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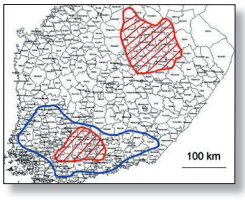
Experience from the Third International Nuclear Emergency Exercise (INEX 3) on Consequence Management



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NEA No. 6163

NUCLEAR ENERGY AGENCY
ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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NUCLEAR ENERGY AGENCY

The OECD Nuclear Energy Agency (NEA) was established on 1st February 1958 under the name of the OEEC European Nuclear Energy Agency. It received its present designation on 20th April 1972, when Japan became its first non-European full member. NEA membership today consists of 28 OECD member countries: Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Luxembourg, Mexico, the Netherlands, Norway, Portugal, Republic of Korea, the Slovak Republic, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The Commission of the European Communities also takes 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 friendly and economical use of nuclear energy for peaceful purposes, as well as
- 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 policy analyses in areas such as energy and sustainable development.

Specific areas of competence of the NEA include safety and regulation of nuclear activities, radioactive waste management, 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.

In these and related tasks, the NEA works in close collaboration with the International Atomic Energy Agency in Vienna, with which it has a Co-operation Agreement, as well as with other international organisations in the nuclear field.

Cover credit: Government of Canada, INEX exercise.

FOREWORD

Since the beginning of the 1990s, the OECD Nuclear Energy Agency (NEA) has offered its member countries a forum for improving efficiency and effectiveness in nuclear emergency management, focusing in particular on the international aspects of emergency preparedness and response. A central approach to this has been the preparation and conduct of the International Nuclear Emergency Exercise (INEX) series.

The INEX 3 consequence management exercises were developed by the NEA Working Party on Nuclear Emergency Matters in response to its members' desire to better prepare for the longer-term response following a nuclear or radiological emergency. The INEX 3 exercise series was developed in 2002-2004, and conducted throughout 2005 and early 2006 by 15 participating countries. The INEX 3 evaluation workshop held in Paris (France) in May 2006 was convened with the objective of allowing participants to share their national experiences with INEX 3, compare approaches, analyse the implications on decision making and identify key needs in longer-term consequence management.

In addition to providing a valuable discussion forum for participants, the workshop concluded by establishing a set of identified needs in longer-term consequence management to which the participants felt that the NEA and international community could usefully contribute. These included the four main areas addressed by the exercise – agriculture and food countermeasures, decisions on countermeasures such as travel, trade or tourism, recovery management and public information – as well as stakeholder involvement and liability/compensation issues.

This report summarises the development of the INEX 3 exercise, the major evaluation outcomes of the national exercises, and the key policy-level outcomes, recommendations and follow-up activities arising from the exercise and workshop.

TABLE OF CONTENTS

1. EXECUTIVE SUMMARY

The INEX 3 consequence management exercise series, part of the OECD Nuclear Energy Agency's ongoing series of International Nuclear Emergency Exercises (INEX), was developed under the auspices of the NEA/CRPPH[1] Working Party on Nuclear Emergency Matters in response to members desire to better prepare for the longer term response following a nuclear or radiological emergency. The INEX 3 exercise series was designed and conducted to allow participants to investigate the national and international arrangements for responding to widespread radiological contamination of the environment and the consequence management issues likely to be raised in the medium to long term period after such an event. Areas of particular interest included agriculture and food countermeasures, decision making on countermeasures such as travel, trade or tourism, recovery management and public information and communication.

The INEX 3 exercise series was developed in 2002-2004, and conducted throughout 2005 and early 2006 by 15 participating countries. Exercise evaluation questionnaires completed by each country provided detailed information on the national approaches taken with respect to each of the exercise objectives, as well as issues relating to the international interfaces between countries. Key information and issues identified through the analysis of these questionnaires were provided as input into the follow-up International Evaluation Workshop on the INEX 3 Consequence Management Exercises.

The INEX 3 evaluation workshop, held in Paris (France) in May 2006, and attended by about 100 participants from 25 countries and two international organisations, was convened with the objective of allowing participants to share their national INEX 3 experiences, compare approaches, analyse the implications on decision making, and identify key needs in longer-term consequence management. In addition to providing a valuable discussion forum for participants, the workshop concluded with a set of identified key needs in longer-term consequence management for which the participants felt that the NEA and international community could usefully contribute in the areas of the four key exercise objectives, and in two cross-cutting areas, namely stakeholder involvement and liability/compensation.

Following the workshop, the identified needs were reviewed by the NEA Working Party on Nuclear Emergency Matters for consideration as part of its INEX 3 follow-up activities. As a result, the group launched a set of initiatives to facilitate improvements in the areas of i) agriculture, food and recovery countermeasures, ii) liability issues in consequence management, iii) communications and stakeholder aspects in consequence and recovery management, and iv) guidance on soft countermeasures. The outcomes from these initiatives will be made available to all interested national authorities and international organisations as a contribution towards improving longer-term consequence management nationally and internationally.

1. CRPPH: Committee on Radiation Protection and Public Health.

2. INTRODUCTION

Responding to member countries post-Chernobyl concerns, the OECD/NEA created in 1990 the Expert Group on Emergency Exercises (now the Working Party on Nuclear Emergency Matters – WPNEM) to initiate and co-ordinate the conduct of International Nuclear Emergency Exercises (INEX) to improve the quality and co-ordination of emergency response systems and facilitate consensus on nuclear emergency management approaches between countries. The INEX series of international emergency preparedness exercises has proved successful in the testing and developing the arrangements for responding to nuclear emergencies.

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 the INEX 1 exercises was hosted by 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. Four specific INEX 2 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 (IACRNA). Many important issues were identified from the INEX 1, 2 and 2000 exercise programmes and subsequently valuable lessons have been learned regarding the early phase response to nuclear emergencies (see Appendix 1: Bibliography).

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

Despite the significant advances made in early phase emergency management as a result of these INEX series, longer-term consequence management has remained a difficult challenge for emergency managers. However, within the last few years, there has been a growing desire in the nuclear emergency management community to better master response in the later phases following a nuclear or radiological emergency. This can be loosely defined as the period after the crisis phase has passed and radioactive contamination has been released into the environment. The characterisation of contamination deposited in the environment may not be fully complete at the beginning of this phase. Agricultural aspects will be increasingly important, the involvement of stakeholders in decision-making processes will be significant, and recovery activities will begin. A multitude of practical questions will arise during this period, and policy, structural and procedural aspects of consequence and recovery management must be in place for governments and other stakeholders to appropriately respond.

In order to address the desire of NEA member countries to better prepare for the later phase response to a nuclear or radiological emergency, the NEA began development in 2002 of the INEX 3 consequence management exercises. This third series of INEX exercises focused on consequence management issues that would likely arise as a result of a nuclear or radiological emergency that has 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.

The INEX 3 exercise series, conducted in 2005-2006, involved two distinct and complementary stages. First, 15 participating countries chose to conduct a national-level INEX 3 exercise based on broadly comparable contamination footprint scenarios and focusing on medium and longer-term consequence management aspects after radioactive contamination of the environment has occurred. Evaluations completed by each participating country provided information on the approaches taken with respect to each of the exercise objectives, providing a basis for comparison of national practices in longer-term consequence management. Following the completion of all exercises, an international evaluation workshop was held to allow participants and other interested countries to exchange their national experiences, analyse commonalities and differences in approaches, discuss the implications of such approaches on decision makers, and identify aspects of national decision making which would benefit from international co-operation and co-ordination. Following the workshop, the 25th meeting of the NEA/WPNEM was convened to review the outcomes, consider the recommendations on needs put forward to it by the workshop participants, and develop a strategy for ways forward to resolve the key longer term consequence management issues raised by the INEX 3 exercise series and workshop.

INEX 3 was a “no fault” exercise, with the evaluation focusing on plans, procedures, organisational structures, and supporting systems, rather than on individual performance. The opportunity for countries to evaluate and compare their approaches to longer-term consequence management was the justification for the INEX 3 exercise series, and its evaluation in terms of lessons and issues identified, and actions proposed was the key to its success.

This report discusses the history of the INEX 3 development, and provides the major outcomes and recommendations from the INEX 3 exercises and evaluation workshop.

Table 1. **Evolution of objectives over the International Nuclear Emergency Exercises (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 learned from INEX 2 exercises.

INEX 3 (2005-2006) objectives

- To investigate decision-making processes in the medium to longer-term following a nuclear or radiological emergency, focussing on the areas of:
  - Agricultural countermeasures and food restrictions.
  - Soft countermeasures, such as travel, trade, and tourism.
  - Recovery management.
  - Public information.

3. INEX 3 PLANNING AND PREPARATION

Recognising the extensive lessons learned in early phase emergency preparedness and management resulting from the INEX 2 and 2000 series of international command-post exercises, the WPNEM expressed in 2002 its specific interest in investigating the decision-making mechanisms in the medium and longer term after a nuclear or radiological emergency that has resulted in serious off-site contamination (i.e. severe enough to warrant a national level response). This could include various aspects associated with the management of the contamination, such as agricultural countermeasures, food restrictions, socio-economic aspects, psychological impacts, compensation issues, decisions on "soft"[2] countermeasures such as trade and travel, and harmonisation of response. Furthermore, there was a desire to develop an exercise that did not rely on a country having and operating a nuclear power programme. It was thus agreed that the next generation of international nuclear emergency exercises – INEX 3 – should focus on decision-making mechanisms and processes in the medium and late phases after a nuclear or radiological emergency with serious contamination.

Due to the generally less-defined arrangements for longer term consequence management, and a potentially extended time frame of the associated decision-making processes, it was decided to develop INEX 3 as a table-top consequence management exercise, which, like the successful INEX 1, would provide flexibility in terms of design, conduct and reuse. The table-top format would then provide a mechanism for participants to investigate issues related to their consequence management arrangements without pressures associated with real-time command-post exercises. The exercise would be based on non-trivial contamination footprint scenario that would be such that relevant authorities would need to consider appropriate countermeasures. The exercise would then focus on the medium and longer term decision-making mechanisms in the affected countries, and on the similarities and differences in the decisions taken.

Additionally, it was agreed that the exercise should be such that the scenario could be applied, with suitable modification, in all countries and regions, and could be held in several regions or countries over a time period of several months, at the choice of each participating country. Unlike the previous INEX 2 and 2000 command-post exercise series, in which each of the five international exercises were built upon a single national-level exercise in the accident host country with simultaneous play of other participating countries, the INEX 3 exercise would be presented to each participating country as a stand-alone table-top exercise package that could be customised and implemented independently of other participants, according to national need. The evaluation of all of individual INEX 3 exercises, in which each country would play and respond as the event host country using a standardised but scaleable scenario and a common evaluation would then allow a comparison of approaches and outcomes in longer-term consequence management decision making, and a

2. In this context, "soft" countermeasures are generally those measures other than for immediate personal or agricultural protection that typically deal with less urgent actions and advice, but for which the underlying technical, social, economic and political issues may be complex. They could require actions in multiple states, often independent of each other. They are so named in contrast to "hard" countermeasures such as evacuation, sheltering, and access restrictions. The WPNEM has recognised that more accurate terminology is needed for these types of countermeasures.

common basis for the identification of issues for further investigation. As with the other INEX exercises, a post-exercise evaluation workshop would be held to analyse the lessons learned, share experience and identify areas for improvement. The participation of higher level decision makers and political bodies would be explicitly encouraged.

In order to assist in the development and organisation of the INEX 3 exercise series based on this general guidance, the WPNEM created in 2003 the INEX 3 Preparation group (Appendix 1). The INEX 3 Preparation group was specifically mandated to:

- Define in detail the key objectives for INEX 3.
- Develop in detail the INEX 3 exercise scenarios.
- Prepare detailed guides for exercise players and for exercise controllers.
- Prepare an evaluation procedure for the key objectives defined.
- Prepare the publication of the post-exercise analysis.
- Discuss the preparation of follow-up activities.

The details of the INEX 3 exercise as developed by the INEX 3 Preparation group are discussed below. Readers interested in more information are referred to the detailed INEX technical materials (Appendix 1: Bibliography).

3.1 INEX 3 objectives and scope

The primary motivation behind INEX-3 was to ensure the adequacy of plans and arrangements for later phase consequence management in response to a nuclear or radiological emergency causing serious radioactive contamination (warranting a national level response) of the populated environment, and to identify improvements to enhance national and international preparedness. This would be supported through an exercise evaluation to identify and characterise consequence management issues that would likely arise after such an emergency in order to develop effective mechanisms for their resolution, and to better prepare emergency management authorities to deal with these issues should they arise.

In this regard, the key INEX 3 exercise objectives as established by the WPNEM were to investigate the longer term decision-making processes and consequence management aspects with regards to the application of:

- Agricultural countermeasures and food restrictions, in terms of:
  - Decision making – based on scarce data and once the impact has been determined.
  - International and national implications of the decisions taken.
  - Human impact.
- Decision making on soft countermeasures, such as travel, trade, environmental impact and tourism.
- Recovery management issues.
- Public information in the medium and longer term.

Based on these four broad objectives, a set of detailed objectives was prepared by the INEX 3 Preparation group to facilitate a comprehensive and consistent evaluation by each participating country of the exercise outcomes with regard to the consequence management aspects of the INEX 3 exercise. The following detailed objectives formed the basis for the exercise evaluation questionnaire, and facilitated the international comparison of national outcomes:

- Compare the information provided to other States, IAEA and other international organisations.
- Compare (where appropriate) the implementation and lifting of “hard” countermeasures, (e.g. evacuation, sheltering, access restrictions).

- Compare the implementation and lifting of any “soft” or later phase countermeasures, analyse common approaches and investigate inconsistencies.
- Compare the implementation and lifting of restrictions on food production including live stock.
- Compare the implementation and lifting of restrictions on food consumption.
- Compare the implementation and lifting of import/export restriction.
- Compare the content and consistency of public information (within country, regionally and internationally.
- Compare any other decisions with possible international implication.
- Compare (where appropriate) the rationale for the decision to request international assistance. Compare the types of assistance requested.
- Compare the monitoring and measurement/modelling strategies.
- Compare the decision-making strategies and bases for decisions.
- Compare the prognosis for levels of radioactive material in food stuffs.
- Compare the doses calculated.

While all national-level INEX 3 exercises addressed similar themes under the standard objectives, each participating country was also free to develop the additional national objectives for their exercise within the broad framework of the INEX 3 series. Such national objectives would be included and tested within the framework of the identified key international level objectives.

As with the previous INEX series, a key component of the INEX 3 series was the follow-up evaluation workshop designed to provide a forum to collectively compare and analyse from an international perspective the individual national responses. The INEX 3 evaluation workshop provided an opportunity for participants to collectively analyse decisions, the decision-making processes and their rationale, identification of differences and their possible implications, together with the identification of any needs for further international harmonisation/standardisation and of best and common practices applied. The exercise evaluation questionnaires completed by each country, based on the above detailed objectives, provided key input into the evaluation workshop (Section 4).

The scope and requirements of the INEX 3 exercises were expected to differ between participating countries, which were responsible for determining the extent of their exercise in accordance with their own national objectives and arrangements. It was suggested, however, that each INEX 3 exercise should be conducted as a national level exercise with such supporting play as desired by the national planning committee in order to achieve this.

It was a recognised limitation of the INEX 3 exercises that in the case of “non-accidental” scenarios, the inclusion of security aspects were considered beyond the scope of the generic INEX 3 consequence management exercise. The scenarios proposed however, did not preclude or prohibit the involvement of security services or the consideration of security aspects in an individual country’s exercise. However they were not considered as part of the formal assessment of the INEX 3 exercise programme.

Finally, it is noted that INEX 3 was not intended nor designed as a test of any of the relevant international emergency conventions. However, it was recognised that the decision-making process used by countries during the exercises could include the need to inform neighbouring countries or the international community about the emergency and the decisions taken to implement countermeasures, especially if they involved import/export, food restrictions, travel, trade and tourism. It was the responsibility of each participating country to determine how this aspect, if relevant, was included in their exercise.

3.2 Scenarios

The INEX 3 exercise series was intended to investigate the national decision-making processes for managing the medium and longer-term consequences of a nuclear or radiological emergency. It was thus expected that the scenario would be severe enough to require a national level response in each participating country. However, it was recognised that the required scale of impact that could be considered to warrant a national level response could differ significantly between countries. Additionally, it was intended to provide a mechanism for countries without nuclear power programmes to be able to test their consequence management arrangements.

To accommodate these specific variations within a single design approach, the INEX 3 Preparation group based the exercise planning on the development of standardised and scaleable technical planning materials that could be customised by each participating country to facilitate their own staging of a national-level incident. It was the intention that each country should be able to adapt and extend the INEX 3 technical materials as needed in order to develop a detailed national exercise scenario of an appropriate scale to test the national aspects of that country's consequence management arrangements, consistent with the overall exercise objectives.

As the INEX 3 exercises were intended to provide a mechanism for countries without nuclear power programmes to be able to test their consequence management arrangements, the feasibility of defining a single generic exercise scenario for all INEX 3 participants was considered in depth. Many scenarios were considered with regard to their ability to deliver appropriate impacts in relation to the key objectives, bearing in mind the need for credibility, the participation of national decision makers, and the opportunity for any participating country to exercise thoroughly all aspects of its consequence management response. However, it was deemed unlikely that a single generic and credible scenario that did not involve a nuclear power plant could deliver sufficient variation in the scale and impact of potential consequences for all countries whilst remaining credible.

In order to achieve the required flexibility in the scale and impact of the potential consequences, the INEX 3 Preparation group developed two scenarios with different initiating events. Individual countries would have the possibility to decide which scenario they wished to play based upon national characteristics and needs. Based upon a single scenario or combination of scenarios, each country would be able to prepare an appropriate national test of their consequence management arrangements and objectives. Either approach would provide sufficient generic aspects for participants to complete a standard exercise evaluation questionnaire and compare their national responses at the follow-up evaluation workshop.

In both scenarios, a scaleable contamination footprint was developed as the initiating event to allow the key international objectives of the exercise to be tested while at the same time leaving enough flexibility to the participating countries to address national needs and any specific national objectives. These two scenarios included:

- Deliberate distribution of radioactive substances with a crop duster/sprayer by unknown persons (with or without terrorist intent according to national choice). This scenario involved the radioactive contamination of crops in field sometime prior to harvest (days to weeks, dependent on type of crop and radionuclide). The material would be clandestinely dispersed on one or more fields, and the contamination arising from the application would be such that the maximum permitted levels for foodstuffs described in national or international guidance would be exceeded.
- Fire in an industrial facility and/or accidental smelting of a large radioactive source in a metal recycling facility. This scenario involves the release of radionuclides from a fixed point and its

subsequent dispersion and deposition in the environment. The location of the release point could be varied within any national territory. The simplicity of this scenario and the assumptions upon which it was based provided significant flexibility, allowing participants to adapt it to different national requirements, contexts and situations, for example in applying it to a release from a fire in an industrial nuclear facility, laboratory or a smelter.

It was considered that in both scenarios, the extent of the contamination footprint arising from this delivery mechanism could be appropriately varied and scaled by each country to meet national exercise requirements.

Recognising that the consideration of consequence management in "real-time" for either of these scenarios would involve resource commitments over a period of many weeks, the INEX 3 exercise was intended to be conducted in two distinct phases. Phase 1 of the INEX 3 exercise simulated the end of the crisis response (not exercised) and the start of the consequence management and recovery phase. In short, the emergency services and any urgent countermeasures (if defined in the national exercise) would already be implemented at the start of the exercise. The medium-term issues where other countermeasures may be required would be considered. It was anticipated that this phase of the scenario would raise issues that needed to be addressed by many organisations regarding the protection of people and the environment. It was suggested that this phase would be representative of the situation 1-2 days after the initiating event and/or the detection of the contamination. In general terms, the assessment of the impact and the identification of potential consequences would still be ongoing and an incomplete picture of the situation being faced would exist.

Phase 2 of the exercise simulated a later period in the response, after monitoring resources would have characterised the scale and nature of the incident. Phase 2 was intended to test the application of longer-term countermeasures and the development of recovery strategies. Where appropriate, the recovery phase and the issues regarding the return to normality would be considered together with other longer-term aspects including the consideration of countermeasures applied during the emergency response. It was suggested that this phase of the exercise would be representative of a time period of 1-3 weeks after the incident.

In order to assist each country in implementing these scenarios and phases as part of their national exercise planning, a set of detailed INEX 3 technical materials was prepared, including outline narratives of the initiating events, distribution patterns and resulting footprints. The requirement for time compression between phases was managed through the preparation of appropriate briefing material and driving inputs.

In both scenarios, the design allowed the general exercise objectives to be met by assuming that the contamination takes place at harvest time and that the crops are already in the market or being processed. Detection of the contamination event would occur during harvest and after the crops are in the market place causing concern over contaminated foodstuffs in the national and international market. Both scenarios provided sufficient generic aspects for participants to compare their national responses, and in order to provide a baseline for comparison, the following aspects were recommended for consideration by countries.

Table 2. **Recommended aspects for INEX 3 exercises**

Contaminated area	
Type:	Agricultural environment
Size:	Several tens of kilometres^2 – especially in case of cross-border contamination
Products:	• Leafy and/or green vegetables, fruit etc. • Olives, grapes (or other high value products), if applicable. • Milk and milk products (if iodine or strontium released).
Release	
Source-term:	Released activity should be large enough to ensure a "typical" contamination of the products considered of the order of 1 000 Bq/kg.
Radionuclides:	^{137}Cs, ^{90}Sr, ^{131}I.
Season:	Harvesting season.
Weather conditions:	The weather conditions are of little relevance for the crop sprayer scenario. Rain or scattered showers during the release phase of the fire scenario will offer smaller zones with higher activity ("hot spots").
Phases	
Phase 1:	The first phase of the exercise will begin as soon as national radiation protection experts are alerted, i.e. as soon as there are indications, preliminary measurements, and/or information that there is a serious contamination. There will be an incomplete understanding of the extent/level of contamination.
Phase 2:	The second phase of the exercise will start when a full characterisation of the contaminated area is available.

It was recognised that many countries have focused much interest on non-accidental or malicious events. However, as the INEX 3 exercises were not intended to be classified as "counter-terrorism" exercises, the exercise scenarios and associated technical materials attempted to provide a means of testing the consequence management arrangements for such incidents without necessitating the involvement of security services and other such organisations. These aspects were considered beyond the scope of INEX 3, although countries could, if so desired, include these aspects in their national exercise.

3.3 National exercise planning and conduct

As a tabletop exercise, the INEX 3 exercises allowed participants to examine in detail the process of consequence management following a nuclear or radiological emergency, with the emphasis on problem solving and discussions rather than rapid, spontaneous decision making. Participants were encouraged to discuss decisions and interfaces in-depth with the other participating response organisations.

The work to develop each national exercise was the responsibility of each participating country. All participating countries were provided with exercise planning materials, including generic instructions, exercise scenarios and technical material, sample exercise event timelines with examples of injects, key objectives and evaluation tools to assist in the development of the national level INEX 3 exercise. Each INEX 3 exercise was expected to address similar themes under the key objectives but was not expected to develop identical details. However, it was the intention that each participating country should be able to adapt and extend the materials provided in order to develop an exercise

scenario of an appropriate scale to test the national aspects of their country's consequence management response. Consequently, the development of the precise national scenario for each INEX 3 exercise within the broad framework of the INEX 3 series was left to the discretion of the participating countries, including the inclusion of any international aspects, if specifically required (e.g. simulated requests for assistance). Based on the exercise outcomes, each country completed an INEX 3 Exercise Evaluation Questionnaire for input into the post-exercise evaluation workshop. The workshop was then expected to focus on areas of common understanding and variation in strategies and practices.

As part of their planning, each country was responsible for extending the remit of their INEX 3 exercise to a level deemed appropriate for their country, and including as necessary country-specific aspects such as the deployment of monitoring resources, management of media and technical assessment teams subject to the fulfilment of the overall objectives. It was intended that, in addition to the technical emergency managers, senior national decision makers be invited to participate in the exercises in order to deliver the appropriate level of response and thereby increase the benefits obtained from the INEX 3 exercise, both nationally and internationally.

3.4 Exercise evaluation

As with the previous international exercise series, a post-exercise evaluation workshop designed to provide an international comparison of national responses was included as the most effective means of assessing the INEX 3 exercise outcomes, based on the findings reported in the individual national exercise evaluation questionnaires. The workshop included analyses of decision, decision-making processes and their rationale, identification of differences and their possible implications, together with the identification of any needs for further international harmonisation/standardisation and of best and common practices applied.

Evaluation of the exercise activities followed the key objectives identified and described in the INEX 3 Exercise Evaluation Questionnaire, and any national and/or regional objectives. The questionnaire was designed to capture the actions, decisions, and corresponding issues relating to the INEX 3 detailed objectives, and included the following major themes:

- Information on participating country, including organisations involved in the preparation and conduct of INEX 3.
- Information on the scenario chosen, including details of the scenario, national modifications and objectives, information provided to participants, and involvement of neighbouring countries.
- Information on national practices in managing consequences of contamination, including details on decisions concerning various countermeasures (rationale, criteria, international co-ordination, long-term considerations, implementation and withdrawal) in the areas of:
  - Agricultural production, food consumption, trade, soft countermeasures (travel, tourism).
  - Provision of information to the public (when, what, how to those in the affected area and public at large).
  - Recovery management procedures (details of decision, consideration of decontamination and waste, pre-established criteria, organisational responsibility, stakeholder involvement).
  - Information to neighbouring countries and the international community; national decisions which could have international implications; and requests for international assistance.
  - Decision-making authority (including level of responsibility and changes during different phases of the response); and press releases.

- Experience with regional/cross-border play of INEX 3, if played, including aspects co-ordinated, types of information exchanged, degree of harmonisation and identified inconsistencies.
- Decision aiding strategies and tools, including details on pre-established decision strategies and use of decision-aiding tools.

Results from each country's exercise evaluation in relation to the above themes, described in more detail in Section 4, served as the core input into the INEX 3 evaluation workshop.

4. SUMMARY OF INEX 3 EXERCISE CONDUCT AND EVALUATION QUESTIONNAIRES

The series of individual INEX 3 national exercises was conducted between 2005 and early 2006 by 15 countries in Europe, North America and Asia, comprising a mix of OECD and non-OECD member countries, both with and without nuclear power programmes. These national exercises were conducted either independently or jointly with a neighbouring country (Austria/Germany, Czech Republic/Slovak Republic), based on the exercise scenarios prepared by the INEX 3 preparation group. This section summarises the outcomes of these national exercises based on the feedback provided by the participating countries in their individual exercise evaluation questionnaires.

With regards to the scenarios implemented in each national exercise, five countries used a scenario involving direct application of radioactive material onto agricultural fields, and eight countries used a scenario involving a fire with radioactive material being released. One national scenario involved dissemination of radioactive material by a mechanism other than a fire or direct application on a crop. In most cases, the generic exercise scenarios were modified by the participants to meet country or region-specific needs.

Table 3. **Participating countries and scenarios**

Scenario and Country	Radioactive material
Adapted Crop Spraying Scenario	
Canada*	^{90}Sr
Finland	^{137}Cs
Italy	^{137}Cs
Sweden	^{137}Cs
Hungary	^{131}I; ^{137}Cs
Adapted Fire Scenario	
Austria and Germany	^{137}Cs
Ireland	^{131}I; ^{132}I; ^{134}Cs; ^{137}Cs; ^{89}Sr; ^{90}Sr-; ^{85m}Kr; ^{88}Kr; ^{140}La; ^{106}Ru; ^{132}Te; ^{133}Xe; ^{135}Xe
Chinese Taipei	^{137}Cs; ^{85}Kr; ^{133}Xe; ^{131}I
Czech Republic and Slovak Republic	^{137}Cs; ^{131}I; ^{90}Sr
France	^{137}Cs; ^{131}I
Poland	^{131}I; ^{137}Cs; ^{9}Sr
Other	
Latvia	^{137}Cs
United Kingdom	0.01% Chernobyl Source Term: ^{133}Xe-; ^{131}I; ^{132}I; ^{133}I; ^{134}I; ^{135}I; ^{134}Cs; $^{-137}$Cs; ^{132}Te; ^{89}Sr; ^{90}Sr; ^{140}; ^{95}Zr; ^{99}Mo; ^{103}Ru; ^{106}Ru; ^{141}Ce; ^{144}Ce; ^{239}Np; ^{238}Pu; ^{239}Pu; ^{240}Pu; ^{241}Pu; ^{242}Cm

* The United States participated as an observer in the Canadian exercise.

The number of individual participants as well as the number and type of participating organisations and agencies in each exercise varied between countries. The number of participants ranged from less than 10 to about 140, and the number of participating government ministries and organisations or agencies ranged from 1 to 30. Organisations and officials that participated in the national exercises typically included ministries of agriculture, public health, radiation protection, environmental protection, emergency and disaster management, and transportation, as well as local and regional officials. In addition, some countries, based on specific national decisions, involved a much broader range of participating organisations and representatives than in previous INEX exercises, including representatives from the food industry, farmers unions, trade officials and/or consumer and retail interest groups. It was observed that this broadening of the scope of stakeholder involvement in emergency management helped to identify issues affecting emergency and post-emergency management that could have otherwise remained unidentified.

Each participating country completed the standard exercise evaluation questionnaire to facilitate post-exercise assessment of their consequence management approaches to the exercise scenario. Evaluation of each exercise followed the key objectives identified and described in the INEX 3 evaluation questionnaire, as well as any additional national objectives. These individual national questionnaires were analysed and summarised with regards to the four key exercise objectives, with the aim of extracting unique issues and key information and identifying cross-cutting issues that were relevant regardless of the scenario chosen. To achieve this, a comprehensive table containing all questionnaire data classified by objective was prepared and used for comparison and analysis, from which key information was extracted and issues identified. Evaluation by each country of the INEX 3 exercises in the form of issues identified, actions proposed and lessons learned was the key to the success of INEX 3, and provided the opportunity to compare national approaches, and identify international aspects that could be usefully addressed. Main observations and issues from the analysis, as presented to the participants of the evaluation workshop, are summarised and presented below.

4.1 Agricultural countermeasures and food restrictions

Regardless of the scenarios chosen in the individual national exercises, all participating countries implemented agricultural countermeasures and food restrictions during the exercises, and supplied considerable detail on the adopted approaches as part of the evaluation. All countries imposed bans on production and consumption of agricultural products based on either calculated or estimated public doses, or as a general precautionary action until further evaluations could be conducted. As expected, the scope of the agricultural countermeasures and issues addressed during the exercise was extensive due to differing geographic areas and country-specific scenario modifications including placement and scaling of the contamination.

All participating countries implemented similar types of restrictions regarding the consumption and processing of agricultural crops. However, in general these were applied differently in each country, with the types of restrictions dependant on the specific national scenario. Types of countermeasures implemented included:

- Restrictions on the harvest, sale, and consumption of fruit and open-ground crops, as well as natural and self-cultivated products.
- Sheltering of livestock.
- Prohibition on the processing and consumption of milk and dairy products.
- Restrictions and advice on the consumption of surface, rain or tank-stored water.
- Restrictions on the production, management and consumption of meat and animal products, including on the use of contaminated forage and the slaughter of animals that had been fed contaminated feed.

Countermeasures involving milk production, consumption and distribution included restrictions on use, as well as diversion of milk contaminated below guidance levels to alternate food processing. Some countries implemented restrictions on the use of fish products. Some also recommended or implemented additional countermeasures on the harvest and consumption of natural and self-cultivated products. Various approaches were taken to countermeasures regarding water use.

A range of outcomes were observed regarding the long-term implementation and lifting of restrictions on agricultural production and consumption. Decision on these included considerations of economics and compensation, market situations, growing season, legislative requirements, monitoring results, management and disposal of contaminated products, environmental recovery measures, and future economic activities. Some countries noted the need for long-term strategies to address potential human health concerns and issues of public acceptance as part of these decisions. It was also noted by some countries that the lifting of restrictions on production and consumption could be hindered by a possible lack of sufficient resources and personnel to undertake sampling activities, and that a strategic approach to sampling would need to be considered to satisfy both scientific and public demands.

Several important issues were identified, including uncertainty on public acceptance of food once levels of contamination had fallen below specified intervention levels, or that had not exceeded these levels but nonetheless contained measurable levels elevated above background values. For example, in some exercises, participating representatives from the food industry, trade unions, and commerce made a decision to accept only uncontaminated goods in their own production and sale of foodstuffs. The basis for this decision was the potential long-term economic losses to the domestic and export markets that would result from an expected public boycott and loss of reputation due to food products containing any level of contamination resulting from the emergency situation.

While the majority of countries did not discuss in detail the economic considerations associated with restrictions, some countries noted that such considerations would be one factor amongst several in the decision-making process. One country noted that the short-term economic considerations associated with temporary restrictions would be of much lower importance than public health considerations and the potentially more damaging longer-term implications of loss of confidence in the food supply. In this regard, there was a suggestion that follow-up financial studies regarding the total effects of different countermeasure options over extended periods would help clarify the decision-making process.

Based on the analyses of the exercise outcomes regarding this objective, the following key issues were identified for further discussion within the evaluation workshop:

- How is the lifting of agricultural and food countermeasures affected or influenced by levels of public confidence and acceptance, or other social and technical considerations (for example, with respect to slightly contaminated materials or demands for uncontaminated food)?
- What economic considerations could be taken into consideration when deciding on agricultural countermeasures, and how might they affect decision making? If losses are compensable, what is the basis for determining eligibility and amounts?
- If the extent of contamination is unknown, how are the types and scales of countermeasures or precautionary actions determined, what is the basis for such decisions, and what is the process for modifying these as more information becomes available?
- How are restrictions on use of water and on natural or self-cultivated products determined?
- When and how is it determined if international assistance may be necessary?

In summary, it appears that most countries who participated in INEX 3 are prepared to address agricultural countermeasures and food restrictions; however, issues that would benefit from further

investigation and improvement include decision making on precautionary actions, the impact of economic considerations on decision making, the role of stakeholders, and the link between public acceptance and the implementation and lifting of countermeasures.

4.2 "Soft" countermeasures

Soft countermeasures are generally those consequence management measures other than for immediate personal or agricultural protection that typically deal with less urgent actions and advice, but for which the underlying technical, social, economic and political issues may be complex. They could require actions in multiple states, often independent of each other. These could include decisions such as those concerning trade, travel or tourism in connection with the affected areas, or decisions on national interests (citizens, activities or commerce) for emergencies occurring in another country. Another important feature is that stakeholder involvement aspects will play an increasingly important role.

Participants were asked to provide information relating to the type and extent of countermeasures implemented, and whether there was a difference in application between those visiting an affected area and those living in the affected area. In contrast to agricultural countermeasures, while many participating countries considered soft countermeasures, only a few countries implemented such countermeasures during the exercise. Such countermeasures typically involved advice for travellers and tourists to limit travel within designated affected areas. Some countries considered implementing soft countermeasures but decided it was not necessary either because it was considered to be out of exercise scope, or the affected area was small and projected dose rates to the public were low. The majority of countries simply stated that they considered soft countermeasures but chose not to implement them.

Given the types of exercise outcomes and the lower level of detail provided in the evaluations with regards to this exercise objective, it appears that in general countries may lack a clear decision-making process for identifying the types and scope of consequence management countermeasures that could be considered, determining their necessity or how such countermeasures might be implemented. It is noted that regardless of the scenario chosen for the exercise, the extent of the contamination would not be immediately available, and in cases where the event was a result of a clandestine intentional act, the time between the initial discovery and the determination of the extent of contamination could be days or possibly weeks. This would affect the choice of countermeasures and the manner of implementation.

Based on the analyses of the exercise outcomes for this objective, the following key questions were identified:

- What criteria or strategies would aid the decision-making process for the full range of consequence management countermeasures?
- How are decisions on the implementation and lifting of these countermeasures affected by public confidence and acceptance, and what are the long-term social and technical considerations in these decisions?
- What type of restrictions or advisories can be put in place, how is their extent determined, and how are they communicated and implemented?
- In the case of an event that was previously undetected, what are the mechanisms for dealing with individuals who were in the affected region prior to discovery of the event?
- How is consistency with advice to local populations ensured? Can/should advisories be implemented for a longer time than the restrictions to people living in the affected area?

In summary, soft countermeasures, although considered in most exercises, were not implemented by most participating countries. This may be primarily due to a general lack of decision-making frameworks for such countermeasures. Areas of further investigation include criteria for the implementation and lifting of countermeasures, and guidance and strategies to aid decision making on appropriate countermeasures and advice.

4.3 Recovery management

In general, recovery management actions are focused on restoring affected habitats, environment, infrastructure and populations to some level of normalcy or routine operation and use following an emergency. It can be assumed that the transition from the initial response and medium phase to the longer-term recovery phase would occur some time after the area of impact and the type and level of contamination have been determined and initial protective action recommendations have been issued. The type and scope of recovery actions will likely be affected by the decisions on countermeasures that have already been implemented as part of the overall consequence management. These will also involve a broad range of stakeholders to ensure effectiveness and sustainability.

During the INEX 3 exercises, most participating countries addressed recovery management in some form, although in general it appeared to be a challenging issue for most participants. The majority of countries noted one or more concerns with regard to recovery management, including a lack of organisations, facilities or procedures to deal with the expected quantities of radioactive waste. For example, although most countries indicated that there are identified organisations in charge of waste handling, in many cases the facilities and arrangements needed to manage process and store the waste are limited, and likely would be insufficient to handle the expected quantities. In general, it can be assumed that in many countries, recovery plans are not be as well developed as emergency and consequence management arrangements.

Participating countries had a wide range of responses with regards to the expected quantities of contaminated material to be managed, possibly due to differences in national scenarios as well as approaches to countermeasure implementation. While in some cases it was noted that only a minimal portion of the total amount of contaminated agricultural crops and products would have concentrations that exceed intervention levels, one country noted that previous actual experience with stakeholders concerning the treatment of contaminated agricultural products revealed a tendency to reject any contaminated products even when below maximum permitted levels. This position was also identified in some INEX 3 exercises as part of the decision process dealing with agricultural and food countermeasures (Section 4.1). Only a few countries indicated that they have pre-established procedures for stakeholder involvement in decisions regarding contaminated areas and materials. Depending on what is deemed acceptable by stakeholders, the amount of waste material may be extensive, and considerable effort may be required to solve the problem of appropriate handling and disposal.

Based on the analyses of the exercise outcomes, the following key questions were identified:

- How are appropriate and mutually acceptable limits for withdrawal of countermeasures and for recovery/cleanup established – “how clean is clean”?
- What stakeholders could be involved when dealing with the recovery measures, and how could they be organised to make their involvement meaningful and effective?
- What suite of activities needs to be considered, and guidance or principles developed as part of preparedness activities, to ensure comprehensive recovery management?
- What types of countermeasures need to be considered for items that may have radioactive residue and remain in the affected environment?

- What procedures need to be in place to examine the waste disposal options, including determination of quantities of radioactive waste associated with large diverse areas, and what are the criteria for choosing one option over another?
- What is the role of monitoring for human and ecosystem health within recovery management?
- Is there a role for international assistance when there are insufficient waste processing facilities?

As with soft countermeasures, the objective of recovery management appeared to be less well defined and implemented in the national exercises. Nonetheless, many issues were identified, including lack of clear decision-making processes for establishing appropriate and mutually acceptable limits for recovery and cleanup, processes for effectively involving stakeholders in the recovery process, and guidance or principles to ensure comprehensive recovery management.

4.4 Public information

Public information and interaction is of major relevance to all aspects of consequence and recovery management and is critical in determining public acceptance and confidence of decisions during the response to an emergency event. The strategies adopted during longer-term public communication and stakeholder involvement will be influenced by the greater information demands and expectations of both the media and public during this phase of the response.

Within the scope of INEX 3, the transition to longer-term communications aspects was exercised in various degrees by the participants. All countries either prepared press releases to issue to the public or discussed what types of information would be disseminated. Similarly, all countries provided simulated the provision of information via radio, television, and/or national communication systems. Several countries also provided detailed information on websites and published telephone numbers that people could call to receive information. Most countries also used broadcasts with experts and medical personnel to answer questions and reassure the public.

Some countries indicated that there would be no difference between information given to residents in the affected area and to the general public. Others provided detailed information to the residents in the affected areas and a general announcement regarding the incident to the general public.

The level of detail that was provided to the public varied between countries, and covered topics such as the source of radioactivity, countermeasures and monitoring activities, health risks, contact information and provision of background or explanatory information. All press releases prepared as part of the exercise contained some level of detail on the countermeasures to be taken, and several countries broadcast revised press releases as detailed information became available. None of the press releases addressed the lifting of countermeasures. The response of the public and media to the supplied information, and any follow-up actions required to manage such feedback and transition into longer-term communications approaches was not addressed by any country.

Based on the analyses of exercise outcomes, the following key questions were identified:

- What communications strategies can be developed as part of consequence management, and how could these evolve to handle the stakeholder needs during the longer-term response?
- What types of information and products could be communicated to inform and assure the public (including countermeasures, types of exposure, health risks, etc)?
- How is the effectiveness of information determined, and what feedback would be expected from the public/media in cases where communication is not effective? What mechanisms could be used to recover from situations where information is considered insufficient or conflicting by the media/public?

- If authorities state that there are no health hazards associated with an event, yet precautionary countermeasures are implemented, what is the impact of these apparent inconsistencies on public confidence, and how are they managed?
- How well developed are communication arrangements for areas where detailed plans are not already in place (e.g., outside of facility emergency planning zone)?
- Could the types of public information disseminated be co-ordinated among countries, and agencies within countries to ensure the information disseminated is consistent?

In summary, while official arrangements for public information are generally well prepared, consistency, completeness and effectiveness of information, and the transition to a longer-term strategy for communications and public interaction are issues that would benefit from further investigation. The interaction of the authorities with the media, and their mutual role and impact on public confidence and acceptance requires further analysis. Strategies for recovery from situations where information has not been effective remain an issue.

4.5 Cross-cutting issues: stakeholder aspects, public acceptance and economic considerations in decision making

In addition to issues regarding the four key exercise objectives, and the linkages between the decision-making processes for these, the exercise analysis also revealed two important cross-cutting issues, namely the role and impact of stakeholder aspects and public acceptance, and the role of economic considerations in decision making.

The role and impact of public confidence and acceptance on consequence management decision making and implementation and effectiveness of countermeasures was identified as cross-cutting issue through which all of the INEX 3 exercise objectives should be viewed. It was clearly noted in all of the identified issues that the role of stakeholders and public acceptance are key issues in the implementation and effectiveness of countermeasures, particularly in the medium to longer-term decision making that will take place as part of the overall consequence management. The role of stakeholder involvement prior to, and after an event, in building public acceptance and implementing sustainable protective actions is an important issue for the INEX 3 post-exercise analysis and follow-up strategic recommendations.

With regards to the role of economic considerations within the key INEX 3 objectives, a number of issues were identified in relation to nuclear third party liability and in particular, the manner in which availability of financial resources can affect decision making in relation to countermeasures following a nuclear or radiological emergency. Several important issues were identified, including the basis for determining eligibility and amounts of compensation for compensable losses, economic considerations and implications on compensation associated with the uncertainty of public acceptance of food once it has fallen below intervention levels, food below official intervention levels but elevated above background levels, and the relationship between public acceptance, waste management and economic costs. These issues will become particularly relevant upon the entry into force of the revised Paris Convention (and more extensive ratification of the revised Vienna Convention) both of which provide for compensation for preventive measures and environmental damage under certain circumstances.

The key questions and issues identified through the analysis of the individual INEX 3 exercise evaluation questionnaires, given in Sections 4.1-4.5 above, were provided as input into the workshop, and provided the basis for the workshop discussions.

5. INEX 3 EVALUATION WORKSHOP AND OUTCOMES

The International Evaluation Workshop on the INEX 3 Consequence Management Exercises, held in Paris (France) from 30 May – 1 June 2006, was attended by about 100 participants from 25 countries and two international organisations (see list of participants, Appendix 3). The workshop was directed at national authorities that had held an INEX 3 exercise; however, representatives from other countries were encouraged to attend the workshop to bring in other practical experience in planning and preparing for consequence management in the longer term. Additionally, due to the international interest in this exercise, the workshop invitation was distributed through the contact points of the Inter-Agency Committee for the Response to Nuclear Accidents (IACRNA).

As part of the INEX 3 exercise conduct and evaluation, the workshop was designed to facilitate a collective investigation and analysis of the exercise outcomes with regards to the four key exercise objectives. The overall objective of the workshop was to identify good practice, key issues and the main needs to improve consequence management arrangements nationally and internationally, and to which the international community could contribute. In order to deliver its objectives, the workshop was structured around moderated discussions aimed at collectively investigating the issues raised by the exercise outcomes and identifying areas of international interest. Using the INEX 3 evaluation analysis (Section 4) as the starting point for the discussions, workshop participants shared their national experiences, discussed and analysed approaches to consequence management and the bases for variations, and identified possible implications on decision makers. As part of issue identification, consideration was given to their seriousness, risk to overall effectiveness of response, and the level of planning or consideration required as part of emergency preparedness.

In the final session of the workshop, the key needs in consequence management as identified during the workshop and to which the international community could contribute towards their resolution, were reviewed and discussed. These are summarised below according to exercise objective. Needs relating to the cross-cutting issues of stakeholder involvement and compensation are discussed in Section 5.5.

5.1 Key needs in food and agricultural countermeasures

During the discussions on agricultural and food countermeasures, several themes emerged based on the INEX 3 outcomes, as well as other practical experience in participating countries. Participants noted that with regards to technical and planning considerations, the capacity to undertake adequate sampling of food and agricultural products was likely insufficient to meet expected demands (for example sampling to identify contamination, and to ensure the public), and that therefore strategies aimed at optimising use of available resources would be needed.

The role of stakeholders was identified as an important feature within the decision-process for agricultural and food countermeasures. The complexity of this issue was highlighted by the recognition that there are many different types of stakeholders (authorities, farmers, distributors, unions, public), often with different priorities and perspectives.

The safety of food from the regulatory perspective, and the purity of food from the producer and public perspective were seen as two critical, but potentially conflicting objectives. Public health protection policy is generally supported through the establishment of permissible levels for contamination in food. On the other hand, market forces tend to move towards zero contamination. Farmers and producers put high priority on their reputation to deliver wholesome products, and food companies will strive to use products from "clean" sources whenever possible. This has clear implications on the role and usefulness of traditional intervention levels, as well as the choices and decisions regarding possible countermeasures.

Additionally, decisions on agricultural and food countermeasures will have a clear impact on the quantities and options for managing waste. The scale of the emergency and the manner in which countermeasures are implemented and followed will influence the volumes of unusable agricultural products. Large accidents can cause the interdiction of large agricultural areas; and the choice of intervention level will have further effect on size of area involved. The public acceptability of formally implemented countermeasures, including alternate processing or uses of contaminated products, will also determine the degree of compliance with the countermeasure, and the ultimately the volume of unmarketable products that must be managed.

Decisions relating to contaminated agricultural products will also have an effect on the management of compensation, including types, amounts and extent. Approaches to compensation will also be affected if market forces result in additional unmarketable products beyond official restrictions. Farmers and insurance companies have some experience in compensation (often in the context of natural disasters) and this should be taken into consideration.

It is in the interest of all stakeholders to have a process that will lead to reasonable and acceptable guidance for agriculture and food countermeasures. Strict intervention levels are likely not the best practical solution. Compliance with formal intervention levels may permit food into production processes and onto on store shelves, but it may very well remain unwanted by producers and consumers, in which case the guidance has not served its purpose. The usefulness of guidance and the credibility of the responsible authorities could be better served through interaction and consultation between stakeholders at the government, industry and public levels. The development in the planning stage of acceptable and therefore practical strategies through a consultative process involving government, industry and public will facilitate the management of longer-term agricultural and food countermeasures. Failure to resolve issues of public acceptability could lead to more serious long-term issues in the areas of waste, compensation and recovery management.

Identified needs

Based on the workshop discussions in the area of agricultural and food countermeasures, the participants identified several key needs and areas for improvement in longer-term consequence management which would benefit from international cooperation and collaborative approaches. These included:

- Development of guidance and strategies on the long-term management of agricultural and food countermeasures, including strategies for improving stakeholder involvement in the decision-framing processes.
- Development of processes to facilitate the exchange of information of national approaches to agricultural and food countermeasures, including the development of an exercise, workshop or some other mechanism focussing on waste management decision-making processes.
- Development of guidance and objectives for quantifying, obtaining and managing monitoring resources (nationally and internationally), considering linkages to modelling and other relevant considerations.

5.2 Key needs in soft countermeasures

In contrast to the limited feedback provided as part of the INEX 3 exercise evaluation questionnaires, the topic of soft countermeasures generated considerable discussion during the workshop. In defining and characterising the nature of soft countermeasures, it was generally agreed that these would include a broad range of countermeasures that could be considered by authorities beyond those urgent health protection measures (such as evacuation, sheltering, iodine prophylaxis) that are taken to prevent deterministic health effects and minimise the risk of stochastic effects. In contrast to these, decisions on soft countermeasures are strongly affected by social, economic, psychological, political and possibly ethical factors, even if implemented in the early phase of an emergency. Competent authorities of nuclear and radiation safety organisations may only be partly involved in this decision making. Additionally, it was suggested that soft countermeasures could also be understood primarily as actions taken to protect a country's own interests in another affected country. Therefore, decisions or triggers for decisions could come from outside the affected country (e.g., requests for information for travel, trade, or tourism).

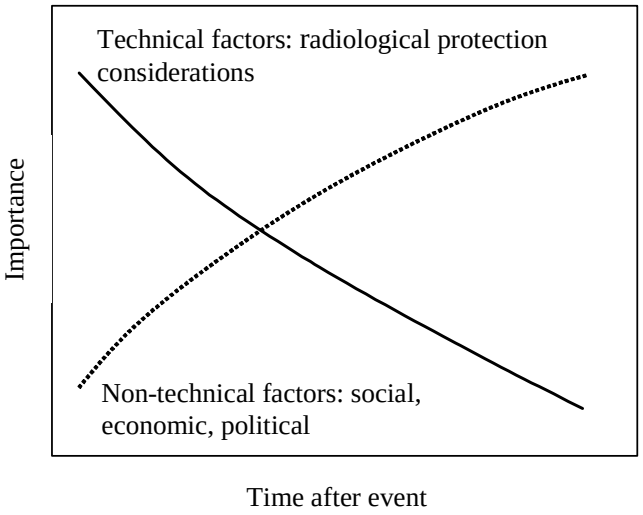
Based on this characterisation, it was agreed that the limited feedback on this objective during the exercise was largely a result of a general difficulty in including the complexity of the associated decision-making processes within the INEX 3 exercise framework. The participants requested that consideration be given to developing a more effective mechanism for testing these aspects in the future.

Regardless of the extent to which these countermeasures were investigated as part of the INEX 3 exercise conduct, the workshop participants agreed that their complexity presents a number of challenges to emergency management authorities with regards to their implementation and withdrawal. These include the difficulty (if not impossibility) of establishing clear and simple intervention levels for such countermeasures, the potential for non-harmonised decisions between countries and the potential socio-economic consequences associated with their implementation or non-implementation.

Decisions on these countermeasures must also take account of the increased relevance of stakeholder input with regards to their implementation, particularly from organisations or groups that might not normally be involved in early phase emergency management, and of the complex linkages to other non-technical criteria. Radiological protection considerations are only one aspect in the decision process for such countermeasures, and other factors – social, economic and political – will play an increasingly important role that will evolve over time (Figure 1). The participants recognised that the type of mechanisms needed to accommodate all relevant criteria in an appropriate decision process is not clear, and that the range and extent of involvement of other stakeholders is also uncertain, but potentially broad. However, appropriate linkages and interfaces with other relevant organisations should be undertaken as part of planning.

Given the potentially broad range of technical and non-technical considerations, decisions on soft countermeasures may be subject to wide variations in approach and application by different countries, potentially leading to conflicting advice. Decisions on the termination of countermeasures will be equally complex, particularly if some measures have been implemented on a precautionary basis, in the absence of full characterisation of the situation. While reflecting the need for national variations, a consistent framework, including clear explanations to all stakeholders, would facilitate the building of public confidence regarding decisions on both implementation and withdrawal of these countermeasures, as the reasons for a particular decision may be complex or not obvious.

Figure 1. **Evolution of technical and non-technical considerations in decision making over time** (representative)



In order to move towards resolving these issues, the participants agreed that not only is a good scientific and technical basis needed, but also a recognition of the variability and uncertainty of other factors that could occur in an actual situation. Strategies and considerations for decision making, rather than strict numbers, are needed, otherwise the technical basis has little value. The importance of exercising international interfaces to identify real issues and of developing guidance or strategies that can be tested in exercises with stakeholders was noted.

Identified needs

Based on the workshop discussions, the participants identified several key needs and areas for improvement with regards to soft countermeasures which would benefit from international co-operation and collaborative approaches. These included:

- Development of guidance and strategies for soft countermeasures, including identification of possible actions, scope and feasibility, and range of stakeholders. Such guidance should account for the expanding spectrum of considerations for decision making with time, recognising that strict technical and radiological criteria play only a small part in the longer term management of the consequences. This should build on related work already done elsewhere (existing national guides/catalogues, outcomes of international initiatives).
- Guidance on mechanisms and processes for testing high-level strategic decision making on soft countermeasures, and involving decision makers at all levels.

5.3 Key needs in recovery management

Similar to the discussions on soft countermeasures, the discussion of the INEX 3 outcomes with regards to recovery management focused on key considerations and criteria for decision making, and the role of stakeholder aspects in the decision process. In defining recovery management, it was agreed that this involved returning the affected areas and populations to normalcy, but that this needed to be based on a concept of normalcy and acceptability that was mutually agreeable, to the extent possible, amongst stakeholders. This would take into account that phases of recovery may not be the same for all affected regions, and that while the goal is a return to normalcy, the timeframe to do was situation specific.

Other considerations for decision making included the mutual impact and influence of compensation mechanisms and decision making, and the possible constraints that early decisions could impose on later decisions as well as on types and levels of compensation. Another important aspect is the need for approaches or strategies for terminating or withdrawing countermeasures as part of its implementation plan.

There was considerable discussion concerning the importance of stakeholder involvement in the recovery management decision process. One area that was identified as being particularly important was in relation to the development of mutually acceptable limits or criteria for the withdrawal of countermeasures. Due to the type and extent of countermeasures that could be implemented as part of later phase consequence management and recovery, it is highly likely that decisions on their withdrawal could involve a very broad range of stakeholders with multiple perspectives, noting that as with agricultural and food countermeasures, public and industry acceptance might not be the same as regulatory acceptance. This will present significant challenges regarding the development of mutually acceptable strategies for countermeasures termination.

The development of mutually acceptable criteria for withdrawal, which should represent a balance between many technical, social, economic and political factors, might not always be possible. Additionally, criteria or approaches considered acceptable during planning could require renegotiation based on the specific recovery situation. The role of compensation and financial incentives, mutual agreement or force of law may also need to be considered as part of the recovery strategies. Regardless, it was agreed that the process for involving and engaging all stakeholders in the development of recovery strategies is more important than the specific numbers for action or termination, and that such engagement should start as part of planning.

Identified needs

In order to facilitate better international consistency in approaches to recovery management, the workshop participants identified several key needs and areas for improvement which would benefit from international cooperation and collaborative approaches. These include:

- Development of international guidance on objectives and processes for recovery management, building on the outcomes of existing relevant national and international guidance and studies to avoid repetition and usefully fill in gaps. Such guidance should deal with response and recovery together, focusing on processes and strategies (rather than numbers) including:
  - Stakeholder involvement processes.
  - Compendiums of existing approaches and strategies including analyses of their merits, effectiveness, etc.
  - Guidance related to recovery for urban contamination (whether accidental or arising from a malevolent act).
- Development of a benchmark comparison exercise to investigate national definitions and approaches for returning to “normality” (for example, an urban contamination scenario similar to Goiania).

5.4 Key needs in public and media information

The workshop session on public and media information began with a keynote presentation from an invited media representative on the role of the media during a nuclear emergency. It was stressed that because emergency management authorities will usually be dealing with media who have no knowledge of the topic, they therefore must be proactive in putting themselves forward as the official

source of information on the event, and should not assume that the media will regard them as the official source. It is not enough to be an official source of information; rather, authorities must make themselves the official source by establishing a relationship with the media as part of emergency preparedness. Authorities must strive for a high level of media preparedness, accuracy and credibility. It was noted that the media themselves have a role to play as part of the response management in helping to identify issues of public concern.

Regarding the specific scope of the INEX 3 exercise, it was noted that the principles of the media are the same in the short term and long term. As the situation develops, the media will look for longer term stories and new angles, but the basic approach of the media will not change, and therefore consistency of message and advice is important in building and maintaining credibility.

In the plenary discussions, the participants addressed issues regarding media interaction and public communication with respect to the INEX 3 objectives and outcomes. While much work has been done on early phase crisis communications, areas for improvement still exist with regards to longer term communications needs, highlighted by the INEX 3 outcomes showing that most participating countries addressed public information primarily using a crisis communications approach. Questions remain on the mechanisms for transition from early phase information arrangements into longer-term strategies for communication and dialogue. As part of these strategies, authorities should be able to build on information that has been prepared to inform the media and public as part of emergency planning and that has been made available during an emergency when little other information is available. However, in order to be effective, this one-way provision of information needs to change into an interactive approach for longer-term communication and dialogue with stakeholders.

The media is only one way of communicating with stakeholders. It is more difficult to use the media in the long term for reassurance or interaction with stakeholders because of changing media interest, and the need for direct interaction with affected populations. Such interaction is not simply a matter of issuing press releases, but of dialogue, bearing in mind that different stakeholders have different information needs, and that there is a need to answer questions that people are asking, and provide information they are requesting.

While it is the role of national governments to communicate and conduct dialogue with their populations, this can be supported by international organisations through the development of generic frameworks, guidance, or strategies, including approaches to information exchange, to facilitate consistency and good practice between countries. This should recognise the need for local flexibility, as authorities will have to explain and manage national and regional differences in any measures implemented or withdrawn, which will be particular problem for longer term management.

Identified needs

Based on the workshop discussions, the participants identified several key needs and areas for improvement with regards to public information, communication and dialogue which would benefit from international cooperation and collaborative approaches, and bearing in mind the need to involve media professionals as relevant. These included:

- Development of guidance and strategies for public, media and political communications for the medium and longer term. This guidance needs to consider:
  - Building a better relationship with the media community.
  - Using media as source of information for the emergency operations centre.

  - Making officials available to ensure that the authority/organisation is recognised as the "official" organisation.
  - Ensuring the maintenance of credibility.
  - Communicating directly with the public, through stakeholders, for example (but not limited to) after the media lose interest.
  - Through current work on stakeholder involvement, identify objectives and information needs for various audiences.
- Prepared facts sheets on issues that will arise in the medium to longer term, including prepared and sufficient information for TV and internet.
- Request that the issue of inviting an independent international organisation to assert that a crisis is under control be raised at appropriate forum to clarify role of international organisations in this respect and considerations involved in making such a statement.
- Conduct a forum (workshop, conferences, other NEA working groups) to invite and interact with media professionals, public communications officers and others who would be involved in the management of crises and emergencies.
- Develop and conduct and INEX exercise focussing on public and media information.

These key needs in longer-term consequence management were forward to the NEA/WPNEM for their further consideration.

5.5 Key needs in stakeholder involvement and economic considerations in decision making

Throughout the INEX 3 workshop discussions, the linkages between stakeholder involvement and stakeholder acceptance, and the importance of these to the effective implementation and management of countermeasures as identified through the all of the key exercise objectives was strongly reinforced. The discussions showed that if the decisions and guidance of authorities is not accepted by implicated stakeholders, then this will impact negatively on the credibility of authorities, the effective implementation of countermeasures and recommended guidance, the amount of waste produced (for example, if industry and public voluntarily boycott the use and consumption of food below guidance levels), and the types and amounts of compensation. Stakeholder engagement is not an end in itself, but rather is aimed towards improving the longer-term response to an event as managed through implementation, effectiveness and withdrawal of countermeasures.

To facilitate effective communications and stakeholder interaction, there is a need to develop specific programmes, approaches and strategies to interact, educate and communicate with stakeholders as part of emergency preparedness and across all phases of the event (crisis, early, medium, longer term), recognising that different stakeholders have different needs. This goes beyond media information, and is rather an issue of public communications and dialogue. The traditional impediments of lack of time, resources and interest in these issues need to be overcome, and appropriate arrangements undertaken as part of the overall planning for emergency situations. The following actions to facilitate building and maintaining public confidence and acceptance were suggested:

- Conduct a workshop or other forum to consider in greater detail stakeholder involvement at all stages of preparedness and response.
- Develop mechanisms and guidance for improving stakeholder involvement in decision-framing processes nationally and internationally.
- Develop and implement surveillance systems to support the technical basis for decisions.
- Develop and implement information sharing systems to help co-ordinate actions and information between organisations and countries and ensure consistency.

The linkages of the exercise objectives and outcomes to issues of liability and compensation, and the impact that these might have on decision making, was also identified. In order to better understand these issues, the following action was also suggested:

- Investigate the need for international guidance, frameworks and/or information exchange on approaches, mechanisms, interfaces and considerations for national compensation systems, including relevant linkages to international conventions on indemnification of damage in a nuclear emergency.

6. INEX 3 EXERCISE FOLLOW-UP

Following the INEX 3 evaluation workshop, the WPNEM reviewed the workshop outcomes and identified key needs in consequence management, with a view towards developing strategies to help resolve the key longer term consequence management issues raised by the INEX 3 experience. The WPNEM noted that the INEX 3 process was an important start in the examination of longer term consequence management issues, but that since many of these issues are not firmly based on quantitative criteria and involve a wide range of technical and socio-economic considerations, there is still a challenge to developing concrete strategies for their resolution.

A detailed discussion of the key needs identified by the INEX 3 workshop participants in each of the four exercise objectives, including possible ideas for further work, resulted in several additional issues and suggestions, including the importance of key cross-cutting issues such as the role of stakeholder involvement and the complexity of the decision-making process in consequence management and recovery.

Based on the review of each identified issue to determine its current status internationally, to identify gaps and areas for improvement, and investigate any linkages into other related projects, the WPNEM identified a series of INEX 3 follow-up activities that would bring value to the international community, including:

- *Expert Group on Recovery, Agriculture, and Food Countermeasures* to develop a report providing experience exchange on national and international strategies, approaches and considerations adopted; identified gaps; and other relevant issues in recovery, agricultural and food countermeasures. This work will be carried out through information exchange methods, and supported by an analysis and correlation of existing case studies in recovery and agricultural management (radiological and other) with the INEX 3 outcomes to extract key lessons for future consequence and recovery management.
- *Expert Group on Soft Countermeasures* to develop strategies and approaches for possible actions of relevance and common considerations, and undertake information exchange to move towards compatible decision making on these types of countermeasures.
- *Ad-hoc Scoping Group on Nuclear Third Party Liability and Compensation Issues in Consequence Management* to broadly identify issues related to the linkages between third party liability, compensation and consequence management, including impacts on decision making. The outcome of the work will be a proposal for further detailed investigations that could be usefully and jointly addressed by the WPNEM and NEA Nuclear Law Committee.
- *Experience Exchange Workshop on Stakeholder Involvement in Consequence and Recovery Managemen*t to organise a workshop to examine stakeholder involvement and public dialogue aspects of consequence and recovery management through selected case studies. The outcomes from the other INEX 3 follow-up groups will serve as input into this activity.

The outcomes of these activities will be shared broadly with the international community.

7. SUMMARY

Building on the outcomes of the previous INEX early phase exercise series, the INEX 3 consequence management exercise has represented an important step towards improving the ability of national authorities to manage the longer term issues following a nuclear or radiological emergency. The INEX 3 exercise and evaluation workshop have clearly showed the desire of national authorities to share best practices, identify areas for improvement in longer-term response and recovery, and undertake actions for their resolution as part of their overall emergency preparedness programmes.

As a new type of exercise focusing on the less explored area of longer-term consequence and recovery management issues, the INEX 3 outcomes have generally provided a set of recommendations on areas for improvement, rather than a clear list of best practices and approaches. Importantly, it has brought a clear recognition of the importance of stakeholder involvement aspects in later phase consequence management, and the interaction and interdependency of decision making and approaches to stakeholder communication, agriculture, food and other countermeasures, recovery management, waste and compensation.

The NEA Working Party on Nuclear Emergency Matters will work towards providing useful input into the resolution of the identified needs in consequence management so that these can be made available to all interested national authorities and international organisations, and tested in future exercises.

Appendix **1**

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Appendix 2

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Appendix 3

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Experience from the Third International Nuclear Emergency Exercise (INEX 3) on Consequence Management

Since the beginning of the 1990s, the OECD Nuclear Energy Agency (NEA) has offered its member countries a forum for improving efficiency and effectiveness in nuclear emergency management, focusing in particular on the international aspects of emergency preparedness and response. A central approach to this has been the preparation and conduct of the International Nuclear Emergency Exercise (INEX) series.

The INEX 3 consequence management exercise series was developed by the NEA Working Party on Nuclear Emergency Matters in response to its members' desire to better prepare for the longer-term response following a nuclear or radiological emergency. INEX 3 was designed and conducted to allow participants to investigate the national and international arrangements for responding to widespread radiological contamination of the environment and the consequence management issues likely to be raised in the medium to long term following such an event. The main areas addressed included agriculture and food countermeasures, decisions on countermeasures such as travel, trade or tourism, recovery management and public information. The exercise series, conducted in 2005-2006, was followed by an evaluation workshop aimed at allowing participants to share their national experiences with INEX 3, compare approaches, analyse the implications on decision making and identify key needs in longer-term consequence management.

This report summarises the development of the INEX 3 exercise, the major evaluation outcomes of the national exercises, and the key policy-level outcomes, recommendations and follow-up activities arising from the exercise and workshop.

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