Radiological Protection Institute of Ireland

An Institiúid Éireannach um Chosaint Raideolaíoch

Guidance Notes on Intervention Planning and Emergency Preparedness for Radiological Accidents

Guidance Notes

On Intervention Planning and Emergency Preparedness for Radiological Accidents

Radiological Protection Institute of Ireland
3 Clonskeagh Square,
Dublin 14

August 2008

Contents

Legislative Framework

Article 37 of the Radiological Protection Act, 1991 (Ionising Radiation) Order, 2000, S.I. No. 125 of 2000 on Intervention and Emergency Preparedness, states that in the case of a practice in relation to which a licence has been granted, the undertaking carrying on the practice shall, when directed in writing by the Institute to do so:-

1. Evaluate the possibility of a radiological emergency resulting from the practice which would give rise to significant hazards to members of the public,
2. Evaluate the likely spatial and temporal distribution of the radioactive substances dispersed in the event of such an emergency and the corresponding potential exposures,
3. Prepare an appropriate intervention plan to deal with such an emergency. The intervention plan shall be prepared after consultation with the Institute and the local authority within whose functional area the undertaking carries on the practice,
4. Submit a copy of the intervention plan to the Institute and the relevant local authority as soon as it is prepared,
5. Carry out drills and exercises to test the intervention plan at regular intervals,
6. Ensure that, where appropriate, suitably trained personnel are available for technical, medical and health intervention, and
7. Ensure that any person under the control of the undertaking who may be involved in or may be affected by the intervention plan is given suitable instruction in the arrangements of the plan.

This guidance note is intended to be of assistance to licensees in drafting appropriate intervention plans to deal with radiological emergencies.

Introduction and Scope

Certain categories of licensee, such as those involved in the transportation of radioactive materials, those involved in industrial radiography, those involved in research and/or industrial irradiation, those with six or more sealed radioactive sources in gauges (other than beta backscatter gauges) and those hospitals with nuclear medicine or radiotherapy departments shall be directed by the Institute to prepare intervention plans in accordance with the provisions of Article 37 above.

The purpose of an intervention plan is to minimise the radiation exposure to the employees of the undertaking concerned, to the general public and to the emergency services personnel that may arise from any radiological emergency associated with a practice. Radiological emergencies can range from minor unplanned events or incidents involving spillages of small quantities of unsealed radioactive materials to more serious radiological events or incidents involving industrial radiography sources, irradiation facilities or medical radiotherapy sources.

General Content of the Plan

The level of detail in the intervention plan should reflect the circumstances anticipated. For certain practices, such as site radiography and the transport of radioactive materials, a generic plan may be appropriate. This generic plan would cover possible accidents and incidents associated with standard operating procedures carried out in different places at different times, but where the consequences of the accident or incident are likely to be similar.

In particular, the intervention plan should identify:

1. The individuals responsible for activating and co-ordinating the plan, the staff involved, including contact numbers, and their assigned responsibilities,
2. The procedures for assessing the seriousness of the situation,
3. The notification procedures for informing the Institute, emergency services and the relevant local authority,
4. The circumstances in which the emergency services should be involved and the arrangements for medical assistance for dealing with conventional and radiation induced injuries,
5. The immediate mitigating actions to be taken, for example in clearing the accident area and establishing temporary means of preventing access to that area,

6. The organisation of intervention appropriate to the circumstances of the radiological emergency and the assessment of the effectiveness of the intervention,
7. The information that should be given to the public and/or the media, concerning measures being taken to limit the consequences of the accident or incident,
8. The nature and location of personal protective equipment required and the procedures to be adopted in using this equipment,
9. The number and type of radiation and contamination monitors required,
10. The personal dosimetry requirements for people involved in limiting the consequences of the accident or incident,
11. The level of personnel training required and the type and frequency of exercises that should be undertaken,
12. The post-incident dosimetry requirements to determine the doses received by all personnel affected involved in the incident, and
13. The mechanism and responsible person(s) for reviewing and updating the emergency plan.

In determining the extent and frequency of drills and exercises required to test and maintain the various provisions of the intervention plan consideration should be given to:

1. The potential severity of the accident or incident,
2. The likely doses that could be received by employees, general public and emergency personnel,
3. The complexity of the intervention plan,
4. The number of people likely to be involved in its implementation, and
5. The involvement of the emergency services.

Six Stages in Intervention Planning

Intervention planning and emergency preparedness can generally be regarded as comprising six stages:

1. Identification of potential accidents and other emergency situations that may arise and the evaluation of the risks associated with these,
2. Development of an intervention plan to deal with the identified hazards,
3. Specification and acquisition of emergency equipment,
4. Training to implement the intervention plan, including training in the use of the emergency equipment,
5. Exercises at appropriate intervals to test the implementation of the intervention plan, and
6. Periodic reviews and, where necessary, updating of the plan.

Responsibility for adequately implementing each of the six stages of the intervention plan rests with the licensee. Implementation of the plan may involve participation by outside organisations and specialist consultants. If so, then the intervention plan must clearly address such outside participation and must ensure that outside participants are fully aware of, and accept, their various responsibilities.

1. Initial Safety/Risk Assessment

The starting point for preparing the intervention plan should be the identification of all reasonably foreseeable accident and emergency situations, including their likely causes, and an estimation of the potential doses to all persons including workers, those who may be involved in dealing with the incident and members of the public.

While the nature of the sources, the activities for which they are used, and the environment in which they are located should be taken into account in individual plans, experience to date has shown that there are a number of identifiable events that have the greatest potential for causing significant radiation exposure to workers and possibly the general public.

Sealed Sources

Reasonably foreseeable emergency situations involving sealed sources include:

- A theft or loss of a source, container or exposure device,
- Damage to a source or container, for example mechanical damage as a result of someone inadvertently cutting or filing a source, fire damage, corrosion and damage during transport,
- Radioactive contamination resulting from a damaged or faulty source, and
- Malfunction or deliberate override of safety systems.

In the case of industrial radiography the following emergency situations can be considered as reasonably foreseeable:

- Failure to retract a source into its shielded container,
- A source becoming stuck outside a shielded container, whether within the collimator, the guide tube or close to the entrance to the container, and
- Disconnection of a source from a wind-out cable.

In the case of gauge sources, the most common incident involves failure of the shutter mechanism with the shutter remaining open.

Each of these emergency situations constitutes an event that will necessitate the implementation of the intervention plan. In cases where appropriate controls are not in place, or the required intervention is not undertaken, each of these scenarios can lead to a serious radiological accident.

Radiation Generators (Irradiating Apparatus)

Reasonably foreseeable emergency situations involving radiation generators, for example in industrial X-ray applications, include:

- An exposure timer failing to terminate an exposure,
- Unintentional energising of an X-ray tube,
- An operator failing to terminate a manually controlled exposure,
- A malfunction of a critical safety or warning system, including deliberate action to override the system,
- Physical damage leading to equipment malfunction or damage to shielding, and
- The theft or loss of an X-ray unit, which, might then be operated by an unauthorised person.

In each of the above scenarios an accident situation becomes likely if the event is accompanied by a failure of the associated safety and warning systems, or if the operator fails to heed a warning signal. The intervention plan should focus on each of the above scenarios to ensure that, if they occur, they do not lead to an accident where an individual may be exposed to a significant radiation dose.

Unsealed Sources

Reasonably foreseeable emergency situations involving unsealed sources include:

- The loss, theft or other misappropriation of a radioactive substance,
- The spillage of radioactive substance, including in the case of a gas, aerosol or dust a release to the atmosphere,
- An incident involving contamination which might result in ingestion or inhalation, and
- An incident occurring during the transport of radioactive materials and involving damage or suspected damage to the packages.

2. Development of Intervention Plan

The intervention plan should address each reasonably foreseeable accident situation and should be so designed so as to restrict, as far as is reasonably achievable, any exposures that may result from the identified accident situation. In particular the intervention plan should:

1. Identify those persons authorised to implement and co-ordinate the various stages of the plan,
2. Identify those persons/organisations that should be notified at the various stages of the plan i.e., the Institute, emergency services and the relevant local authority including their telephone, mobile and fax numbers, email and postal addresses,
3. Explicitly state when and how the intervention plan shall be implemented,
4. Detail the procedures to be followed at various phases, specific to each identified potential emergency situation. Various phases within an overall plan might be the initial identification phase, the incident response phase, the recovery phase and the post-accident and follow-up phase,
5. Detail the special procedures to be followed in life threatening situations including details of all emergency medical support and their relevant contact telephone numbers,
6. Include a list of the type, availability and location of all emergency equipment that should be available,
7. Include a list of first aid equipment that should be available and its location along with the names of persons trained to use it, and
8. Include, where appropriate, an outline of the post-emergency procedures necessary to restore normal operating conditions.

The intervention plan should also include the following general advice that will be applicable in all situations:

- Avoid panic,
- Never touch a radioactive source,
- Prevent unauthorised access to the site of the incident,
- Retire to a safe distance, plan subsequent actions and then implement the plan,
- Seek the advice of experts if you are uncertain what to do, and
- Seek additional assistance where necessary.

3. Emergency Equipment

The licensee should ensure that emergency equipment, appropriate to dealing with an emergency situation is provided. Furthermore the equipment should be readily available and functional at all times.

The following is a guide to emergency equipment that is likely to be required. Additional equipment may be also required depending on the nature of the sources involved and the emergency situation:

- An appropriate number of functional and calibrated survey meters, contamination monitors and personal electronic doserate meters,
- Barrier materials and warning notices,
- Bags of lead shot, spare lead sheet, collimators,
- Suitable tool kit and source recovery equipment (long handling tools, pliers, screwdrivers, bolt cutters, spanners, hacksaws, torch etc.),
- An emergency shielded storage container,
- Communication equipment,
- Spare batteries,
- Stationery supplies, and
- Equipment manuals.

Procedures should also be put in place to ensure that regular audits are carried out to verify that all emergency equipment is on site and functioning correctly.

4. Training

All persons assigned a role in the intervention plan should be adequately trained to ensure efficient and effective implementation of the plan. This training should include familiarisation with, and an understanding of, their role in the plan, together with training in the use of emergency equipment. Training provisions should be audited at appropriate intervals, which should not in any case exceed 12 months.

5. Emergency Exercises

Emergency exercises to test critical components of the intervention plan should be held at regular intervals commensurate with the potential radiological hazard. After each exercise a comprehensive review of the exercise should be undertaken and the intervention plan reviewed and, if necessary, amended to take account of the results of the exercise.

6. Periodic Review of the Intervention Plan

A formal comprehensive review of the intervention plan should be undertaken as follows:

1. Within the licence period prior to renewal of the licence,
2. Immediately following the introduction of any new item of equipment, or modification to a procedure, which may have an effect on safety, and
3. Following an exercise of the intervention plan.

In addition a review of the plan with respect to named individuals, communication lines and the provision of emergency equipment shall be undertaken on an annual basis.

The periodic review should include provisions to update any relevant aspects of the intervention plan in response to lessons learned from accidents that have occurred elsewhere.
An essential part of the whole review process is to learn from accident situations that do occur and to feed back the lessons learned so as to improve equipment, operating procedures and the intervention plan. To this end a comprehensive accident report shall be prepared.

Useful References

Radiological Protection Act, 1991 (Ionising Radiation) Order, 2000, S.I. No. 125 of 2000.

Council Directive 96/29/EURATOM of 13 May 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation.

Radiological Protection Institute of Ireland, Guidelines for Reporting of Incidents, January 2002.

International Atomic Energy Agency, Method for Developing Arrangements for Response to a Nuclear or Radiological Emergency (updating IAEA-TECDOC-953), Vienna, September 2003, ISBN 92-0-111503-2.

International Atomic Energy Agency, Emergency Planning and Preparedness for Accidents Involving Radioactive Materials used in Medicine, Industry, Research and Teaching, Safety Series No. 91, Vienna, January 1989, ISSN 0074-1892.

International Atomic Energy Agency, Emergency Response Planning and Preparedness for Transport Accident Involving Radioactive Material, Safety Series No. 87, Vienna, January 1998, ISBN 92-0-123088-5.

International Atomic Energy Agency, Regulations for the Safe Transport of Radioactive Material – 1996 Edition (Revised), Safety Standard Series No. TS-R-1 (ST-1, Revised), 2000. STI/PUB/1098, ISBN 92-0-100500-8.

International Atomic Energy Agency, Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material, Safety Standard Series No. TS-G1.1 (ST-2), 2002. STI/PUB/1109, ISBN 92-0-111802-3.

International Atomic Energy Agency, Planning and Preparing for Emergency Response to Transport Accidents Involving Radioactive Material, Safety Standard Series No. TS-G-1.2 (ST-3), 2002. STI/PUB/1119, ISBN 92-0-111602-0.

International Atomic Energy Agency Website: www.iaea.org.

Radiological Protection Institute of Ireland
An Institiúid Éireannach um Chosaint Raideolaíoch

Mission Statement

"In the three year period from 2008 to 2010 the RPII will grow the level of awareness and implementation of the measures needed to protect people in Ireland from the harmful effects of ionising (and non-ionising) radiation through scientifically based regulation, monitoring and advice."

Contact us

Radiological Protection Institute of Ireland (RPII)
3 Clonskeagh Square
Dublin 14,
Ireland
Tel: +353 1 2697766
Fax: +353 1 2697437
Email: rpii@rpii.ie
Web: www.rpii.ie