of a Nuclear or Radiological Emergency*, OECD, Paris.

NEA (2001a), *Experience from International Nuclear Emergency Exercises: The INEX-2 Series*, OECD, Paris.

NEA (2001b), *Second International Nuclear Emergency Exercise INEX-2: Final Report of the Canadian Regional Exercise*, OECD, Paris.

NEA (2001c), *Second International Nuclear Emergency Exercise INEX-2: Final Report of the Hungarian Regional Exercise*, OECD, Paris.

NEA (2000a), *Monitoring and Data Management Strategies for Nuclear Emergencies*, OECD, Paris.

NEA (2000b), *Second International Nuclear Emergency Exercise INEX-2: Final Report of the Finnish Regional Exercise*, OECD, Paris.

NEA (1998a), *Nuclear Emergency Data Management*, OECD, Paris.

NEA (1998b), *Second International Nuclear Emergency Exercise INEX-2: Final Report of the Swiss Regional Exercise*, OECD, Paris.

NEA (1997), *Agricultural Aspects of Nuclear and/or Radiological Emergency Situations*, OECD, Paris.

NEA (1995a), *INEX-1: An International Nuclear Emergency Exercise*, OECD, Paris.

NEA (1995b), *The Implementation of Short-term Countermeasures after a Nuclear Accident (Stable Iodine, Sheltering and Evacuation)*, OECD, Paris.

Annex 2. INEX-5 Preparation Group Membership

INEX-5 Exercise Development

France	Olivier Isnard
Germany	Florian Gering
Hungary	Geza Macsuga
Norway	Finn Ugletveit
Slovak Republic	Peter Carny; Tatiana Duranova
Switzerland	Dominique Rauber
United States	Ann Heinrich; Vince McClelland (Chairman); Jill Zubarev
NEA	Edward Lazo; Burcin Okyar

INEX-5 International Workshop Programme Committee

France	Adeline Clos; Jean-François Dodeman; Florence Gallay
Germany	Johannes Kuhlen; Florian Gering; Wolfram Rother; Matthias Zähringer
Ireland	Veronica Smith
Slovak Republic	Tatiana Duranova
Slovenia	Igor Sirc
United States	Sara de Cair; Patricia Milligan
NEA	Chiara Guido; Olvido Guzmán; Emilia Kopeć; Edward Lazo

Annex 3. List of participants: The Topical Session on INEX-5

Austria	Peter Hofer
Belgium	Michel Sonck
Canada	Bernie Beaudin; Dominique Nsengiyumva
Croatia	Davor Rašeta
Czech Republic	Iveta Doskocilova
France	Jean-François Dodman; Olivier Isnard
Germany	Johannes Kuhlen; Wolfram Rother; Matthias Zaehringer
Ireland	Kilian Smith; Veronica Smith
Italy	Paulo Zeppa
Japan	Kota Eto; Naoto Ichii; Kazuya Yamamoto
Netherlands	Wim Molhoek
Poland	Karol Lyskawinski; Michal Zuba
Portugal	João Oliveira Martins
Russia	Liudmila Bogdanova; Sergey Krasnoperov
Slovak Republic	Tatiana Duranova; Eduard Metke; Adriana Sokolikova
Slovenia	Marjan Tkavc
Spain	Jose Manuel Calvarro; Juan Pedro Garcia Cadierno
Switzerland	Thomas Brogle; Dominique Rauber
United States	Sara Decair; Ann Heinrich; Patricia Milligan
IAEA	Florian Baciu
WHO	Zhanat Carr
NEA	Olvido Guzmán; Edward Lazo; Jihtong Lin; Seiji Masuda; Aleksandr Rakhuba; Michael Siemann

Annex 4. List of participants: The INEX-5 International Workshop

Austria	Peter Hofer
Belgium	Tanja Perko; Christian Vandecasteele
Canada	Dominique Nsengiyumva
Czech Republic	Helena Chuda
Finland	Antero Kuusi
France	Adeline Clos; Jean-François Dodeman; Thierry Schneider
Germany	Johannes Kuhlen; Wolfram Rother; Tobias Schlummer; Matthias Zaehringer
Hungary	Csaba Balogh
Ireland	Veronica Smith; Robert Ryan
Italy	Paulo Zeppa
Japan	Hiroaki Shindo; Kazuya Yamamoto
Netherlands	Kirsten Drost; Wim Molhoek
Norway	Astrid Liland
Poland	Karol Lyskawinski; Michal Zuba
Portugal	João Oliveira Martins
Russia	Liudmila Bogdanova; Sergey Krasnoperov
Slovak Republic	Tatiana Duranova (WebEx); Eduard Metke; Adriana Sokolikova
Slovenia	Igor Sirc
Spain	Jose Manuel Calvarro; Juan Pedro Garcia Cadierno

Switzerland	Annina Frischknecht; Dominique Rauber
United Kingdom	Val Alderson; Mike Griffiths
United States	Sara Decair (WebEx); Patricia Milligan
IAEA	Kilian Smith
EC	Kevin Jackson
NEA	Chiara Guido; Olvido Guzmán; Laurène Henry; Emilia Kopeć; Edward Lazo; Toshiaki Tamai

NEA PUBLICATIONS AND INFORMATION

The full catalogue of publications is available online at www.oecd-nea.org/pub.

In addition to basic information on the Agency and its work programme, the NEA website offers free downloads of hundreds of technical and policy-oriented reports. The professional journal of the Agency, NEA News – featuring articles on the latest nuclear energy issues – is available online at www.oecd-nea.org/nea-news.

An NEA monthly electronic bulletin is also distributed free of charge to subscribers, providing updates of new results, events and publications. Sign up at www.oecd-nea.org/bulletin.

Visit us on Facebook at www.facebook.com/OECDNuclearEnergyAgency or follow us on Twitter @OECD_NEA.

OECD/NEA PUBLISHING, 2 rue André-Pascal, 75775 PARIS CEDEX 16

Experience from the Fifth International Nuclear Emergency Exercise (INEX-5)

The NEA has a long tradition of expertise in the area of nuclear emergency policy, planning, preparedness and management. Through its activities in this field, it offers member countries unbiased assistance on nuclear preparedness matters, with a view to facilitating improvements in nuclear emergency preparedness strategies and response at the international level. A central approach to this has been the preparation and conduct of the International Nuclear Emergency Exercise (INEX) series.

The Fifth International Nuclear Emergency Exercise (INEX-5) was developed specifically in response to member countries' desire to test and demonstrate the value of changes put in place following the Fukushima Daiichi nuclear power plant accident. Exercise objectives focused on notification, communication and interfaces related to catastrophic events involving ionising radiation and/or radioactive material. The exercise was held during 2015 and 2016, with 22 countries participating in the exercise.

This report summarises the major evaluation outcomes of the national and regional exercises, policy level outcomes, recommendations and follow-up activities emerging from INEX-5 and the discussions at the INEX-5 International Workshop. A set of key needs were identified in areas such as real-time communication and information sharing among countries and international partners, improving cross-border and international co-ordination of protective measures and considering the mental health impacts on populations when implementing protective measures.

Nuclear Energy Agency (NEA)
46, quai Alphonse Le Gallo
92100 Boulogne-Billancourt, France
Tel.: +33 (0)1 45 24 10 15
nea@oecd-nea.org www.oecd-nea.org

NEA No. 7379