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NUCLEAR ENERGY AGENCY
COMMITTEE ON RADIOLOGICAL PROTECTION AND PUBLIC HEALTH

Working Party on Nuclear Emergency Matters

INEX-6 Guide for Exercise Players

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Table of Contents

1 Introduction

1.1 Purpose of This document

As part of its ongoing series of international exercises, the OECD Nuclear Energy Agency (NEA) has developed the Sixth International Nuclear Emergency Exercise (INEX-6) on the long-term recovery to radiological and nuclear emergencies, to be conducted in January-March 2024.

The purpose of this document is to provide general guidance to the INEX-6 Exercise Players on their participation in their country/territory's INEX-6 exercise. It should be read in conjunction with the INEX-6: General Information document (NEA/CRPPH/INEX(2023)2). This guide is supposed to be provided to Players via their National Planning Committee and National Exercise Organiser two weeks before the first exercise module runs.

1.2 Overview of INEX-6

Since 1993, the International Nuclear Emergency Exercise (INEX) series, organised by the OECD Nuclear Energy Agency, has proved successful in testing, investigating and facilitating improvements in emergency management systems nationally and internationally. Previous INEX exercises focused largely on national and international aspects of early phase management of emergencies at nuclear power plants and more recently, in INEX-3 and INEX-4, have touched upon issues associated with consequence management and the transition to recovery. INEX-6 will focus on the long-term recovery phase. The long-term recovery phase, which corresponds to an existing exposure situation, begins when the radiation source at the origin of the event is considered to be sufficiently secured and/or the exposure situation is adequately characterised to support long-term decision-making (for off-site accidents only the latter applies). This is a challenging phase of an emergency to exercise, which involves a wide range of complex issues never tested before at the international level.[1]

The considerable number of issues that local, national and international authorities will be faced with in the long-term recovery phase of radiological and nuclear emergencies makes it extremely difficult to set up an exercise that adequately tests all aspects of recovery. It will also be difficult to replicate reality in terms of condensing the recovery timeline into a single exercise. In the case of a real event, policy leads, lawyers, decision makers, regulators, government departments, public authorities, would have more time to deliberate and decide on the course of action to take. With this in mind, INEX-6 has been developed as a series of table-top exercise modules to reduce the complexity involved and tackle each of the recovery issues as manageable bitesize exercises. For INEX-6, modules have been developed to test the following recovery areas:

(1) Health Impacts

(2) Food Safety

(3) Remediation and Decontamination

(4) Radioactive Waste Management

[1] Further information about the history of the INEX series can be found on the NEA website.

All modules will be based on a single scenario. This scenario has been selected to target, per module, the specific themes and related topics in question. As the exercise will start after the termination of the emergency phase, the response actions will be simulated and the exercise will be designed to focus on the consequences for long-term recovery. For example, any decisions around the preceding evacuation or shelter orders will be simulated and the focus in this example would be on the re-housing of residents and the associated Mental Health and Psychosocial Support (MHPSS) issues. The same applies to the cause of the emergency, as the INEX-6 will focus on the consequences for recovery rather than the cause.

Discussion among and between Players should be open and non-critical. The goal is to establish an enhanced table-top exercise environment where issues regarding long-term recovery activities can be identified and discussed freely/openly.

Following its exercise, each country or territory will complete a standard questionnaire to capture observations, lessons and issues for submission to the Expert Group on the Sixth International Nuclear Emergency Exercise (EGINEX6) Evaluation Sub-Group of the Working Party on Nuclear Emergency Matters (WPNEM). This feedback will form the basis of the INEX-6 International Evaluation Workshop, being organised by NEA in late 2024 to early 2025[2]. The workshop will allow participants to exchange and analyse experience from the individual INEX-6 exercises and identify cross-cutting issues or gaps impacting multiple states. An important outcome will be the identification of good practices as well as areas for improvement that would benefit from international cooperation. The outcomes of the INEX-6 evaluation process will shape the future WPNEM programme of work.

1.3 Exercise Scope and Limitations

It is recognised that while NEA member countries have robust exercise programmes addressing response and transition phases of radiological and nuclear emergencies, plans and exercises for the longer-term recovery are not as well established. INEX-6 therefore provides an opportunity for participating countries and territories to test arrangements for the recovery phase and to work alongside other countries and territories to draw international best practices and areas for improvement. A series of guiding statements have been agreed to appropriately scope of the exercise. These are as follows:

The Sixth International Nuclear Emergency Exercise (INEX-6) will:

- be delivered individually by participating countries and territories as Table-Top Exercises using the same exercise scenario in order to draw comparisons between countries and territories
- involve a series of ‘modules’ focussing on key topical issues associated with long-term recovery management
- be a “question-driven” exercise where Players are challenged to use existing policies, protocols, and emergency preparedness plans/procedures to explain what longer-term protective actions will be taken
- be prepared as a package that enables countries and territories to re-use the exercise materials after completion of INEX-6, including a methodology that allows for additional long-term recovery modules to be added at a later stage following the same format. For example, WPNEM may request that further INEX-6 exercises are held in later years to test additional long-term recovery issues
- involve a scenario that begins after termination of a radiological or nuclear emergency, i.e. an existing exposure situation

[2] Dates of the INEX-6 Evaluation Workshop are still To Be Confirmed (TBC)

- be open for all countries and territories to participate regardless of their current level of preparedness for recovery
- maintain a direct link with the NEA publication 'Building a Framework for Post-Nuclear Accident Recovery Preparedness' to test implementation of such national-level guidance
- build on experience from previous INEX exercises
- facilitate the examination of similarities and differences in recovery management strategies, including where possible on transboundary issues between neighbouring countries and territories

The Sixth International Nuclear Emergency Exercise (INEX-6) will not:

- test all elements associated with long-term recovery
- be built upon a very technically detailed accident scenario description, but rather on a more narrative or semi-quantitative one

INEX-6 is *not* a real-time command-post exercise. Rather, it is comprised of a series of national table-top exercises conducted by participating countries and territories.

INEX-6 is a *"no fault"* exercise. Neither participating countries, territories nor individuals will have their performance or outcomes assessed. Evaluation will focus on the arrangements and approaches for longer-term recovery management in relation to the exercise scenario, including plans, procedures, organisational structures, information exchange, decision making processes, resources, international interfaces and supporting systems.

1.4 Expectations of INEX-6 Players

Exercise Players include all invited participants from national responsible organisations and agencies under the national emergency arrangements that are required to respond to the exercise scenario. It is expected that there are officials or other representatives of the principal response organisations/national authorities (e.g., emergency planners, responders, and technical decision-makers from national authorities and local authorities where relevant for recovery) within the country, as well as other invited relevant governmental and non-governmental stakeholders. In preparation for the exercise, it is recommended that all Exercise Players read and be familiar with the contents of this guide, and any other exercise materials provided through the National Planning Committee.

In order to obtain full benefit from the exercise, all Players are expected to be prepared to discuss their allocated roles and responsibilities as defined in their national emergency management arrangements. They will be expected to know the emergency management aspects of the organisation they represent, including relevant resources and linkages to other organisations, be appropriately trained and be familiar with their arrangements for nuclear emergencies, in general. As a question-driven exercise, all Exercise Players should be prepared to discuss issues relevant to their roles and responsibilities in the context of the INEX-6 scenario.

In the line with their respective National Planning Committee, Exercise Players are expected to attend any pre-exercise training sessions or briefings, according to availability. During the exercise, Players must keep their actions within the defined scope of the exercise. Any additional direction, including details regarding the exercise objectives, scenario and rules will be provided to Players as pre-exercise training or as part of the introductory remarks to the exercise. The exercise will be observed by Exercise Recorders and Moderators able to offer injects and clarifications.

2 INEX-6 Exercise Concept

2.1 INEX-6 Aims and Objectives

The **aim** of INEX-6 is two-fold:

- To exercise national and international arrangements for the recovery phase of a nuclear or radiological emergency and to identify improvements to enhance national and international preparedness for recovery; and
- To exchange experience with other countries and territories that have conducted and evaluated an INEX-6 exercise

To meet this aim, the following common objectives have been set:

- Test preparedness for recovery, including organisational structures, roles and responsibilities, stakeholder engagement, as well as mechanisms for international cooperation to assess the adequacy of current arrangements and identify potential gaps against the NEA Framework for Recovery Preparedness;
- Test the decision-making process for the implementation of longer-term protective actions, including the justification and optimisation of such actions considering both radiological and non-radiological issues;
- Test the adoption of an all-hazards approach to recovery management, utilising skills, knowledge and capabilities from outside of the nuclear field.

Each of the INEX-6 modules also have detailed objectives in support of the overarching common objectives above. These can be found in the following sections. All of the aim and objectives, as well as module specific objectives, will be evaluated from both a national and international perspective and form the core of the exercise and post-exercise evaluation questionnaire.

2.2 INEX-6 Exercise Scenario

Taking into consideration the identified exercise aim and objectives, INEX-6 has been developed around a single generic scenario that starts after the termination of the emergency phase. The response actions will be simulated and the exercise will be designed to focus on the consequences for long-term recovery. This scenario has been selected to target four specific modules: (1) Health Impacts; (2) Food Safety; (3) Remediation and Decontamination; and (4) Radioactive Waste Management. The basic design characteristics for the scenario include:

- A radiological release where the cause of the emergency is not defined;
- 'Layers' of information related to each of the exercise modules;
- A series of themes and topics, with pre-defined questions to drive discussions relating to the long-term recovery issues addressed in each module.

The INEX-6 generic scenario has been designed around these characteristics and includes:

- Starts approximately 12 months after the emergency.
- The scenario is not based on a Nuclear Power Plant accident, to ensure it is relevant to both nuclear and non-nuclear countries and territories. This also allows

for a range of radionuclides to be considered which could be observed from different accidents in different countries, and is aimed at half-lives that will be long enough to be relevant.

- Each module will go into more detail on the scenario relevant to the specific recovery topic in question.
- The cause of the incident is not described in detail as the INEX-6 starts from the consequences and impacts (existing exposure situation) rather than from the source term and release conditions.
- The scenario should be considered as if it occurred in its own country or territory.

Details of the exercise initiating scenario are provided in Annex A.

2.3 INEX-6 Exercise Format

To meet the stated objectives in the most efficient manner, INEX-6 has been designed as a question-driven table-top modular exercise in which the Players from the various relevant organisations and other invited stakeholders are gathered in a common location. An Exercise Moderator will provide the overall control to the exercise and facilitate the discussions based on the scenario evolutions and exercise themes and topics. The moderated discussion format will allow participants to investigate in-depth their arrangements for dealing with the exercise scenario, without the resource constraints associated with a realistic and protracted decision-making timeline.

As a "question-driven" exercise, the emphasis of exercise play is on discussion, problem solving and issue identification rather than rapid decision-making. Players will be challenged to use existing protocols, policies and procedures/plans to explain what long-term recovery phase actions will be provided. The modules are provided in a separate document "INEX-6 Exercise Slidepack" and will be provided to the Exercise Players on the day of the exercise, by the Exercise Moderator.

The exercise will begin with a narrative description of the scenario from the Exercise Moderator. Players will receive narrative and technical information about the event and subsequent themes. As the exercise progresses, the Moderator will provide Players with updated information related to each theme and associated questions set out by the EGINEX-6. This material will facilitate detailed discussion on the relevant themes associated with each module and identify good practices or gaps to be addressed in post-exercise follow-up.

In responding to the scenario, the Exercise Players may assume the use of equipment and resources compatible with the arrangements that exist in their country, including bi- and multi-lateral agreements where a country may be overwhelmed or require specific support. Outcomes and issues brought forward are recorded by Evaluators/Recorders for future action. Exercise outcomes and issues will be recorded for further analyses and for inclusion in the INEX-6 Exercise Evaluation Questionnaire. Individual performance will not be assessed.

At the exercise conclusion, the Moderator will indicate the termination of each modules exercise play to all Participants and outline the next steps with respect to the exercise outcomes and evaluation. This will normally include an immediate post-exercise debriefing between Evaluators/Recorders and the Players to record any additional information and general impressions, and a final wrap-up.

2.4 Exercise Duration

It should be noted that each module has a designated run time of 4 hours, though the time for each theme within these modules will vary. The remainder of the time is associated with debrief and capture of learning. The duration of the specific national exercise and related modules will be communicated to Players by the National Planning Committee.

2.5 Exercise Artificiality and Simulation

By definition, an exercise is a simulation of a postulated event. In the case of INEX-6, Players will be briefed by the Moderators to expect and be prepared to accept some exercise artificialities, such as data, information or limitations on play. These are introduced to help ensure that Players are not unduly hindered in their play by the absence of a person, organisation or information that they would ordinarily expect to be available. The exercise is forward looking and it is important that this focus is maintained. The discussion of past actions in the emergency phase is nor an objective nor a concern of this exercise.

Given the artificiality that is introduced by starting an exercise, the Moderator will provide an appropriate briefing at the beginning of the exercise on the recovery phase and the key issues addressed in each module. This will help to frame the subsequent module specific exercise play, and allow Players to familiarise themselves with the other Players and organisations that would have already come together. Another instance of artificiality is possible simulation of any non-participating organisations. In order to accomplish the exercise objectives in the time and space available and with limited participation, Moderators may be required to simulate input from non-participating organisations, as appropriate to the exercise format and the issues being addressed. For INEX-6, any required external communications will be defined by national objectives.

3 Module 1: Health Impacts

3.1 Module Objectives

The objectives for Module 1: Health Impacts are:

- Examine the operational plans in place to implement and maintain long-term monitoring and screening programme of health status;
- Explore whether the existing medical system or the proposed post-accident system can manage post emergency health care needs; and
- Explore the implementation of actions identified in the Practical Guidance for Mental Health and Psychosocial Support in Radiological and Nuclear Emergencies

These will be assessed and evaluated alongside the aim and common objectives that have been outlined for the exercise.

3.2 Themes and Topics

There are three themes for Module 1: Health Impacts, each of these themes have a number of topics incorporated into them, which are outlined below. Where relevant, topics that are not covered, are also outlined.

3.2.1. Theme 1: Health status

The topics covered by this theme are:

- Individual dosimetry programmes for highly exposed individuals
- Population-wide dosimetry programmes
- Database of individuals impacted by the emergency
- Continued health monitoring programme for local and (self) relocated individuals
- Identify key health indicators that will be monitored

3.2.2. Theme 2: Medical Follow up and the Health Care System

The topics covered by this theme are:

- Hospitals/healthcare facilities to deal with the long-term needs of exposed individuals
- Long-term health and well-being interventions
- Training for health care personnel (for treatment and screening)

The topics *NOT* covered in this theme are:

- Communicating with the affected community on health and well-being needs

3.2.3. Theme 3: Mental Health[3]

The topics covered by this theme are:

- Provision of social support systems for evacuees and their host communities if evacuation or relocation continues
- Community engagement in decision-making and maintaining or rebuilding trust in social structures through community empowerment
- Re-establishment (if disrupted) of a functioning public health system that addresses the mental health and psychosocial needs of the community
- Mental health promotion campaigns
- Public communication strategy for the recovery phase including MHPSS[4]

The topics *NOT* covered in this theme are:

- Nuclear liability aspects:
  - does national legislation provide for compensation of mental health impacts?
  - if yes, is insurance or other financial security available to provide funding?

NOTE)

In addition to the NEA publication 'Building a Framework for Post-Nuclear Accident Recovery Preparedness' which could be used by countries for the purpose of the exercise, this theme could be linked to part of the forthcoming NEA publication '"Practical guidance for mental health and psychosocial support in radiological and nuclear emergencies". The latter will be available in due course.

[3] Mental health is defined by WHO (2022) as "a state of mental well-being that enables people to cope with the stresses of life, realize their abilities, learn well and work well, and contribute to their community. It is an integral component of health and well-being that underpins our individual and collective abilities to make decisions, build relationships and shape the world we live in. Mental health is a basic human right. And it is crucial to personal, community and socio-economic development." https://www.who.int/en/news-room/fact-sheets/detail/mental-health-strengthening-our-response (Accessed 11.09.2022)

[4] MHPSS means Mental Health and Psychosocial Support. According to IASC (2021), "*the term MHPSS is used to describe any type of local or outside support that aims to protect or promote psychosocial well-being and/or prevent or treat mental disorder*". The terms 'mental health' and 'psychosocial well-being' overlap. Mental health cannot be attained without psychosocial well-being and vice versa. https://interagencystandingcommittee.org/iasc-reference-group-mental-health-and-psychosocial-support-emergency-settings/iasc-common-monitoring-and-evaluation-framework-mental-health-and-psychosocial-support-emergency

4 Module 2: Food Safety

4.1 Module Objectives

The objectives for Module 2: Food Safety are:

- Test whether the existing national policy and regulatory framework supports the regeneration of food supplies, trade and consumer confidence;
- Explore the quality assurance procedures related to food safety, including long-term monitoring and screening programmes; and
- Explore how issues associated with domestic and international trade will be managed, including building and maintaining consumer confidence.

These will be assessed and evaluated alongside the aim and common objectives that have been outlined for the exercise.

4.2 Themes and Topics

There are three themes for Module 2: Food Safety, each of these themes have a number of topics incorporated into them, which are outlined below. Where relevant, topics that are not covered, are also outlined.

4.2.1. Theme 1: Regulatory and Policy Framework

The topics covered by this theme are:

- The legal basis for maintaining and/or lifting of restrictions related to the consumption, delivery and production of food
- The radiological criteria applied by participating countries and territories
- The engagement with stakeholders

4.2.2. Theme 2: Quality Assurance

The topics covered by this theme are:

- Long-term food safety strategy, including the implementation of a quality assurance plan and strategy for lifting restrictions
- Roles and responsibilities of stakeholders
- Availability of resources, capacity and capability to carry out quality assurance, e.g. monitoring and screening, including how to surge capacity and compile a request for international aid/assistance
- Empowering stakeholders, e.g. food industry, to develop independent monitoring programmes – is this publicly acceptable?
- Independent verification of monitoring and screening programme

4.2.3. Theme 3: Trade and Consumer Confidence

The topics covered by this theme are:

- International exports, including the application and acceptance of radiological criteria for food
- Legal basis for international trade
- Compensation
- Regeneration of trade and campaigns to build consumer confidence
- Stakeholder engagement in lifting restrictions

5 Module 3: Remediation and Decontamination

5.1 Module Objectives

The objectives for Module 3: Remediation and Decontamination are:

- Explore whether existing national policy and legislation will support the implementation of remedial actions;
- Examine how decisions would be made around remediation of affected urban and rural areas, including a test of assessing and deciding upon the various options available to remediate and decontaminate an area; and
- Explore how you would implement the remediation strategy, including the specific protective and/or remedial actions identified above.

These will be assessed and evaluated alongside the aim and common objectives that have been outlined for the exercise.

5.2 Themes and Topics

There are three themes for Module 3: Remediation and Decontamination, each of these themes have a number of topics incorporated into them, which are outlined below. Where relevant, topics that are not covered, are also outlined.

5.2.1. Theme 1: Regulatory and Policy Framework

The topics covered by this theme are:

- Regulatory framework covering the management of contaminated areas in post-accident situations (IAEA GSR Part 3 Requirements)
- National policy for prioritising areas for remediation and decontamination
- Defining radiological criteria, e.g. reference level, to trigger remedial actions
- National legislation applicable to compensation of damage to property and the environment
- Governance - responsibilities
- Funding –who pays?

The topics *NOT* covered in this theme are:

- Ownership of contaminated areas

5.2.2. Theme 2: Identification of Remediation Goals and Remediation Actions

The topics covered by this theme are:

- Defining remediation goals and end points, including the engagement of stakeholders in the decision-making process. Selection of remedial actions to be based on:
  - Suitability of remedial actions
  - Applicability of remedial actions based on radionuclides
  - Constraints of remedial actions
  - Effectiveness of remedial actions
  - Waste Management considerations
  - Site-specific considerations
- Evaluation of selected remedial actions in consultation with stakeholders

5.2.3. Theme 3: Implementation of Remedial Actions

The topics covered by this theme are:

- Resources, capacity and capabilities required to implement remedial actions
- Surge capacity and international assistance requests
- Environmental monitoring programme to assess effectiveness of remediation

The topics *NOT* covered in this theme are:

- Operational plans to carry out agreed remedial actions in practice. For example:
  - Removal of topsoil
  - Control of access
  - Surface removal (buildings)
- Stakeholder engagement

6 Module 4: Radioactive Waste Management

6.1 Module Objectives

The objectives for Module 4: Radioactive Waste Management are:

- Explore whether the existing national regulatory framework for managing radioactive waste can be applied to the types and volumes of waste generated in a radiological incident;
- Test the arrangements in place to package and transport radioactive waste generated in emergencies;
- Examine how radioactive waste will be managed in the context of temporary storage; and
- Explore potential end points for radioactive waste.

These will be assessed and evaluated alongside the aim and common objectives that have been outlined for the exercise.

6.2 Themes and Topics

There are four themes for Module 4: Radioactive Waste Management, each of these themes have a number of topics incorporated into them, which are outlined below. Where relevant, topics that are not covered, are also outlined.

6.2.1. Theme 1: Regulatory and Policy Framework

The topics covered by this theme are:

- The national policy, strategy and legislation for radioactive waste management in emergencies, including arrangements for:
  - Characterisation of waste
  - Criteria for categorisation of waste, including use of the National Reference Inventory
  - Licensing considerations
  - Application of the waste hierarchy to minimise waste and avoid mixing
  - Describe the existing National Policy and legislation for supporting pre-disposal (capacity, processing, storage, treatment) and anticipated end-points (clearance, discharge, reuse, recycling, disposal). Include integrated surge waste capacity plans.
  - Storage site selection and options
- Roles and responsibilities

The topics *NOT* covered in this theme are:

- Stakeholder engagement

6.2.2. Theme 2: Transport of Radioactive Waste

The topics covered by this theme are:

- Availability of resources to transport radioactive waste (including surge capacity and requests for aid / international assistance)
- Logistics of moving waste, including cross-border issues and nuclear liability aspects (e.g., treaty relations with neighbouring countries and territories, availability of financial security to cover transport of waste)

6.2.3. Theme 3: Temporary Storage

The topics covered by this theme are:

- Selection of staging areas (staging areas in place for months – years)
  - Local environment considerations
  - Stakeholder engagement and community acceptance
  - Operation of staging areas (Segregation, Packaging, Storage, Monitoring)
- Selection of temporary storage facilities (10 years +)
  - Use existing facilities or develop new facilities – how many and where?
  - Regulatory / licensing considerations
  - Stakeholder engagement and community acceptance

The topics *NOT* covered in this theme are:

- Operation of temporary storage facilities
  - Processing wastes (detailed characterisation, monitoring, segregation, treatment)
  - Packaging for temporary storage

6.2.4. Theme 4: Disposal Routes

The topics covered by this theme are:

- Application of the waste hierarchy – reduce, reuse, recycle, dispose
- Public acceptance and options for reusing and recycling materials
- Identification of disposal routes, including how incineration facilities will be established

7 Exercise Participants

7.1 Roles and Responsibilities

The National Exercise Organiser (NEO)/National Planning Committee (NPC) has identified the organisations, agencies and stakeholders in their country that should play in the national/regional INEX-6 tabletop exercise. The roles and responsibilities of these are elaborated below:

- *Exercise Players* include all invited participants from responsible organisations under the national emergency arrangements that are required to respond to the exercise scenario, as well as other invited relevant stakeholders. All Players will be expected to follow their established procedures or be prepared to discuss their reactions to exercise events as they develop or are presented. These actions should be consistent with what they would be expected to do under normal routine or emergency responsibilities.
- *Exercise Moderators* are designated individual(s) within the exercise venue with the responsibility for ensuring that the exercise play and discussions progress smoothly according to the exercise framework, and that Exercise Players are provided with all necessary technical materials and driving inputs according to the exercise timeline. Moderators have an essential role in ensuring the exercise remains focussed, that issues are brought forth, discussed, and recorded, and that all opportunities are taken to achieve the exercise objectives within the exercise duration.
- *Exercise Evaluators/Recorders* are the designated individual(s) within the exercise venue with the responsibility for ensuring that exercise outcomes in relation to exercise objectives and topics are effectively recorded to support the completion of the INEX-6 Exercise Evaluation Questionnaire and any other national exercise reporting. The Evaluators/Recorders may need to discuss with Players about particular aspects of the exercise play and discussion, to ensure accurate recording of the results and any issues raised during the exercise. Evaluators/Recorders will not evaluate the performance of individual Players.
- *Exercise Observers* are the individuals invited to observe the exercise with no responsibility to contribute to exercise play or the organisation.

7.2 Player Orientation, Training and Supporting Documents

Evaluators/Recorders. It is suggested that NEO/NPC may use the generic INEX-6 Technical Materials (See 10. References of INEX-6 Materials) as a basis for training on aspects specific to INEX-6. Players will be notified of any training or information sessions through their NEO/NPC.

8 Basic Exercise Rules

The NEO/NPC will prepare and distribute all Exercise Rules to all Players, Moderators, Evaluators and Recorders. The following basic exercise rules are provided for illustrative purposes:

- Exercise Players must use their established policies, protocols, and plans/procedures for the handling of long-term recovery following nuclear or radiological emergencies in order to deal with issues that arise during the exercise. If a required procedure does not exist, or “ad-hoc” procedures are proposed, this will be documented by the Evaluators/Recorders;
- Players should use the technical data and information provided by Moderator from the NEA/INEX-6 scenario as well as actual organisational data and information to answer the questions. If a Player makes any assumptions or estimates as part of the play, the Evaluators/Recorders should be made aware and record the details. For example, the scenario gives 1 ton of radiological waste and Players know how many disposal locations are available for its disposal, as well as their capacity.
- To ensure that communications cannot be misinterpreted, any written communications used in the exercise must be prefaced with "EXERCISE INEX-6 EXERCISE" and concluded with "EXERCISE-EXERCISE". This also applies to any external communications during the exercise;
- The health and safety of the event will need to be ensured by the host organisation. This should include relevant and typical risk assessments being undertaken, as well as ensuring participants get enough breaks during exercise play.

The National Planning Committee will ensure that any other locally developed national exercise rules are circulated to Exercise Players in advance of the INEX-6 exercise conduct.

9 Evaluation and Reporting

INEX-6 is a "no fault" exercise. Neither participating countries nor territories nor individuals will have their performance assessed.

The fundamental reason for conducting a national INEX-6 exercise is to test and investigate national arrangements or approaches on emergency management aspects of long-term recovery, to identify relevant issues and facilitate improvements nationally and internationally. In order to provide a basis for improvements, it is important that the experience and outcomes of the national INEX-6 exercises be documented and shared to the extent possible. As with other INEX exercises, the INEX-6 evaluation will be based on national outcomes using a common evaluation questionnaire distributed as part of the generic technical materials, and an international evaluation workshop held after exercise completion. The INEX-6 Exercise Evaluation Questionnaire has been developed based on the INEX-6 common and module-specific objectives; any supplemental national objectives added by the NPC will not be captured as part of the NEA's INEX-6 evaluation. The questionnaires and overall evaluation will focus on identifying good practices, common issues and areas for further investigation. Following the exercise, the Exercise Evaluator/Recorder and other relevant personnel will complete the evaluation questionnaire for submission to the NEA by end of May 2024, as well as any specific exercise report for internal use within the country or territory. The information recorded by Evaluators/Recorders during the exercise will provide the basis for these reports.

The outcomes of each national exercise in terms of observations, lessons and issues identified in the evaluation questionnaires will form the basis of the follow-up INEX-6 International Evaluation Workshop, which is being organised by NEA after completion of all national exercises in participating countries and territories. The objective of the workshop is to allow participants to exchange and analyse experience from the national exercises, identify good practices as well as cross-cutting issues or gaps impacting multiple states, and formulate key needs that would benefit from international co-operation. All countries and territories having conducted an INEX-6 exercise, in addition to other interested countries, territories and international organisations, will be invited to participate in the workshop.

10 References of INEX-6 Materials

(1) INEX-6: General Information, NEA/CRPPH/INEX(2023)2

(2) INEX-6: How to start preparing for the INEX-6 exercise, NEA/CRPPH/INEX(2023)3

(3) INEX-6: Guide for National Planning Committees, NEA/CRPPH/INEX(2023)9

(4) INEX-6: Exercise Evaluation Questionnaire, Forthcoming

11 Glossary of Terms Related to Organisational Aspects

National Exercise Organiser (NEO)	The individual or organisation who "*owns"* the exercise and has overall responsibility for ensuring efficient exercise delivery and that all participating organisations are involved from the beginning of the exercise development process.
National Planning Committee (NPC)	The collective group of representatives from responsible organisations (see Exercise Planning Representative), chaired by the National Exercise Organiser, with the overall responsibility for delivering the national table-top or workshop exercise.
Exercise Players	Participants in the exercise that are required to respond to the exercise scenario in accordance with existing policies, protocols, and emergency preparedness and response plans/procedures.
Exercise Moderator	The individual(s) with responsibility for maintaining the efficient conduct of a national INEX-6 exercise. The Exercise Moderator is responsible for ensuring that the exercise play and discussions progress smoothly according to the exercise framework, and that Exercise Players are provided with all necessary technical materials and driving inputs according to the exercise timeline.
Exercise Evaluator/Recorder	The individual(s) with the responsibility for ensuring that exercise activities in support of exercise objectives are effectively recorded to support the completion of the INEX-6 Exercise Evaluation Questionnaire and any other exercise reporting.
Exercise Observer	Individuals invited to observe the exercise with no responsibility to contribute to exercise play or the organisation

Annex A: INEX-6 Exercise Scenario

A1. Overview of the INEX-6 Scenario

As it is difficult to replicate reality in terms of condensing the recovery timeline into a single exercise, INEX-6 has been developed as tabletop exercise with a scenario narrative and a series of modules to reduce the complexity involved. The scenario narrative describes a general landscape of the exercise and a base for each module. The modules are used to tackle each of the recovery issues as manageable, bitesize exercises.

A2. How will National Organisations use the Exercise Scenario?

Within each country, the national emergency recovery arrangements will dictate the scale of exercise required and the level of involvement of national organisations to test the key objectives described in Section 2.1. The exercise scenario is composed of the scenario narrative (A3) and slidepacks. The scenario narrative gives a generic background for the recovery phase exercise. The slidepacks include a series of topics and questions to be addressed during the exercise and are detailed enough to carry out the exercise. The Exercise Moderator will facilitate the exercise progression using the slidepacks.

A3. Scenario Narrative

Background

This exercise starts from the situation approximately 12 months after the emergency. Detailed modelling has been conducted against a (potential) radiological incident scenario to generate a series of impacts to be dealt with within the long-term recovery phase. The scenario, not based on a Nuclear Power Plant accident, is relevant to both nuclear and non-nuclear countries and territories. Each module will go into more detail on the scenario relevant to the specific recovery topic in question. The cause of the incident is not described in detail as the INEX-6 starts from the consequences and impacts rather than from the source term and release conditions. The scenario should be considered as if it occurred in its own country or territory.

The levels of contamination used in this exercise has been deliberately chosen to test the resources of those countries and territories involved. Reflexions after this exercise may aid in further identifying the level of resources that each country and/or territory may wish to have, in relation to what possible incidents may occur.

The Incident

The basis of the scenario is a transport accident, where a fire broke out on a vehicle transporting nuclear material. The outbreak of the fire led the driver to pull off the road. Fumes from the fire overcame him. Other road users called the emergency services 5 minutes after the fire was initiated. During the call, there

was no mention of a nuclear transport package. Response time for the Emergency Services was 20 minutes, and it took a further 10 minutes to quench the fire. Upon examination could see the trefoil of a nuclear movement.

Further cooling of the fire-stricken vehicle followed. With temperatures reduced, the aerial release terminated within 1 hour. Surface water drains were protected, and effluent was contained and later recovered. The late realisation of this as a radiological event resulted in an unavoidable dose to the public, where evacuation during the release could not be achieved.

NOTE: This is a fictitious incident scenario and should be context only, even if this transportation type is unlikely or prohibited in participating countries or territories.

Radioactive Contamination

12 months have passed since the radiological incident occurred. It caused widespread dispersion of radioactive contamination (hereinafter referred to as just “contamination”) of the surrounding environment, including across regional boundaries (Figure A.1). Contamination that has also been detected outside the country or territory is well below action levels and does not require remedial actions or restrictions on food production or consumption. Neighbouring countries and territories remain concerned by the ongoing recovery and are focussing on reassuring their populations and responding to the subsequent social and economic impacts.

The weather conditions at the time of the incident caused the aerial release and contamination to spread over many kilometres. Several factors influenced the mobility of the dispersed contamination during and after the emergency response phase, namely, the weather, the movement of people and vehicles, and the protective actions applied during the response phase. Accordingly, there has been additional complexity leaving several hotspots of contamination. Samples collected from the contaminated areas indicate the remaining presence of several major isotopes, including Cs137, Cs134, Am241, Ce144, Ru106, Sr90, Co60, H3, Pm147, Pu (all), U (except 238), and Cm242.

So far, very little remedial action has been taken to decontaminate the area and the approach in preceding 12 months has been to restrict and control access to the contaminated areas. Those areas with contamination >1 kBq m-2, are deemed within the contaminated area and are subject to potential assessment.

Radioactive substances were also dispersed into nearby watercourses and reservoirs (Figure A.2), and water used during the emergency response was collected and stored in tanks.

Land use in the affected area is a mix of urban and rural which is composed of basic infrastructure including healthcare facilities, businesses, agricultural land and manufacturing factories.

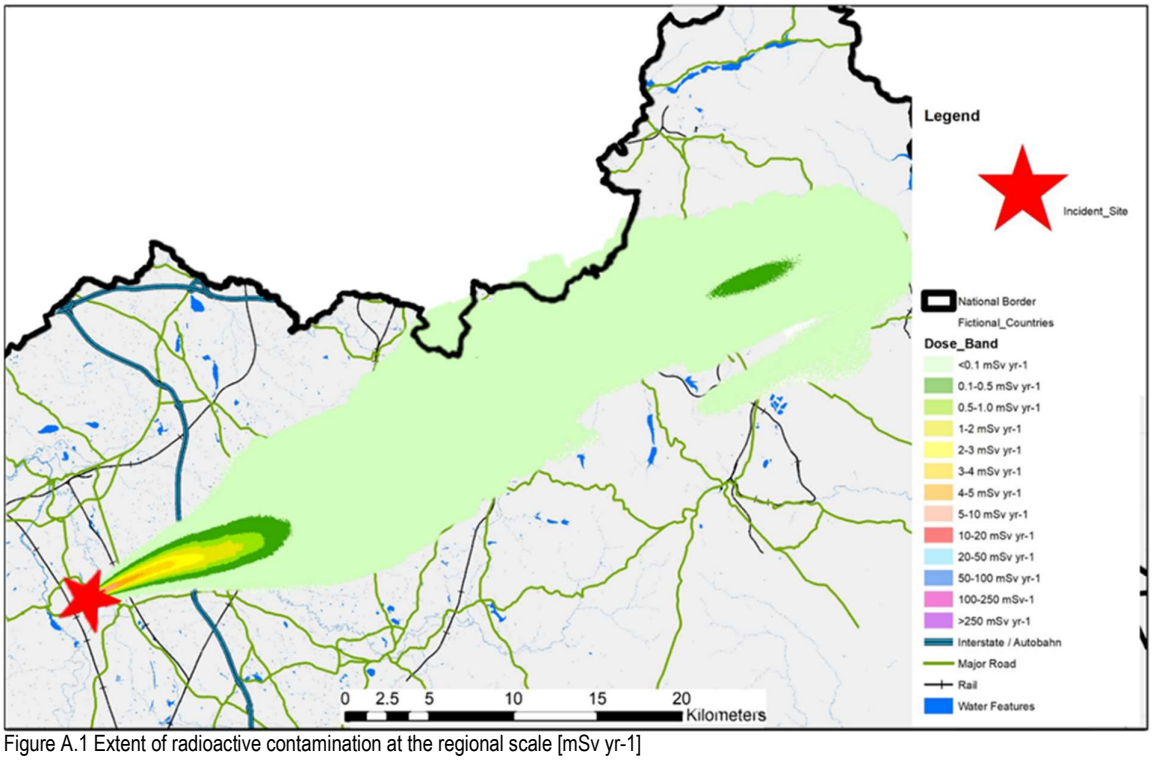

Figure A.1 Extent of radioactive contamination at the regional scale [mSv yr-1]

Evacuation

The incident occurred mid-morning when students and teachers were in school and employees were present at their workplaces. There were also transit populations, such as commuters and tourists. In addition, a number of vulnerable individuals, either through age or health, were located at medical, educational, caring and accommodation facilities at the time of the incident. Evacuation of residents, workers and vulnerable groups took place shortly after the aerial release caused by the incident based on dose prognosis modelling and assessments of emergency dose (> 30mSv) and ground shine dose rate from deposition (> 5mSv yr-1). These individuals were displaced into temporary accommodation.

12 months after the incident, the majority of areas from which residents were required to evacuate remain closed and are strictly prohibited from entering. Accordingly, all houses, buildings and infrastructures within these areas are inaccessible pending a decision around remediation and decontamination. Following a large monitoring and sampling programme to characterise the area, some parts that were initially evacuated were found to have no or very low-level contamination, meaning that residents and businesses could return. However, many residents have not been allowed to return and are becoming increasingly frustrated and unsettled by the conditions they are facing, with some displaying clear need for Mental Health and Psychosocial Support (MHPSS). Symptoms, such as chronic fatigue, insomnia, and headaches, are reported among them.

Healthcare

There are three hospitals/clinics in the affected area. One is a municipal hospital designated as a radiation emergency care centre, another is mental health clinic and the other is a nursing home for the aged. All the hospital/clinic patients/residents were evacuated (vulnerable evacuees) to other clinics and homes

surrounding the area immediately after the incident. The hospitals/clinics in the affected area have remained closed. The impact of re-locating the patients and residents is considerable and needs to be managed, particularly the observed physical and mental impacts this has had on vulnerable groups. A long-term strategy for restoring healthcare facilities is required.

Schools

1 school remains closed within the affected area, and 21 schools were closed temporarily but have since reopened as anticipated annual dose from deposition was confirmed to be less than 5mSv yr^{-1}. A lot of concerns are raised by parents who have children in areas with low contamination levels, including those where schools resumed soon after the incident.

Traffic

Roads and rail have been severely affected (Figure A.2). One of the main national highways and interconnecting rail routes pass through the contaminated area and have been closed pending a decision to remediate since the incident occurred. Neighbouring regions rely on these routes to distribute essential goods by rail and road. Alternative temporary distribution routes have been put in place, but this is putting pressure on the network and a permanent solution to restoring the highway and railway is critical.

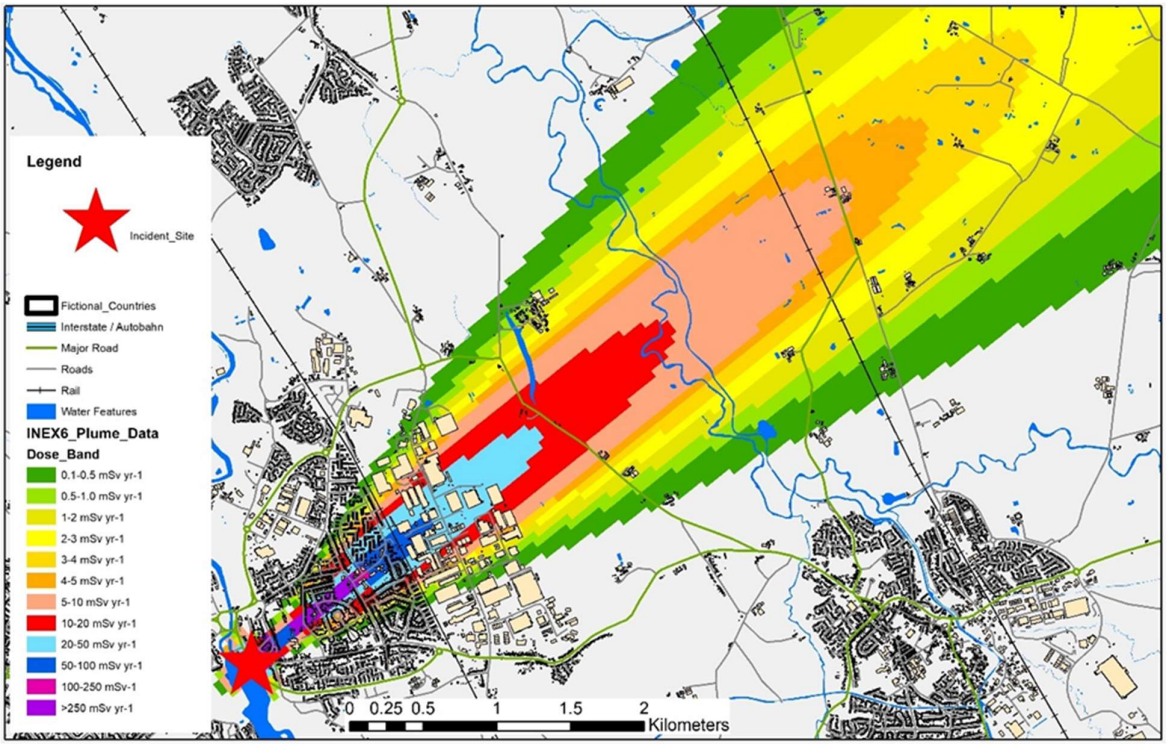

Figure A.2 Range of estimated ground shine dose rate from deposition at the local level [mSv yr-1]

Food Production

The agricultural land is used for the production of food, including crops and animals for products such as meat and eggs. When the incident happened, it was just before harvesting. Crops were left in the field and would form a part of solid wastes based on the selection of remedial measures. Local farmers who did not have restrictions imposed upon them by the incident are worried about long-term reputational damage to their products and the long-term impact on trade. Most of the agricultural food products in the area are

consumed locally, however the crops and meat produced in the area are also well-known nationally and internationally, so the potential of future exports is of concern. A detailed quality assurance programme, including monitoring and screening of food, will need to be established. A large proportion of the animals within the affected area were, or are planned to be, culled. Management of animal remains is of concern and a long-term plan to deal with the accumulated waste is needed. Production cannot resume until remediation of the agricultural land has taken place and wastes are suitably managed. Compensation of stakeholders involved in food production and supply is an ongoing concern.

Business

210 businesses (excluding schools and medical facilities) have remained closed since the start of the emergency resulting in significant economic and social impacts. The economic impact on these businesses equates to $2.2m (USD) per day, with many reporting significant financial losses. Within the affected area there is a large industrial estate, including businesses such as car manufacturing plant, offices, warehousing, hotels, transport etc. This industrial estate, which is in an area of high levels of contamination, employs many local residents. Owners are keen to resume business, however face supply chain and staffing issues, particularly where employees have been relocated to other areas. The trade of goods and commodities is challenging and a detailed monitoring and screening programme is needed in order to lift restrictions on contaminated goods currently in force. Compensation for those affected is also a significant consideration.

There would be an expectation for two-thirds of the 210 businesses to be released for reoccupation after some degree of remediation. However, there will be a number of staffing, supply chain and customer confidence issues that will require addressing at a national level.

There are approximately three-fourths of the 210 businesses within the >5 mSv $year^{-1}$ contaminated area. Normally, these would qualify as controlled radiological environments, bringing about a significant change and cost to working practices, in addition to regulatory control/oversight. Contamination controls would be necessary to enter and egress from these areas before and potentially after any radiological remediation. Remediation of these is likely to be costly and prolonged.

Stakeholder engagement and communications

In general, the local community has been adhering to the advice provided by the government and local officials. However, there is a growing demand within the public for action to restore and regenerate areas which have been affected by the incident. Local stakeholders are becoming increasingly concerned about what will happen to their homes, how infrastructure will be restored, and what impact this will have on them financially, for example the impact on house prices. Liability and compensation is a key cross-cutting theme of interest, with some industries already starting to file lawsuits. Media coverage of the incident has significantly reduced from the response phase, and the focus has shifted to the impact on people's lives and livelihoods. The affected community are demanding regular information and engagement about the risks involved and the proposed plan of action.

Annex B: Module-Specific Scenario, Information and Data for Module 1: Health Impacts

1. Your country or territory should determine their threshold for evacuation due to the short term doses and long term ground shine dose rates in the affected areas. Note that the data sets used here assume the following thresholds for evacuation. If the value of the participating country or territory is different from the thresholds, please change the value itself without changing the number of people.

    a. >30 mSv short term doses at the time of the accident (1 year ago)

    b. >5 mSv year^{-1} from ground shine ongoing dose rate

2. Estimates of the Effective dose from the emergency phase have been made. Irregular shapes of the Figure B.1 are due to assignment of doses estimates to ZIP codes/postal districts.

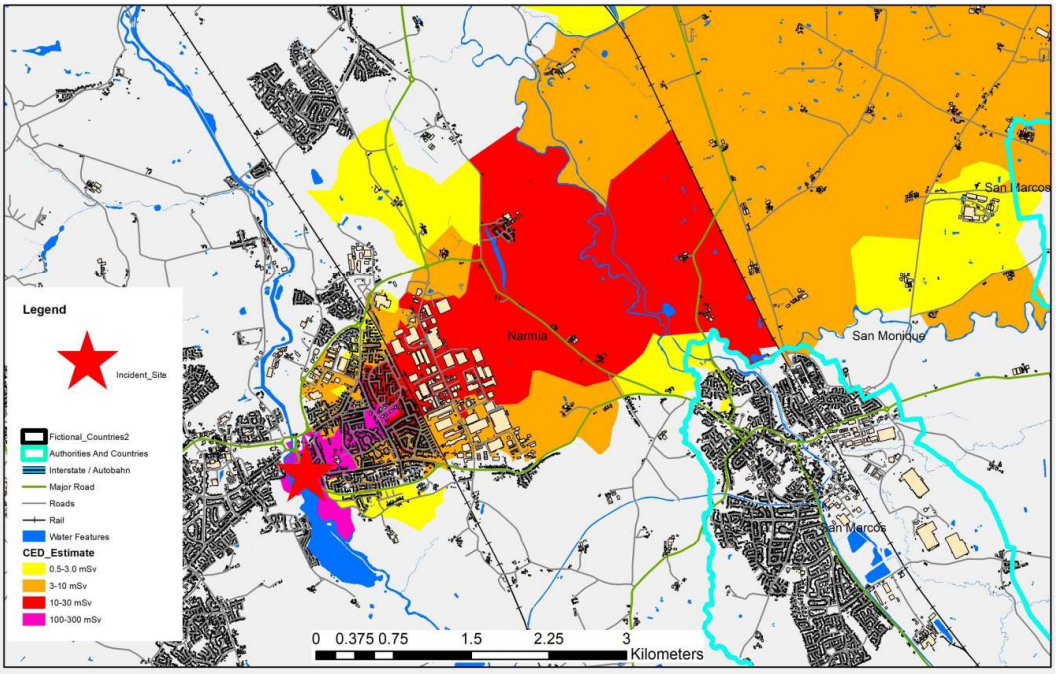

Figure B.1 Estimated effective doses by ZIP code/postal district

3. The incident occurred mid-morning when students and teachers were in school, and employees were present at their workplaces. There are also transit populations, such as hotels and commuting workers. Estimates for emergency doses alongside the number of transient and resident populations are presented.

Table B.1 Population type by emergency dose

Emergency Doses	Area (km^2)	No. of Residents	No. of Households	No. of Businesses	Estimated No. of Workers
0.5-3.0 mSv	104.6	44,030	19,022	2,960	44,400
3-10 mSv	26.7	3,529	1,491	258	3,870
10-30 mSv	6.0	1,877	751	160	2,400
30-100 mSv	0.3	766	356	34	510
100-300 mSv	0.3	638	280	11	165
Grand Total	137.9	50,840	21,900	3,423	51,345

4. People are considered vulnerable, either through age or health, if at the time of the incident they were located at medical, educational, caring and accommodation facilities.

Table B.2 Vulnerable groups by emergency dose

Likely Vulnerable People	**Potential People Affected**
0.5-3.0 mSv	**5390**
Boarding / Guest House / Bed And Breakfast / Youth Hostel	30
Children's Nursery / Creche	300
College	500
General Practice Surgery / Clinic	380
Hotel/Motel	200
Other Educational Establishment	480
Preparatory / First / Primary / Infant / Junior / Middle School	2040
Professional Medical Service	60
Secondary / High School	1200
Special Needs Establishment.	200
3-10 mSv	**155**
Boarding / Guest House / Bed And Breakfast / Youth Hostel	10
Children's Nursery / Creche	25
Preparatory / First / Primary / Infant / Junior / Middle School	120
30-100 mSv	**175**
Boarding / Guest House / Bed And Breakfast / Youth Hostel	10
Children's Nursery / Creche	25
General Practice Surgery / Clinic	20
Preparatory / First / Primary / Infant / Junior / Middle School	120
100-300 mSv	**440**
General Practice Surgery / Clinic	20
Preparatory / First / Primary / Infant / Junior / Middle School	420
Grand Total	**6160**

5. An evacuation occurred on the day of the accident involving 1404 residents, who were displaced into temporary accommodation based on the emergency dose (>30 mSv). An additional 1290 workers and vulnerable individuals (ex. School children and hospitalized individuals) were evacuated.

Table B.3 Emergency evacuees with greater than 30 mSv dose

Resident Evacuees	1404
Business Evacuees	675
Vulnerable Evacuees	615
Total Evacuees	2,694

6. Following a large monitoring and sampling programme to characterise the area, some areas were identified as having high ground shine doses. Table B.4 shows the dose rate and demographic situations of households and businesses in the affected areas.

Table B.4 Population type impacted and relocation potential

Impacts By Recovery Dose Band	**Population when the incident happened**				**Evacuated due to Ground Shine Dose Rate > 5mSv yr^{-1} during 12 months**			
Ground Shine Dose Band (mSv yr^{-1})	No. of Residents	No. of Households	No. of Businesses	Estimated No. of Workers	No. of Residents	No. of Households	No. of Businesses	Estimated No. of Workers
<0.1	601,741	259,604	474	7,110	0	0	0	0
0.1-0.5	68,127	29,013	2,632	39,480	0	0	0	0
0.5-1.0	1,464	618	75	1,125	0	0	0	0
1-2	230	94	18	270	0	0	0	0
2-3	388	142	9	135	0	0	0	0
3-4	28	11	32	480	0	0	0	0
4-5	0	0	18	270	0	0	0	0
5-10	216	96	39	585	179	73	38	570
10-20	217	91	29	435	171	70	28	420
20-50	230	113	52	780	198	90	44	660
50-100	85	36	20	300	85	36	20	300
100-250	0	0	9	135	0	0	8	120
>250	41	28	8	120	0	0	8	120
Grand Total	672,767	289,846	3,415	51,225	**633**	269	146	2,190

Notes
1. The number of residents is an over-estimate
2. The workers were affected in the emergency but most of them don't live in the affected area
3. There are up to 615 vulnerable people (including school children) from the local area. To avoid double counting, they are not identified explicitly in this table to avoid double counting them within the residential population.

7. Individuals living and working in areas with high ground shine (>5 mSv yr^{-1}) were evacuated in the following days of the emergency once the monitoring programme identified the risk.

8. The number of additional evacuees was approximately 500 because some had already been evacuated during the initial emergency phase.

9. Theme 1: Health Status & Theme 2: Medical Follow up and the Health Care System; There are more than 100 000 people who received estimated doses >0.5 mSv at the time of the incident and throughout the following year. Of those, there are 2,694 people who received estimated emergency doses between 30-300mSv. A total of 803 individuals received doses estimated to be >100 mSv. All of these individuals **may** need monitoring to refine their dose estimates and to track their health status depending on your national policies.

10. Theme 3: Mental Health; Approximately 3000 individuals were evacuated at the time of the incident and throughout the following year as the environmental monitoring program identified areas of elevated ground shine (>5 msv/yr). 1 year after the accident, these individuals remain evacuated and are living in reception centers and in neighboring communities in temporary housing.

Annex C: Module-Specific Scenario, Information and Data for Module 2: Food Safety

1. As a result of the radioactive substances dispersed by the incident, characterisation of the area revealed that agricultural land used for the production of meat and crops has been contaminated over 500km^2. A more detailed quality assurance programme, including monitoring and screening of food, needs to be established. The risk for ongoing contamination must be assessed, and products that need to be restricted from consumption must be identified. A clear strategy and campaigns to support the consumption and trade of food that is below radiological criteria is also needed, as some members of the public are expressing concerns about the government's criteria.

2. Most of the agricultural food products produced in the area are consumed locally. However, crops and meat produced in the area are also well-known both nationally and internationally.

3. Farmers in the surrounding areas who did not have restrictions imposed upon them are worried about long-term reputational damage to the local food production and the long-term impact of domestic and international trade.

4. Some large food retailers have decided that they will temporarily not sell products from the affected area due to low-market demand and a lack of reassurance about the food quality and safety from producers. With this in mind, some food companies and retailers announced that they would conduct independent screening of food products.

5. There is no contamination of food in neighbouring countries and territories. Water is not a consideration in this module, however, it remains an optional topic for participating countries and territories should they wish to include it.

6. The Table C.1 provides information on the produce that has been impacted by the incident.

Table C.1. Produce that has been impacted by the incident

Products	Activity*[1,2] (after the release) [Bq kg^{-1}]	Activity*[1,3] (1 year later) [Bq kg^{-1}]	Consumption Characteristics
Crop 1	< 350	Below detection limit	The third-largest producer in the country/territory
Crop 2	<400	Below detection limit	Consumed locally
Crop 3	<800	< 120	Consumed locally
Crop 4	<550	< 40	Well-known nationally and internationally
Animal 1	< 1,800	< 20	Consumed locally
Animal 2	< 700	Below detection limit	Consumed locally
Animal 3	< 2,300	< 50	Well-known nationally and internationally

*1) The < denotes a generic guide of figures, NOT limits of detection;
*2) Indicative radionuclides: Cs134, Cs137 and others;
*3) Indicative radionuclides: Cs134, Cs137.

7. Theme 1: Regulatory and Policy Framework; Large areas of agricultural land used for the production of crops and other food has been contaminated with radioactivity at varying levels. The production and supply of food from these areas was temporarily restricted during the emergency response phase while characterisation of the affected area took place. A decision is now required on the longer-term implementation of restrictions and the radiological criteria that will be used.

8. Theme 2: Quality Assurance; A large number of stakeholders, including consumer groups, producers and retailers, are calling for more information from government officials on how they plan to assure the quality and safety of food produced in the affected areas. Prior to the incident, approximately 150,000 tonnes of crops were supplied from the affected area each year. This number is much lower as a result of the incident, however, food that is produced will need to undergo rigorous monitoring and screening to ensure quality and a long-term plan for this to escalate as remediation efforts and production increase.

9. Theme 2: Quality Assurance; Food companies and retailers announced that they would conduct independent screening of food products to ensure customer safety. Some retailers within the country/territory have temporarily halted the sale of products from the affected area and advertised that they would only sell products with radioactivity levels below detection limits under the slogan "zero contamination“, regardless of the government's criteria for food contamination. Some members of the public are also expressing concern about the government's criteria.

10. Theme 3: Trade and consumer confidence; The CODEX guideline level for radioactive caesium in food products is 1000 Bq/kg. For the purposes of this scenario, the criterion for your country/territory is lower in comparison to these CODEX guidelines. A supplier has asked the government for permission to export products that cannot be sold domestically. The result of the measurement revealed that the radioactivity level within the food product was above the limit of your country/territory but still acceptable for the CODEX guideline levels. The exporter claims that although the product cannot be sold domestically, it satisfies the CODEX guideline levels and can be exported if the destination country/territory allows it.

11. Theme 3: Trade and Consumer Confidence; Over two years have passed since the incident. Remediation is well underway and agricultural products no longer exceed the limits in a number of areas that were affected by the incident. Compensation has been provided, up to this point, for several food products under the law for products impacted by the restrictions on deliveries. Relevant ministries and agencies have been instructed to consider the termination of the restrictions that have been in place, as well as ending compensation measures.

Annex D: Module-Specific Scenario, Information and Data for Module 3: Remediation and Decontamination

1. The weather conditions at the time of the incident meant the dispersion of contamination spread for many kilometres. Many factors have influenced the mobility of the dispersed of contamination during and after the emergency response phase, namely, weather, the movement of people and vehicles, and protective actions applied in the response phase. Accordingly, there has been additional complexity leaving several hotspots of contamination. The highest levels of contamination, in the region of 10-100 MBq m^{-2}, can be found closest to the scene of the incident extending out to ~1.5 km. Samples collected from the radioactively contaminated areas indicate the remaining presence of several major isotopes, including Cs137, Cs134, Am241, Ce144, Ru106, Sr90, Co60, H3, Pm147, Pu (all), U (except 238), and Cm242.

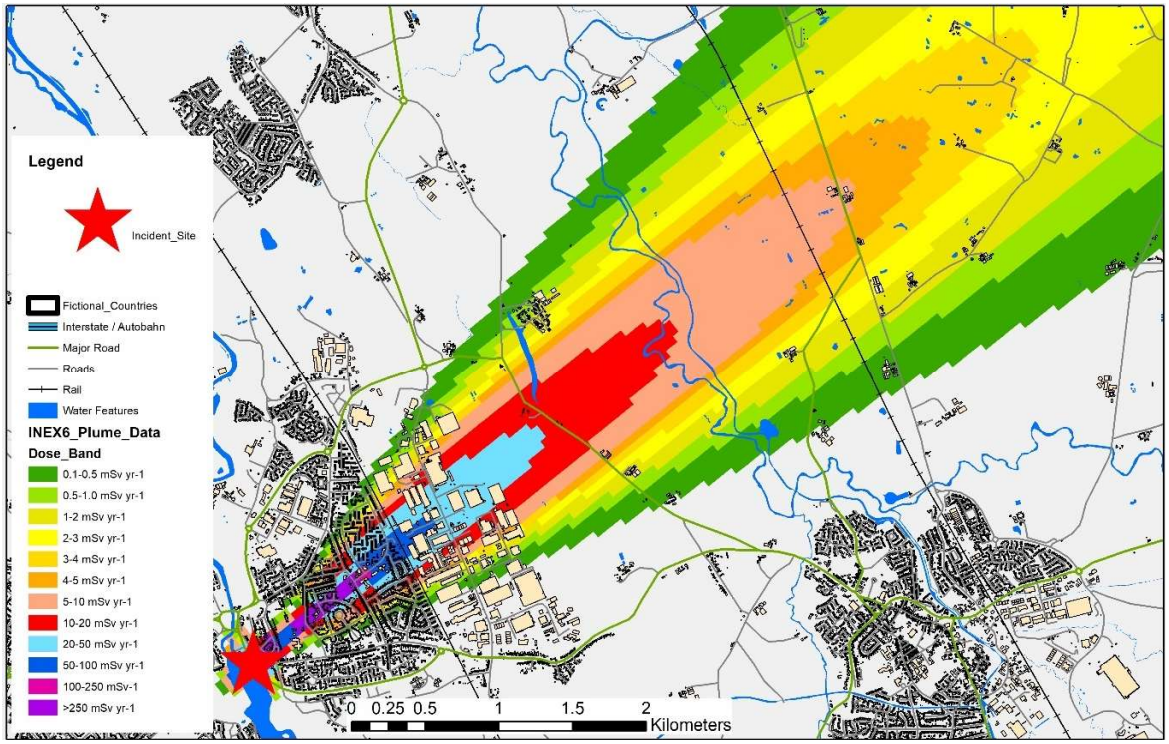

Figure D.1 Range of estimated ground shine dose rate from deposition at the local level [mSv yr^{-1}]

Table D.1 Area of contamination

Contamination Band (kBq m^{-2})	Area (km^2)
1-10	365.51
10-100	137.99
100-1,000	17.68
1,000-10,000	1.72
10,000-100,000	0.12
>100,000	0.02
Grand Total	523.04

2. So far, very little remedial action has been taken to decontaminate the area, but rather the approach has been to restrict and control access to the contaminated areas. Those areas with contamination >1 kBq m^{-2}, a total of 217,094 properties (210,005 residential and 7,089 businesses) are deemed within the contaminated area and subject to assessment and follow-up decisions around remedial actions.

3. Theme 1: Regulatory and Policy Framework; Areas that were restricted from access in the emergency response phase remain closed and decisions are required around the remediation of these areas so they can be re-opened. Such decisions will need to be supported by policy and legislation. Consideration of the levels of contamination and land-use need to be factored in along with a long-term vision for how the affected area will look following remediation and regeneration.

4. Theme 2: Identification of Remediation Goals and Remediation Actions; Radioactive contamination covered an initial area of over 500km^2. The affected area consisted of a mix of urban and rural (including agricultural) land-use. Some residents and businesses have been able to return in areas of no or very-low contamination, however, a number of residents and businesses remain closed. Approximately 210,005 homes and 7,089 businesses are located within the restricted areas pending a decision on remediation. Radionuclides present in the contaminated area, include Cs137, Cs134, Am241, Ce144, Ru106, Sr90, Co60, H3, Pm147, Pu (all), U (except 238), and Cm242. Radioactive contamination is present on a mix of surfaces, including external building surfaces (concrete, steel etc), internal building surfaces (carpets, personal belongings etc), roads and paved areas, and soil and vegegtation.1 school and 3 healthcare facilities (1 hospital) remain closed along with large areas of agricultural land, which has restricted the production and supply of food and commodities.

Annex E: Module-Specific Scenario, Information and Data for Module 4: Radioactive Waste Management

1. Since the radiological incident occurred, remediation of the affected area has taken place resulting in significant volumes of radioactive solid waste at various activity concentrations.

2. Liquid waste is out of scope.

3. Most of the waste is contaminated topsoil, vegetation and food waste (crops) and demolition waste (concrete, steel, etc). Initial characterisation of the waste has taken place during the remediation effort.

4. Remediation wastes have been locally collected and held at multiple holding areas. These consist of Soils, crops & timber, and hardcore (e.g. concrete, brickwork and tarmac) and segregated as < 10GBq/te and >10 GBq/te.

5. The contamination fingerprint comprises of a variety of isotopes, including; Co (4.6%), Cs (22%), Sr (10.7%) & long lived alpha emitters (6.4%).

6. The following 3 tables provide the waste categories, volumes, areas and activities for consideration in this module.

Table E.1 Contaminated soil (estimated)

Soil Activity – 5cm Depth (MBq/m^3)	Soil Removed (m^3)	Area (Hectares)	Total Activity (GBq)	Soil Mass (tonnes)
0.1	4,626,861	9,254	463	6,014,919
1	3,028,317	6,057	3,028	3,936,812
10	570,329	1,141	5,703	741,428
100	2,372,979	4,746	237,298	3,084,873
Grand Total	10,598,486	21,197	246,492	13,778,032

The contaminated soil information is presented in activity concentration categories

a. The contaminated crop information in presented in crop categories and activity concentration

Table E.2 Contaminated crops (estimated)

Crop and Contamination Band	Crop Waste (tonnes)	Area (Hectares)
Cereals	**7,980.7**	**1,047.2**
1-10 kBq m-3	2,195.3	306.4
10-100 kBq m-3	4,757.8	591.5
100-1000 kBq m-3	1,007.0	139.7
1-10 MBq m-3	20.6	9.6
Grassland	**56,960.2**	**18,986.7**
1-10 kBq m-3	38,348.8	12,782.9
10-100 kBq m-3	15,531.1	5,177.0
100-1000 kBq m-3	2,961.8	987.3
1-10 MBq m-3	118.5	39.5
Trees	**51,917.9**	**1,161.9**
1-10 kBq m-3	38,274.9	855.9
10-100 kBq m-3	12,782.5	286.9
100-1000 kBq m-3	617.3	13.7
1-10 MBq m-3	243.2	5.4
Grand Total	**116,858.8**	**21,195.8**

b. The demolition waste information is presented in categories that identify the area from which it comes (divided by the annual dose rates in those areas)

Table E.3 Contaminated demolition waste (estimated)

Waste activity concentration by area	Activity consigned (GBq)	Demolition Waste Raw (m^3)	Packaged Volume (m^3)
Area where dose rate is <100 mSv yr-1	**1411.9**	**40099.6**	**48119.5**
<10 MBq m-3	1112.4	36683.3	44020.0
<100 MBq m-3	299.5	3416.3	4099.5
Area where dose rate is <250 mSv yr-1	**155.58**	**1440.7**	**1728.8**
<100 MBq m-3	155.58	1440.7	1728.8
Area where does rate is >250 mSv yr-1	**7372.5**	**13596.5**	**16315.8**
<100 MBq m-3	4124.4	10113.8	12136.5
>100 MBq m-3	3248.3	3482.7	4179.2
Grand Total	**8940.3**	**55136.8**	**66164.1**

7. Theme 1: Regulatory and Policy Framework; The volumes of waste presented on Table E.1 to E.3 likely exceed or severely stretch capacity for managing radioactive waste under routine operations. Therefore, novel approaches, techniques and legislation may need to be considered.

8. Theme 2: Transport of Radioactive Waste; It is based on one type of waste, contaminated topsoil, to explore as an example. The topsoil to be packaged and transported has been cleared from the contaminated areas and segregated by activity concentration. It has been piled and covered in fields across the contaminated area awaiting onward transportation to storage facilities. 13,778,032 tonnes of contaminated soil has been removed from farmer's fields. Some of that waste may need to be moved from the fields to the temporary storage location (authorized government repository) in compliance with the IAEA Regulations for the Safe Transport of Radioactive Material (Class 7 potentially combined with other hazards). Nations may decide to leave some of the lower activity soil in place. Assume an average load per dump truck of 10 tonnes of soil.

9. Theme 3: Temporary Storage; It is based on one type of waste, contaminated topsoil, to explore as an example. Due to the volume of topsoil to be stored, the waste will need to be moved to a 'staging area' as an intermediate step, before being moved for longer-term temporary storage. As many as 13,778,032 tonnes of topsoil removed from farmlands are in 1 tonne industrial bags. These need a staging area prior to longer term storage.

10. Theme 4: Disposal Routes; There are 66,164 tonnes of steel, glass, wood, and gravel/aggregate that have been removed through remediation and are contaminated at various levels.

11. Theme 4: Disposal Routes; After reuse and recycling programs were applied, there is a large residual amount (35,000 tonnes) of contaminated construction materials (primarily wood) that is suitable for incineration. There are also 7,980 tonnes of cereal crop that are in temporary storage.