



ATOMIC ENERGY COUNCIL

**GUIDANCE ON DOCUMENTING AND IMPLEMENTING
RADIOLOGICAL EMERGENCY RESPONSE PLANS FOR X-RAY
GENERATING EQUIPMENT**

AEC/NSS/GD 5.1, 2026

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Table of Contents

1.0 Introduction	6
1.1 Authority.....	6
1.2 Citation	6
2.0 Purpose.....	6
3.0 Scope	6
4.0 ELEMENTS OF THE EMERGENCY RESPONSE PLAN	7
4.1 Cover page.....	7
4.2 Facility and Activity Information	7
4.2.1 Site and Facility Layout	7
4.3 Radiation source inventory	7
4.4 Objective and Scope of the Emergency response plan.....	8
4.5 Potential hazards.....	8
4.6 Incident/Accident Preventive Measures.....	8
4.7 Mitigation.....	9
4.8 Assessment of Radiation Emergencies	9
4.9 Declaration of Radiation Emergencies	9
4.10 Communications and Arrangements.....	9
4.11 Notification Point.....	9
4.12 Organizational Structure and Responsibilities	10
4.12.1 Emergency Coordinator	10
4.12.2 Radiation Safety Officer (RSO)	10
4.12.3 X-ray operators.....	10
4.12.4 Emergency Workers.....	11
4.12.5 Facility Security personnel.....	11
4.12.6 Medical personnel.....	11
4.12.7 Fire Protection personnel	11
4.13 Emergency Plan Implementing Procedures	12
4.13.1 Restriction of Affected Area	12
4.13.2 Protection of Emergency Workers	12
4.13.3 Emergency Facilities, Supplies and Equipment.....	12
4.13.4 Coordination with Off-site Organizations/Authorities.....	12
4.13.5 Termination of Radiation Emergency	12
4.13.6 Recovery and Rehabilitation	13
4.14 Training of Personnel and Conduct of Emergency Exercises	13
4.15 Record Keeping and Report Preparation	13
4.16 References/Applicable Code and Standards, Tables and Annexure.....	13
4.17 Definitions and Abbreviations	13
5.0 REVISION OF RADIATION EMERGENCY RESPONSE PLAN	14
6.0 QUALITY ASSURANCE	14

7.0 CONCLUSION	14
8.0 Facility Declaration.....	14
8.1 Declaration by the Authorized Person / Facility Management.....	14
8.2 Regulatory Review and Approval (For Official Use)	15
Reviewed by:.....	15
Designation:.....	15
Regulatory Authority	15
Atomic Energy Council (AEC)	15
Decision.....	15
Approved	15
Approved with conditions.....	15
Not Approved.....	15
Reference No.:	15
Date of Decision:	15
Authorized Signature and Seal.....	15
9.0 REFERENCES.....	15

1.0 Introduction

Radiation sources used in medical, industrial and research applications, if not adequately controlled, may pose risks to workers, the public, and the environment. In accordance with the principles of International Atomic Energy Agency (IAEA) Safety Standards Part 7 (Preparedness and Response for a Nuclear or Radiological Emergency), facilities using radiation sources shall establish and maintain emergency preparedness and response arrangements commensurate with the hazards and associated risks of the practice.

Pursuant to Section 59(1) of the Atomic Energy Act Cap. 154, the authorized person bears primary responsibility for ensuring the safe control and management of radiation sources during nuclear or radiological emergencies. Consequently, where a practice or radiation source has the potential for accidents or emergencies, the authorized person is required to ensure that an appropriate emergency plan is prepared, implemented, maintained, and kept operational at all times.

This guide provides structured guidance to applicants and authorized persons on the preparation, documentation and implementation of radiological emergency response plans, with particular emphasis on facilities operating X-ray generating equipment in both medical and industrial facilities. The guide shall be applied using a graded approach, commensurate with the hazard potential and category and complexity of the X-ray generating equipment and associated activities.

1.1 Authority

This Guide is issued pursuant to Sections 59 and 73 of the Atomic Energy Act, Cap. 154.

1.2 Citation

This document may be cited as the Atomic Energy Council Guide on documenting and implementing Radiological Emergency Response Plans for X-ray generating equipment (Medical and Industrial Facilities): AEC/NSS/GD 5.1, 2026

2.0 Purpose

To provide guidance to applicants and authorized persons on the documentation and implementation of radiological emergency response plans for operating X-ray generating equipment.

3.0 Scope

This guide applies to facilities using X-ray generating equipment, including but not limited to:

a) Medical diagnostic X-ray machines

- i. Computed Tomography (CT) scanners
- ii. Fluoroscopy systems
- iii. Dental X-ray units
- iv. X-ray machines

b) Industrial X-ray inspection systems e.g. Security screening X-ray systems

4.0 ELEMENTS OF THE EMERGENCY RESPONSE PLAN

Emergency response plans shall be hazard-based, graded, concise, operational, and facility-specific. The plans shall describe response actions for all credible emergency scenarios arising from the operation, malfunction, misuse, or damage of X-ray machines.

The elements of an emergency response plan have been provided as follows;

4.1 Cover page

This section should provide the title of the emergency response plan, version and validation date on a headed paper.

Other information should also be provided such as authors, preparation date, reviewer and review date, the responsible manager and the approval dates and signatures:

4.2 Facility and Activity Information

This section should provide a description of the facility and its geographical location.

The following information should be provided:

- a) Name and address of the facility
- b) Departments or units where units where X-ray equipment is installed or operated
- c) Operating hours of the facility
- d) Number of authorized personnel
- e) Identification of nearby facilities or activities that may be affected by a radiological emergency.

4.2.1 Site and Facility Layout

This section should provide a facility layout showing:

- a) X-ray rooms and controlled areas
- b) Locations of X-ray machines
- c) Access control points
- d) Evacuation routes
- e) Emergency access paths
- f) Adjacent work areas and public access area

4.3 Radiation source inventory

This section should provide details of the X-ray equipment covered by the emergency response plan. The inventory should include the following information;

- a) Equipment name/type
- b) Installation type (fixed, mobile, or portable)
- c) Manufacturer
- d) Year of Manufacture
- e) Country of Origin
- f) Purpose of the equipment

- g) Model and serial number
- h) Maximum tube voltage (kVp)
- i) Maximum tube current (mA)

4.4 Objective and Scope of the Emergency response plan

This section should clearly describe the objectives and scope of the emergency response plan.

The emergency plan should clearly define objectives including but not limited to:

- a) Protection of workers, patients, the public, and the environment;
- b) Prevention and mitigation of accidental radiation exposure
- c) Rapid identification and control of abnormal conditions
- d) Coordination with external emergency services
- e) Restoration of safe facility operations
- f) Coordination with off-site response organizations;
- g) Restoration of normal operations.

4.5 Potential hazards

This section should describe potential hazards associated with X-ray equipment.

The hazard assessment should address but not limited to:

- a) Potential accidental radiation exposure
- b) Equipment malfunction or failure
- c) Failure of safety interlocks or shielding
- d) Electrical hazards associated with X-ray generators
- e) Fire hazards affecting X-ray rooms or equipment
- f) Unauthorized operation or access to equipment
- g) Natural hazards such as fires, floods or earthquakes
- h) Power failure
- i) Human error or equipment misuse

4.6 Incident/Accident Preventive Measures

This section should describe preventive measures based on the results of hazard assessments.

These measures should include but not limited to:

- a) Access control to X-ray rooms
- b) Interlock and warning systems
- c) Preventive maintenance programs
- d) Routine inspection and testing of safety systems
- e) Operating procedures and radiation protection measures

These arrangements should be periodically reviewed and updated.

4.7 Mitigation

This section should describe measures to minimize consequences of incidents such as:

- a) Immediate shutdown of X-ray equipment
- b) Isolation of affected areas
- c) Evacuation of personnel where necessary
- d) Medical evaluation of potentially exposed individuals

4.8 Assessment of Radiation Emergencies

This section should describe procedures for evaluating radiation emergencies and their potential consequences. This should include:

- a) Use of radiation survey meters
- b) Personal dosimetry records
- c) Area monitoring procedures
- d) Assessment of potential exposure scenarios

4.9 Declaration of Radiation Emergencies

The plan should define criteria and parameters for declaring a radiation emergency.

The plan should specify:

- a) Conditions requiring transition from normal operations to emergency response
e.g. (i) Failure of X-ray equipment safety interlocks
(ii) Accidental exposure to radiation
(iii) Fire involving X-ray equipment
(iv) Damage to shielding structures
- b) Procedures for emergency declaration should be clearly described
- c) Communication procedures and announcement formats
- d) Procedures applicable during both working and non-working hours

4.10 Communications and Arrangements

This section should describe periodic test communication arrangements. These arrangements should include:

- a) Methods for alerting emergency responders and facility personnel
- b) Internal emergency communication procedures
- c) Warning systems for the public where applicable
- d) Emergency contact numbers
- e) Procedures for notifying Atomic Energy Council within one hour of a significant incident

4.11 Notification Point

This section should describe emergency notifications arrangements.

The authorized person should establish a notification point responsible for receiving incident reports, Initiating emergency response actions and communicating with regulatory authorities and emergency services.

4.12 Organizational Structure and Responsibilities

This list of phone numbers of the notification points and all personnel involved including those responsible for implementing and maintenance of the emergency response plan.

These personnel may include but not limited to:

- a) Emergency Coordinator
- b) Radiation Safety Officer (RSO)
- c) X-ray operators
- d) Emergency workers
- e) Facility security personnel
- f) Medical personnel
- g) Fire protection personnel

4.12.1 Emergency Coordinator

This section should indicate and designate an Emergency Coordinator with clear roles and responsibilities.

The Emergency Coordinator shall have overall authority for command, control and coordination of emergency response actions.

His/her responsibilities may include but not limited to:

- a) Initiating response actions
- b) Coordinating response teams
- c) Implementing corrective actions
- d) Declaring and terminating emergencies
- e) Communicating with the public and media. He/she must ensure that the information is accurate, timely, clear and consistent.

Contacts details of an alternate Emergency Coordinator shall also be provided.

4.12.2 Radiation Safety Officer (RSO)

This section should describe roles and responsibilities for Radiation Safety Officer.

His/her responsibilities may include;

- a) Assessing actual or potential radiation exposure
- b) Arranging dosimetry and radiation monitoring
- c) Coordinating decontamination and environmental monitoring

4.12.3 X-ray operators

This section should describe roles and responsibilities for the X-ray operators.

These workers should be clearly designated, trained, and equipped to perform their assigned roles.

4.12.4 Emergency Workers

This section should describe roles and responsibilities for the emergency workers.

Emergency workers shall be designated, trained and equipped to perform emergency response functions. Some of their responsibilities include providing medical care to exposed or contaminated individuals. These workers should be clearly designated, trained, and equipped to perform their assigned roles. A formal training program should be established that is specific to the roles defined in the emergency plan. The training program should include;

- a) Applicable legislation and regulations
- b) Facility knowledge
- c) Radiation protection procedures
- d) Emergency response protocols
- e) First aid training

4.12.5 Facility Security personnel

This section should describe roles and responsibilities of facility security personnel related to emergency response.

The facility security personnel should be trained and equipped to handle and control emergency situations. The major responsibilities of security personnel during the emergency response may include the following;

- a) Evacuation of personnel
- b) Control of access to affected areas
- c) Establishment of assembly areas
- d) Personnel accountability
- e) Coordination with law enforcement agencies and means of communication for emergency teams, and liaison with local law enforcement agencies and rescue services during emergency response

4.12.6 Medical personnel

This section should describe roles and responsibilities for the medical personnel that shall support emergency response. Some of their responsibilities include providing medical care to exposed or contaminated individuals. Medical personnel involved in emergency response should participate in periodic training and emergency exercises conducted at the facility.

Where on-site care is not available, arrangements shall be established with external medical facilities.

4.12.7 Fire Protection personnel

This section should describe fire protection responsibilities. The established coordination arrangements with local fire services and other emergency agencies should be clearly defined.

4.13 Emergency Plan Implementing Procedures

This section should describe approved procedures detailing response actions. These should be developed, maintained, and made readily accessible to all responsible personnel. These procedures may include;

- a. Shutdown of X-ray equipment
- b. Evacuation procedures
- c. Isolation of affected areas
- d. Protection of emergency workers

4.13.1 Restriction of Affected Area

The emergency response plan should describe procedures for restricting access, cordoning off affected areas, and displaying warning signs shall be defined, including criteria for access control and clearance. The access to affected area of facility/activity should be restricted for public/non-emergency workers.

4.13.2 Protection of Emergency Workers

The emergency plan should describe arrangements for the protection of emergency workers. The mechanism for managing, controlling and recording the doses received by emergency workers should be described in emergency plan.

4.13.3 Emergency Facilities, Supplies and Equipment

This section should describe well maintained emergency response equipment including;

- a) Radiation survey meters
- b) Personal dosimeters (e.g. Pen Dosimeter, Electronic Personal Dosimeter - EPD etc.)
- c) Protective equipment (e.g. lead apron, face masks, gloves, shoe cover, paper suits etc.)
- d) Communication devices

4.13.4 Coordination with Off-site Organizations/Authorities

This section should describe measures for coordination with off-site organizations and notification to the Atomic Energy Council including contact details. Emergency arrangements should include coordination with:

- a) Fire services
- b) Hospitals
- c) Police services
- d) Atomic Energy Council

4.13.5 Termination of Radiation Emergency

This section of the emergency response plan should clearly describe conditions for terminating an emergency and returning to normal operations. The process of termination of emergency should also be clearly defined for working and off-working hours including communication and announcements to be made.

4.13.6 Recovery and Rehabilitation

This section of the emergency response plan should describe recovery actions and transition back to normal operations in compliance with Atomic Energy Regulations, 2012.

The recovery actions may include:

- a) Investigation of the incident
- b) Repair or replacement of equipment
- c) Verification of shielding integrity
- d) Review of radiation protection measures

4.14 Training of Personnel and Conduct of Emergency Exercises

This section of the emergency response plan should describe the schedule and requirements of training and exercises for personnel involved in emergency response.

Facilities should ensure personnel involved in emergency response receive:

- a) Radiation protection training
- b) Emergency response training
- c) Refresher training annually especially for Category 1 & 2 radiation generating equipment.

Emergency exercises should be conducted at least once per year.

4.15 Record Keeping and Report Preparation

This section should describe established procedures for preparation and record keeping of incident reports. Records should include:

- a) Incident investigation reports
- b) Emergency worker dose records
- c) Equipment maintenance records
- d) Emergency exercise reports
- e) Equipment calibration records

Reports of significant incidents shall be submitted to Atomic Energy Council.

4.16 References/Applicable Code and Standards, Tables and Annexure

All reference documents, codes and standards, used for preparation of the plan along with the tables and annexes (if any) shall be listed and appropriately cited.

4.17 Definitions and Abbreviations

A dedicated section shall define all technical terms and abbreviations used in the plan.

5.0 REVISION OF RADIATION EMERGENCY RESPONSE PLAN

This section should describe arrangements for review of the emergency response plan.

The emergency response plan shall be periodically reviewed and updated following:

- a. Emergency drills
- b. Incidents or near misses
- c. Changes in equipment or operations
- d. Regulatory updates

6.0 QUALITY ASSURANCE

This section should describe quality assurance arrangements ensure the availability and reliability of emergency response systems, equipment and procedures.

Quality assurance shall include:

- a) Maintenance and testing of equipment
- b) Calibration of radiation monitoring instruments
- c) Verification of warning systems

7.0 CONCLUSION

Although X-ray generating equipment do not contain radioactive sources, improper operation or equipment failure can lead to accidental radiation exposure. Facilities must therefore maintain effective emergency preparedness and response arrangements consistent with national regulations and international safety standards.

This guidance supports applicants and authorized persons in developing emergency response plans that protect workers, patients, the public, and the environment.

8.0 Facility Declaration

8.1 Declaration by the Authorized Person / Facility Management

This section shall include commitment by the representative of the facility to implement the documented procedures therein. This may take the form as below;

I hereby declare that this Radiological Emergency Response Plan has been prepared in accordance with the Atomic Energy Act Cap. 154, the Atomic Energy Regulations, 2012, and IAEA GSR Part 7. The facility undertakes to implement, maintain, and periodically review the emergency arrangements described herein and to ensure that all personnel are trained and equipped to respond effectively to radiological emergencies.

Name of Facility	
Name of Authorized Person	
Designation:	
Signature:	
Date:	

8.2 Regulatory Review and Approval (For Official Use)

Reviewed by:	
Designation:	
Regulatory Authority	Atomic Energy Council (AEC)
Decision	☐ Approved
	☐ Approved with conditions
	☐ Not Approved
Reference No.:	
Date of Decision:	
Authorized Signature and Seal	

9.0 REFERENCES

- i. Atomic Energy Regulations, 2012
- ii. Atomic Energy Act Cap. 154
- iii. Atomic Energy Regulations, 2012