NRRC Stakeholders Guidelines

Kingdom of Saudi Arabia

Development of Emergency Plan for Radiological Facilities

NRRC-SG-018

2023

هيئة الرقابة النووية والإشعاعية
Nuclear and Radiological Regulatory Commission

Stakeholder Guideline

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Preamble

In accordance with the provisions of the NRRC's approved Regulations, this stakeholder guideline describes criteria and/or techniques that are considered appropriate for satisfying the requirements stipulated in the NRRC's regulations.

This stakeholder guideline has been prepared on the basis of International Atomic Energy Agency (IAEA) standards, as well as the and the international best practices and the experiences of similar international regulatory bodies, and in accordance with the Kingdom's international commitments, and it has been approved by the NRRC's CEO resolution No.1383, dated 16/07/2023.

Contents

1. Purpose

Nuclear and Radiological Regulatory Commission (NRRC) has developed an effective regulatory framework for the safety and security of radioactive material throughout their life cycle against unauthorized removal and sabotage. Under the regulatory framework, the prime responsibility for safety and security of radioactive material lies with the authorized person.

NRRC is ensuring safety and security of radiation sources that address the emergency and preparedness for any potential radiological situation through provision of requirement for an emergency plan and regulatory oversight to the authorized person. Regulation on Radiation Safety (NRRC-R-01) –– under Article 107; indicates that "The authorized person shall prepare an Emergency Plan for the protection of people and the environment reflecting findings from the safety assessment taking into consideration the likelihood of an emergency affecting either workers or members of the public as part of emergency preparedness and response".

The purpose of this guideline is to provide guidance for the applicant and/or the authorized person of radiation activities and facilities for the preparation of emergency plan with the goal to protect people and the environment from any potential harmful effect of radiation.

2. Scope

This guideline is applicable for the preparation of radiation emergency plans for radiation activities and facilities that fall only within hazard category III and IV as provided in Annex-I and only for

facility with radioactive material of category 1, 2, and 3 as defined in Regulation on Radiation Safety (NRRC-R-01). Radiation activities and facilities with radiation sources other than radioactive material of category 1, 2, and 3 as defined in Regulation on Radiation Safety (NRRC-R-01) shall prescribe emergency preparedness program in the Radiation Protection Program as provided in the NRRC Stakeholder Guideline for the Preparation of Radiation Protection Program.

3. Abbreviations

ABBREVIATION	DEFINITION
ALARA	As Low as Reasonably Achievable
EPP	Electronic Personal Dosimeter.
ERO	Emergency Response Organization.
MORC	Material Out of Regulatory Control.
PPE	Personal Protective Equipment.
QAP	Quality Assurance Program.
RSO	Radiation Safety Officer.

4. Contents of Emergency Plan

All radiation activities and facilities shall develop radiation emergency plans for response to emergencies, involving radiation source(s), as per the requirement of Regulation on Radiation Safety (NRRC-R-01). The extent of emergency preparedness and response should be determined through careful evaluation of the potential for an emergency, as well as its severity. In preparing an emergency plan, it should be ensured that the plan is brief, specific response actions are described and emergency response organization is clearly defined. The plan should also cover the range of emergency

situations/conditions and corresponding response mechanism against each emergency situation/condition that may occur for the activity and at the facility. An individual (e.g. radiation safety officer) should be made responsible for developing the emergency plan, its implementing procedures, record keeping, preparation of exercise scenarios, conduct of emergency drills/exercises, and training of the facility staff etc.

The following should be the general contents of an emergency plan that shall reflects the requirements of Section 37, Section 38 and Section 39 of the Regulation on Radiation Safety (NRRC-R-01).

4.1 Description of Activity/Facility

Introduction of emergency plan should contain adequate information on type of the activity/facility with complete details of radiation source(s), layout (plan/map) of the facility, address, and location of activity/facility relative to the areas accessible to public. The authorized person or applicant should address facility description that should include, but not limited to the following:

- Location (address);
- Relevant departments where the radiation source is either manufactured, used, or stored including their details;
- Facility working hours; and
- Number of personnel visiting the facility (employees, general public, etc.).
- Other facilities or activities existing in the surroundings that could impact the installation or being affected by an accident.

4.2 Map of the area

The applicant or authorized person should provide a map or layout of the area where radiation source is located and associated entry and exit control points. The map or layout should show emergency measures, as appropriate, (e.g., emergency stop button. If any), being taken by the facility for emergency and preparedness purposes.

4.3 Radiation source description

The applicant or authorized person should provide details of radiation sources such as radionuclide's reference activity (mentioned on source certificate), identification number of sources, physical form, quantity, serial number, and other information that may be prescribed by the NRRC in compliance with Regulation on Radiation Safety (NRRC-R-01).

4.4 Objective and Scope

The objective and scope of the radiation emergency plan of an activity or facility need to be clearly described in this section.

4.5 Hazard/Risk Assessment of the Activity/Facility

The emergency plan should include the details regarding assessment of potential hazards/risks associated with the activity/facility. Hazard category of the activity/facility is determined by the NRRC, in accordance with the criterion given in Annex-I, whereas the assessment of hazards/risks associated with the activity/facility is the responsibility of the

applicant or the authorized person. This assessment should be conducted prior to the preparation of emergency plan and should, at least, take account of the following:

- Identification of all sources of exposures;
- Estimation of radiation doses that could be received by workers/public in case of an emergency;
- Potential effects on the environment;
- Full range of postulated events;
- Identification of population at risk;
- Effect on/of other facilities and activities at the site; and
- Areas (on-site and off-site)/locations for which a radiation emergency could warrant protective and response actions.

The hazards capable of stimulating or worsening the radiation emergency situation should also be considered while preparation of radiation emergency plan. Such hazards may include fire, flood, earthquake, bomb threat etc.
The assessed hazards shall include the following:

- Natural events (geological, meteorological, and biological);
- The event that is caused by humans (intentionally or not intentionally); and
- Incidents due to technology failure.

The authorized person must perform an impact analysis to determine potential hazards that can impact the followings:

- Health and safety of individuals including the public within the affected area at the time of the incident (injury and death);
- The health and safety of staff responding to emergency situation;
- Property, facilities, and infrastructure;
- Environment;
- Continuity of operations;
- Services provided;
- Economic and financial conditions;
- Legal and contractual obligations;
- Reputation or trust of the authorized person; and
- Regional, national, and international considerations

Hazard/risk assessment should be documented and reviewed when appropriate, based on emergency experience or when significant modifications were made. Example on methods for performing a risk assessment including impact analysis can be referred in Annex-II.

4.6 Incident/Accident Prevention

Incident/accident prevention measures should be developed based on a hazard/risk assessment of possible incidents/accidents for all radiation sources under the possessions and control of the authorized person. The goal of the action should be to prevent or to limit the impact of a threatening event/accident people, property, and the environment.

Preventive actions shall take into account the results of the hazard/risk assessment defined in paragraph 4.5. This action should always be updated based on the latest information received.

The authorized person should have a system to monitor the identified hazard/risk. The level of preventive action should be adjusted according to the identified hazard/risk.

The authorized person shall ensure preventive measures which contain at least the following:

- Adequate procedures for controlling radiation source and any potential incident/accident that may potentially occurred;
- System components and equipment important for safety is inspected and tested based on the method set by the party the relevant authorities for any degradation that may lead to shortages or failure in achievement of its function;
- Appropriate maintenance, inspection and testing are carried out without involving unnecessary radiation exposure;
- Appropriate automatic systems to prevent or reduce exposure to radiation sources when operating conditions lead to exceeding operational limit condition; and
- A system that can detect and respond immediately to any unusual operating conditions which may affect protection or safety. This system is capable to allows

for a timely corrective action.

4.7 Mitigation

The authorized person shall develop and implement mitigation actions that takes into account the actions that need to be taken to limit or control the impact on the severity of incidents/accidents that are not preventable.

Mitigation actions should take into account the identification results hazard and risk assessment, impact analysis, plan constraints, experience, operationalization, and cost-benefit analysis.

Mitigation actions should also include interim and long-term actions. The authorized person should establish an intervention level for each possibility of an emergency occurring.

The form, extent and duration of any protective action or remedial actions should be optimized to produce overall maximum benefits in terms of social and economic conditions.

4.8 Resource Management and Logistics

Resource management should consider at least the following elements:

a. Definition on the Personnel, equipment, training, facilities, financial provisions, expertise and knowledge and allocation of time required to prepare emergency response and preparedness capability; and

b. Quantity, response time, capability, weakness assessment, cost, and liability regarding the use of

resources involved.

Resource management should include the following tasks:

- To establish a process to prescribe, inventory, apply and track resources;
- To activate the process before and during the incident/ accidents;
- To provide or deliver resources before and after the incident/accident;
- To stop or recall resources during and after incident/ accident; and
- To perform contingency plan in the event of shortage of resources.

The emergency plan should reflect periodical assessment to evaluate adequacy and deficiencies on the available resource capacity and appropriate measures to overcome any shortcomings.

The existing inventory of both internal and external resources for emergency preparedness and response should always be updated by the authorized person.

4.9 Assessment and Declaration of Radiation Emergencies

The emergency plan should also include a description of the methodology and instrumentation used for assessing the radiation emergency, along with its consequences. The criteria for transition from normal to emergency operations as well as the parameters upon which the decision of declaration of emergency has to be taken should be identified and described in this section of radiation emergency plan.

The process of declaration of emergency including the format for communication and announcements to be made should also be clearly defined, both for working and off-working hours.

4.10 Assignment of Responsibilities for Emergency Response

The emergency response shall be promptly executed and managed without risking safety as prescribed in Article 113 of Regulation on Radiation Safety (NRRC-R-01). The authorized person is responsible for ensuring that arrangements for a timely, managed, controlled, coordinated and effective emergency response are in place. The authorized person should establish and maintain an appropriate emergency response responsibility(ies) for implementing suitable arrangements throughout the emergency. The role and responsibilities of each individual for emergency response should be clearly defined/allocated in the emergency plan. The emergency response organization should deploy coordinated efforts to cope with complete range of postulated events with the identified role of individuals for different emergency situations. Arrangements should be in place to dispatch an emergency response team to the scene for assessing the hazards involving radiation source(s), assessing radiological conditions, mitigating the radiological consequences, and managing/controlling the exposure to emergency workers. Response to radiation emergency involving loss/theft of a radiation source(s), contamination of individuals/area, and overexposure to individuals should be prompt in order

to minimize the hazards and mitigate the consequences. Following functional areas should be considered while designing/establishing an emergency response organization:

- Emergency coordination.
- Facility operation and services.
- Radiation protection.
- Security and traffic control.
- Public information.
- Fire safety and hazardous material control.
- Medical services.
- Coordination with on-site individuals and off-site authorities.

Organizational chart of emergency response setup should be included in the plan. Each authorized person of each activity/ facility may have its own organizational arrangements for response to a radiation emergency according to its available resources.

4.11 Notification Point

The authorized person should establish a notification point which have arrangements to receive notification and to initiate promptly the predetermined actions to activate the emergency response. The notification point should always be able to be alerted for promptly responding to or initiating a response to an emergency. The notification point is held responsible for sending emergency notifications of an actual or potential radiation emergency at the facility to the concerned local/national authorities/organizations.

4.12 Assistance

The authorized person should identify the necessary assistance available and needed either from within authorized activity/ facility or from external resources.

4.13 Communications and Warnings

As part of implementation of requirement of Article 261 of Regulation on Radiation Safety (NRRC-R-01). The authorized person should develop a communication system that is tested periodically.

The authorized person should develop internal and external communication procedures that are periodically to ensure its effectiveness.

The authorized person should identify and develop methods to alert personnel who will be responding in emergency situations involving as necessary other relevant employees at the facility.

The authorized person shall develop an emergency communication protocol and warnings including systems and procedures to provide precautionary warnings to members of the public who might be affected by emergencies that occur.

The authorized person shall establish a procedure for notification to the NRRC for all accidental exposures, emergency exposures and circumstances that require protective action based at least one (1) hour after event.

4.14 Organizational Structure and Responsibilities

4.14.1 Emergency Director/Coordinator

The authorized person shall establish proper organizational

structure with clear assignment of responsibilities for emergency preparedness and response. The emergency director/coordinator with authority for overall command and control should be appointed to organize and manage the emergency response personnel of the facility and works in close liaison with offsite response organizations. This position carries the responsibility and authority to initiate a response action necessary to mitigate the consequences. In case of emergency, emergency director/coordinator should coordinate with the Head of each functional area, as applicable; to implement corrective actions in specified areas. The head of each functional area should report to emergency director/coordinator. These individuals and any other committee (advisory/supervisory) along with emergency director comprise the assigned team with emergency response personnel. The emergency director/coordinator should act as a point of contact between the offsite and onsite response personnel to ensure effective coordination.

The emergency director/coordinator should be made responsible to declare and terminate the emergency as per criteria for declaration and termination of radiation emergencies. The individual designated as emergency director/coordinator may not always be immediately available when an emergency situation arises. Hence, it is essential that his/her alternate should also be designated. The initial responder will be the person in-charge until the emergency director/coordinator, or his/her designated alternate arrives,at which

time the command will be transferred, and responsibilities appropriately divided. The radiation emergency plan should clearly specify the lines of authority, not only for the position of Emergency Director, but also for the Head of each functional group. The duties of emergency director/coordinator should be clearly defined in radiation emergency plan/procedures.

4.14.2 Radiation Safety Officer

The emergency plan should specify the role and responsibilities of RSO and other emergency workers clearly within the organizational functions. The RSO is responsible for immediate assessment of actual or potential exposure to radiation, in order to determine the appropriate level of protection during emergency response. The RSO should also make necessary arrangements for dosimetry, bioassay, decontamination, and environmental monitoring, wherever applicable to satisfy the requirement in Article 110 of Regulation on Radiation Safety (NRRC-R-01).

4.14.3 Emergency Workers

The workers assigned with emergency and preparedness should be properly equipped and trained. A formal training program should be established that is specific roles defined in the emergency plan. The training program should include:

- Legislation and authorities.
- Requirements of local rules/ regulations (if applicable).
- Knowledge of the site.
- Roles, responsibilities, and functions.

- Radiation protection emergency procedures and response protocols.
- First-aid training techniques.

4.14.4 Facility Security

The role and responsibilities of facility security personnel related to emergency preparedness and response should be described in the emergency plan. 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:

- Evacuation of facility personnel.
- Establishment and control of assembly areas.
- Personnel counting.
- Access control.
- Arrangements for escape of facility personnel (if required).
- Arrangements of transportation and means of communication for emergency teams, and liaison with local law enforcement agencies and rescue services during emergency response.

4.14.5 Facility Services

The emergency plan should contain necessary details regarding responsibilities of services available at the facility during emergency response. The relevant facility is generally responsible for ensuring availability of essential services such as; electricity, water, ventilation, heating, and cooling at the

facility. The provision and maintenance of these services normally require round-the-clock availability of personnel familiar with their operations. The person in-charge or supervisor of facility services should be designated as one of the emergency response team members. The responsible personnel for services of the facility are responsible for damage assessment, repair work, technical support and liaison with public utility suppliers. In addition, these personnel should be trained to conduct repairs of facilities and equipment during an emergency situation.

4.14.6 Fire Protection and Other Hazard Control Group

The individual assigned with the responsibility for fire protection must be included in advisory/supervisory committee of the facilities/activities having their own fire protection group. This individual should possess broad knowledge of the facility's fire potential, , facility layout, engineered fire protection systems and availability, and capabilities of equipment and personnel. The training of fire protection group should be arranged and ensured through their involvement in emergency drills/exercises conducted on periodic intervals. Whereas the facilities not having a full-time fire protection capability would rely on response from firefighting service of the Kingdom's Civil Defense or other local firefighting services. The role of the off-site support agencies, such as Civil Defense and Police, may vary considerably and should be incorporated into the emergency

plan of the facility. Contact details of local police and fire protection department should also be included in this section of radiation emergency plan. Radiation emergencies may also involve other hazardous materials, such as chemical, biological, and infectious agents, carcinogens, and cytotoxic materials/substances etc. The industrial safety personnel of the facility responsible for hazardous material control, may provide valuable assistance to Emergency Director/ Coordinator during emergency response.

4.14.7 Public Information Officer

The information regarding availability and responsibilities of person in charge for information dissemination as official communication personnel should be clearly outlined in the emergency plan. The assigned communication personnel should be a designated official of the facility responsible for timely release of necessary information to the media and public. The Emergency Director/Coordinator may also act as communication personnel. Information to the news media should be prepared, reviewed, and released by communication personnel, after approval from the management (if required). A copy of the information should also be shared with NRRC using the contact details provided in Annex -III. The information provided should be simple, useful, timely, consistent, and appropriate. It is important that communication personnel to be aware, and keeps the media apprised, of the developing situation. The communication personnel must have basic understanding of radiation and its

terminology. Public information responsibility should not be left to other officials who are responding to the emergency.

4.14.8 Medical/ Health Professional(s)

A medical/health professional is a valuable member of an emergency response team. The responsibilities of medical/ health personnel should be outlined as part of the preparedness in the plan. If medical care is not available within a facility, liaison/interface with suitable hospitals capable of handling and treatment of exposed/contaminated individuals should be established. The authorized person should ensure that the medical/health professional(s) responsible for provision of emergency medical care having necessary training of emergency response and he/she participates in periodic emergency drills/exercises conducted at the facility.

4.15 Emergency Plan Procedures

Emergency plan implementing procedures should describe the actions necessary to achieve the objectives of emergency plan. The emergency plan should be complemented with the proper procedures. The emergency plan of the facility/activity should include the list of procedures relevant to the plan and all enlisted procedures should be developed, approved, and made readily available to all responsible parties.

4.16 Instructions and Warnings to the Public/Workers

The arrangements for issuance of instructions and warning to the public and workers at the facility should be described in the radiation emergency plan. The information should be provided in simple Arabic language. The means for

notification of emergency to the workers and public at the facility/site (e.g., sirens, hooters, announcements, and warning lights etc.) should be described in the plan. In case of lost, stolen or illicitly removed radiation source, the mechanism to inform the public/target groups off the site should also be described in radiation emergency plan.

4.17 Access Control to Affected Area

The access to affected area of activity/facility should be restricted for public/non-emergency workers. The strategy for actions such as restricting public/non-emergency workers, cordoning off the area, and displaying warning signs and symbols should be included in the emergency plan. Criteria for restriction of access and clearance of affected area should also be included in the emergency plan.

4.18 Protection of Emergency Workers

The workers taking part in response to emergency operation are considered as emergency workers. The emergency workers from the off-site authorities who may take part in response activities should be informed about the risk of radiation exposure and the meanings of radiation signs and placards. The arrangements for the protection of emergency workers should be described in the radiation emergency plan. These arrangements may include PPE and personal dosimetry etc. The emergency workers should be designated and trained to undertake an intervention in the following situations:

- To save lives or to prevent serious injury, including severe deterministic health effects;

- To avert a large collective dose;
- To prevent the development of catastrophi conditions.

The emergency workers should be instructed to follow ALARA principle, for example in keeping their doses, by considering applicable economic and social factors, while performing emergency response actions. The mechanism for managing, controlling, and recording the doses received by emergency workers should be described in the emergency plan.

4.19 Emergency Facilities, Supplies and Equipment

The authorized person should make available all necessary emergency response facilities and equipment to the emergency response teams. Adequate facilities and equipment should be readily available and operable all times. The equipment shall be calibrated as prescribed in Article 104 of Regulation on Radiation Safety (NRRC-R-01), and consistent with the requirements described in the emergency plan. The authorized person should consider provision of the following facilities, supplies, and equipment (also known as components/elements of emergency response infrastructure) to the emergency response teams, as appropriate, for immediate and effective response to radiation emergencies:

- Copies of the approved emergency plan and procedures.
- Seating place for emergency director/coordinator and support personnel.
- Communication arrangements between emergency

responders, onsite emergency organization and off-site response organizations/authorities.

- Updated list of emergency response personnel (chain of command) along with their contact details.
- PPE (e.g., lead apron, face masks, gloves, shoe cover, paper suits etc.).
- Active dose monitoring devices (e.g., Pen Dosimeter, EPD etc.).
- Radiation detection/survey equipment.
- Decontamination arrangements/kit.
- Source handling and recovery tools (e.g., long tong, shielded container etc.).
- Arrangements for radioactive waste management.
- Air sampling and counting equipment.
- Facility floor plans, layouts, and maps.
- Other logistic support as necessary.

The communication system must be able to maintain communication between members of each response team and the notification point, as well as communication with off-site response organizations such as police, fire protection department and hospitals etc. Communication equipment may include dedicated telephone lines, mobile phones, two-way radios, and fax machines. The use and installation of communication equipment and networks must be commensurate with the level of emergency.

4.20 Coordination with Off-site Organizations/Authorities

If the nature of emergency response requires involvement of

off-site organization/authorities, then emergency plan should; identify those authorities; include their contact details and explain procedure of coordination with them. The emergency plan shall include the arrangements that have been made to ensure the contribution of Off-site Organizations when necessary.

The authorized person should, in case of any radiation emergency, immediately inform NRRC as provided in Article 39 of Regulation on Radiation Safety (NRRC-R-01). The contact details of NRRC should be included in the radiation emergency plan of the facility/activity as given in Annex-III. The notification regarding incidents/accidents should be made immediately but not later than one hour to NRRC as per "Incident Reporting Form" provided as Annex-III.

4.21 Termination of Radiation Emergency

The parameters upon which the decision of termination of emergency has to be taken should be identified and described in the emergency plan. The process of termination of emergency should also be clearly defined for working and off-working hours including communication and announcements to be made.

4.22 Recovery and Rehabilitation

The arrangements for transition from emergency phase to recovery operations should be described in the emergency plan. Decisions to withdraw restrictions and other measures, if any, imposed during response to radiation emergency

should be made by formal process. The principles and criteria for recovery and rehabilitation of the activity/facility

from emergency phase to routine work should be included in radiation emergency plan. The recovery operation may include recovery of source(s), repairs to the equipment and buildings, waste disposal or decontamination of the affected site and surrounding area etc. The radioactive waste thus generated should be managed as per requirements of Article 55 of Regulations on Management of Radioactive Waste (NRRC-R-16) and corresponding regulatory guidelines issued there under.

4.23 Training Program

Training of response personnel is crucial for effective emergency management. For these reasons the schedule and requirements of training should be included in the emergency plan. The authorized person or applicant should describe training and retraining program (i.e., annual retraining) for its personnel having emergency response related responsibilities. The facility should ensure that emergency worker who may have a role in radiological emergency should have participated in training/retraining or refresher courses annually.

For emergency workers, the authorized person or applicant should establish and maintain an overall training policy and initial and continuing training programs, based on the long-term qualifications and competencies required for performing the job, and training goals that acknowledge the

critical roles of safety and security.

4.24 Drills and Exercises

Emergency exercises provide the opportunity to test the capabilities of facility and its personnel. The authorized person or applicant should describe its arrangements for drills and exercises to test the effectiveness of planned emergency preparedness and response. This should also include the frequency for such drills and exercises that depends on the hazard/risk associated with the radiation sources (e.g., quarterly, or annually).

4.25 Radiological Emergency Preparedness Awareness progra

The radiological emergency awareness training shall include instructions and emergency procedures to achieve the objective of the emergency plan as prescribed in Article 170 (iv) of the Regulation on Radiation Safety (NRRC-R-01). At a minimum, the radiological emergency and preparedness awareness program should:

- Ensure that staff understand their roles and responsibilities for emergency and preparedness.
- Ensure the staff is familiar with procedures and requirement use for emergency operation.
- Ensure the staff understand the interface between emergency response and nuclear security response.
- Ensure staff are trained to recognize the indicators and events that could lead to emergency.
- Ensure staff are trained to recognize and report suspicious activity that may contribute to radiological

consequences, for example:

- Using false identification.
- Individual exhibiting suspicious behavior.
- Individual causing an alarm without authorization.
- Lost or stolen uniforms or material within the organization.
- Unsafe behavior at the workplace.

4.26 Maintenance Program

Authorized person or applicants shall ensure reliability through a preventive maintenance program to ensure a high degree of availability and reliability of all the supplies, equipment, communication systems and arrangements necessary to perform the functions in a radiation emergency as prescribed in Article 142 (b) of Regulation on Radiation Safety (NRRC-R-01). The authorized person or applicant should describe its arrangements for corrective and preventive maintenance of emergency equipment and systems and ensure that it is in line with the management system or QAP as appropriate. QAP is an essential element to ensure that emergency equipment and supplies are available and functional for use during an emergency response. When the device is out of service for repair or replacement, compensatory measures must be implemented.

4.27 Record Keeping and Report Preparation

The emergency plan shall describe the policy and strategy for keeping and maintaining necessary records and reports. The

emergency plan should include the procedure of record keeping for all incidents and it should identify responsible person for the preparation of post incident report. The plan should also describe the procedure of reporting the incidents/ emergencies to NRRC to satisfy the requirement of Article 261 of Regulation on Radiation Safety (NRRC-R-01). The following record should be maintained, where applicable:

- Emergency worker dose record;
- Radiation monitoring and contamination level record;
- Radioactive waste generated;
- Training;
- Emergency drills/exercises and actual incidents, and
- Equipment calibration record, etc.

4.28 Additional Information

Any additional information that may affect the effectiveness of the emergency plan that is not covered in above sections and is deemed to be essential for that activity/facility should be described in the emergency plan.

4.29 Definitions and Abbreviations

The emergency plan should incorporate definition of all technical terms and abbreviations used in the plan.

4.30 Review and Revision of Emergency Plan

The emergency plan of the activity or facility should be reviewed/revised at least once in five years or whenever necessary in the light of:

- change in application or location of radiation sources,

or facility;

- lessons learned from emergency exercises/drills;
- national and international experience feedback;
- revision in the reference documents and day to day activities; and
- changes in the regulatory requirements.

The revised emergency plan should be submitted to NRRC for review and approval.

5. Related documents and files

Document Name	Document Type	Document Number	Relation to the procedure
Radiation Safety	Regulation	NRRC-R-01	Sets out the general safety requirements in ensuring the protection of people and the environment against the harmful effects of ionizing radiation and for the safety of radiation sources.
Regulations on Management of Radioactive Waste	Regulation	NRRC-R-16	Presents the requirements for the management of radioactive waste.
Security of Radioactive Materials	Regulation	NRRC-R-17	Presents the requirements for the security of radioactive materials throughout their life cycle against unauthorized removal of the radioactive material and sabotage

Annex-I: Emergency Preparedness Categories and Criteria

	Description	Criteria
I	Facilities, such as nuclear power plants, for which on-site events, b (including those not considered in the design) are postulated that could give rise to severe deterministic effects off the site that would warrant precautionary urgent protective actions, urgent protective actions or early protective actions, and other response actions to achieve the goals of emergency response in accordance with international standards, or for which such events have occurred in similar facilities.	• Reactors with power levels greater than 100 MW(th) (power, nuclear ship, and research reactors). • Spent fuel pools that may contain some recently discharged fuel and a total of more than about 0.1 EBq of Cs-137 (equivalent to the inventory in a 3000 MW(th) reactor core). • Facilities with inventories of dispersible radioactive material sufficient to result in severe deterministic effects offsite.
II	Facilities, such as some types of research reactor and nuclear reactors used to provide power for the propulsion of vessels (e.g. ships and submarines), for which on-site events are postulated that could give rise to doses to people off the site that would warrant urgent protective actions or early protective actions and other response actions to achieve the goals of emergency response in accordance with international standards , or for which such events have occurred in similar facilities. Category II (as opposed to category I) does not include facilities for which on-site events (including those not considered in the design) are postulated that could give rise to severe deterministic effects off the site, or for which such events have occurred in similar facilities	• Reactors with power levels greater than 2 MW(th) and less than 100 MW(th) (power reactors, nuclear ship, and research reactors). • Spent fuel pools containing fuel requiring active cooling. • Facilities with potential for an uncontrolled criticality within 0.5 km of the off-site boundary. • Facilities with inventories of dispersible radioactive sufficient to result in doses warranting taking urgent protective action off site.

III	Facilities, such as industrial irradiation facilities or some hospitals, for which on-site events are postulated that could warrant protective actions and other response actions on the site to achieve the goals of emergency response in accordance with international standards, or for which such events have occurred in similar facilities. Category III (as opposed to category II) does not include facilities for which events are postulated that could warrant urgent protective actions or early protective actions off the site, or for which such events have occurred in similar facilities.	• Facilities with potential, if shielding is lost, of direct external (shine) dose rates of more than 100 mGy/h at 1 m. • Facilities with inventories of radioactive sufficient to result in doses warranting taking urgent protective action on the site.
IV	Activities and acts that could give rise to a nuclear or radiological emergency that could warrant protective actions and other response actions to achieve the goals of emergency response in accordance with international standards in an unforeseen location. These activities and acts include: a. transport of nuclear or radioactive material and other authorized activities involving mobile dangerous sources such as industrial radiography sources, nuclear powered satellites, or radioisotope thermoelectric generators. b. theft of a dangerous source and use of a radiological dispersal device or radiological exposure device. This category also includes: i. Detection of elevated radiation levels of unknown origin or of commodities with contamination.	Operators of mobile dangerous sources, including: • A mobile source with: i. Potential, if shielding is lost, of direct external (shine) dose rates of more than 10 mGy/h at 1 m. ii. Those with inventories classified as Dangerous Quantities of Radioactive Material. • Satellites with inventories classified as Dangerous Quantities of Radioactive Material. • Transport of quantities of radioactive material would be dangerous if not controlled. Facilities/locations with a significant probability of encountering an uncontrolled dangerous source such as:

	i. Detection of elevated radiation levels of unknown origin or of commodities with contamination. ii Identification of clinical symptoms due to exposure to radiation. iii A transnational emergency that is not in category V arising from a nuclear or radiological emergency in another State. Category IV represents a level of hazard that applies for all States and jurisdictions.	• Large scrap metal processing facilities • National border crossings. • Facilities with fixed gauges with dangerous sources in accordance
V	Areas within emergency planning zones and emergency planning distances in a State for a facility in category I or II located in another State.	Not Applicable

Annex-II: Methods for performing Hazard/Risk Assessment

This is an example on one of the methods that can be used to perform a hazard/risk assessment as provided in paragraph 4.5. Hazard/risk assessment is part of the necessary aspects in developing a comprehensive emergency plan. The applicant and authorized person are fully responsible for the hazard/risk assessment performed and shall be liable for ensuring compliance with the Commission Laws.

GUIDANCE:

1. Please evaluate the probability of an event occurring according to category which are listed based on the hazard scale. Make the assumption that each event occurs at the worst time or situation (for example when a group of visitors visiting the authorized facility).
2. Record the score for each criterion on each sheet.
3. Among the probabilities that need to be considered during the assessment are (but not limited to the list):
   - Known hazard/risks.
   - Previous records.
   - Manufacturer/supplier statistics.
4. Among matters related to response that need to be considered during the assessment are (but not limited to the list):
   - The time taken to organize the on-scene response action.
   - Capability to response.
   - Finding from previous emergency actions.
5. Among the impacts on humans that need to be considered during the assessment are (but not limited to the list):
   - Potentially causing injury or death to personnel.
   - Has the potential to cause injury or death to the public.

6. Among the impacts on property that need to be considered during the assessment are (but not limited to the list):
   - Costs required to replace property.
   - Costs required to erect a temporary replacement site.
   - Costs necessary for repairs.
   - Time required to repair.
7. Among the impacts on business/services that need to be considered during the assessment are (but not limited to the list):
   - Interference with business.
   - Employees are unable to work as usual.
   - The customer is unable to use the facility.
   - Breach of contractual agreement.
   - Impose fines and penalties or legal costs.
   - Disruption of critical supplies.
   - Disruption to product distribution.
   - Reputation and public image.
   - Financial impact/burden.
8. Among the matters related to preparedness that need to be considered during the assessment are (but not limited to the list):
   - Current status of the emergency plan.
   - Frequency of training or exercise.
   - Training status.
   - Insurance.
   - Provision of alternative sources of critical supplies/services.
9. Consider issues for internal resources including, but not limited to:
   - Types of resources available and ability to meet the preparedness requirements.

- Amount of available supply and ability to meet requirements for emergency response.
- Willingness/availability of the workers.
- Coordination between various departments.
- Create a support system.
- Ability to face disasters.

10. Consider issues for external resources including, but not limited to:
    - Types of agreements with external organization to perform joint training/exercise.
    - Coordination with local and state agencies.
    - Coordination with nearby health centers.
    - Coordination with specialized treatment facilities.
    - Community resources.

Complete all attachments including A. Natural disasters; B. Failure of the system to function; C. Humans; and D. HAZMAT. The summary section will provide specific threat levels and overall.

A. Assessment of Radiation Hazard due to Natural Disaster

Situation	PROBABILITY	SEVERITY = MANITUDE – MITIGATION						RISK
	Probability of Occurrence	Effects on Human	Effects on Property	Effects on Business	Preparation	Internal Response	External Response	RISK
		Probability of Death and Injury	Loss and Physical Damage	Service Interruption	Pre-Planning	Time, Effectiveness and Resources	Assistance and Supply	Relative Threat[1]
SCORE	0 = Not relevant 1 = Low 2 = Medium 3 = High	0 = Not relevant 1 = Low 2 = Medium 3 = High	0 = Not relevant 1 = Low 2 = Medium 3 = High	0 = Not relevant 1 = Low 2 = Medium 3 = High	0 = Not relevant 1 = Low 2 = Medium 3 = High	0 = Not relevant 1 = Low 2 = Medium 3 = High	0 = Not relevant 1 = Low 2 = Medium 3 = High	0-100%
Flood								0%
Typhoon								0%
Tornado								0%
Storm								0%
Earthquake								0%
Tsunami								0%
Drought								0%
Fire								0%
Epidemic								0%
Dam failure (Dam burst)								0%
Average Score								0%

Risk (0.0) = Probability (0.00) x Severity (0.00)

[1] Threat increase with percentage

B. Assessment of Radiation Hazard due to System Failure (Technological Factor)

Situation	PROBABILITY	SEVERITY = MANITUDE – MITIGATION						RISK
		Effects on Human	Effects on Property	Effects on Business	Preparation	Internal Response	External Response	
	Probability of Occurrence	Probability of Death and Injury	Loss and Physical Damage	Service Interruption	Pre-Planning	Time, Effectiveness and Resources	Assistance and Supply	Relative Threat[2]
SCORE	0 = Not relevant 1 = Low 2 = Medium 3 = High	0 = Not relevant 1 = Low 2 = Medium 3 = High	0 = Not relevant 1 = Low 2 = Medium 3 = High	0 = Not relevant 1 = Low 2 = Medium 3 = High	0 = Not relevant 1 = Low 2 = Medium 3 = High	0 = Not relevant 1 = Low 2 = Medium 3 = High	0 = Notrelevant 1 = Low 2 = Medium 3 = High	0-100%
Power Supply l Interruption								0%
Transport Failure								0%
Fuel Shortage								0%
Water Supply Interruption								0%
Fire Alarm failure								0%
Communication Failure								0%
HAVC System failure								0%
Fire								0%
Flood (internal)								

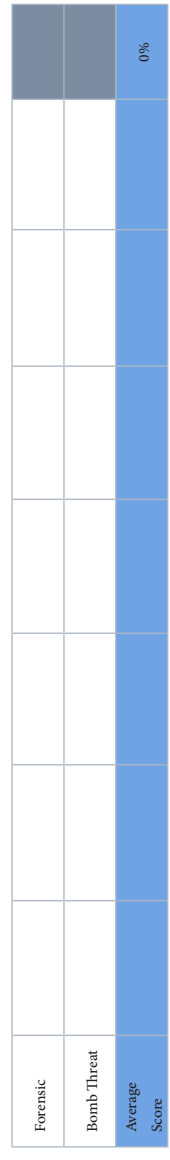
[2]Threat increase with percentage

HAZMAT Exposure								
Lack of Supply								
Structure Damage								
Average Score								0%

C. Assessment of Radiation Hazard due to Human Factor

Situation	PROBABILITY	SEVERITY = MANITUDE – MITIGATION						RISK
		Effects on Human	Effects on Property	Effects on Business	Preparation	Internal Response	External Response	
	Probability of Occurrence	Probability of Death and Injury	Loss and Physical Damage	Service Interruption	Pre-Planning	Time, Effectiveness and Resources	Assistance and Supply	Relative Threat[3]
SCORE	0 = Not relevant 1 = Low 2 = Medium 3 = High	0 = Not relevant 1 = Low 2 = Medium 3 = High	0 = Not relevant 1 = Low 2 = Medium 3 = High	0 = Not relevant 1 = Low 2 = Medium 3 = High	0 = Not relevant 1 = Low 2 = Medium 3 = High	0 = Not relevant 1 = Low 2 = Medium 3 = High	0 = Notrelevant 1 = Low 2 = Medium 3 = High	0-100%
Event with Many Victim (Trauma)								0%
Event with Many Victim (Medical/ Contagious)								0%
Bio Terrorism								0%
Presence of VIP								0%
Hostage								0%
Public disruption								0%
Labor Act								0%

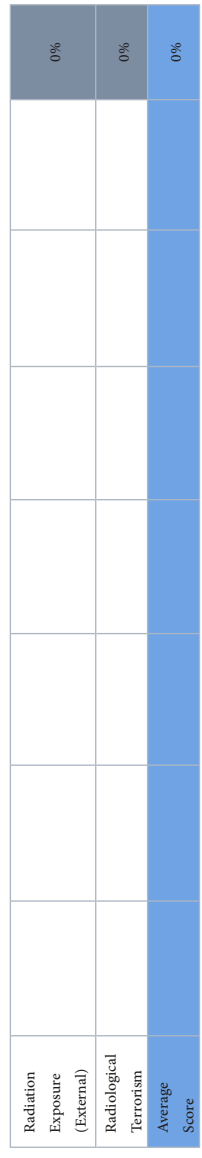
[3]**Threat increase with percentage**


0%
Average Score
Bomb Threat
Forensic

D. Assessment of Radiation Hazard due to Dangerous Material (HAZMAT)

Situation	PROBABILITY	SEVERITY = MANITUDE – MITIGATION						RISK
	Probability of Occurrence	Effects on Human: Probability of Death and Injury	Effects on Property: Loss and Physical Damage	Effects on Business: Service Interruption	Preparation: Pre-Planning	Internal Response: Time, Effectiveness and Resources	External Response: Assistance and Supply	Relative Threat[4]
SCORE	0 = Not relevant 1 = Low 2 = Medium 3 = High	0 = Not relevant 1 = Low 2 = Medium 3 = High	0 = Not relevant 1 = Low 2 = Medium 3 = High	0 = Not relevant 1 = Low 2 = Medium 3 = High	0 = Not relevant 1 = Low 2 = Medium 3 = High	0 = Not relevant 1 = Low 2 = Medium 3 = High	0 = Notrelevant 1 = Low 2 = Medium 3 = High	0-100%
HAZMAT Event with Many Victim (More than 5 victim)								0%
HAZMAT Event with few Victim (Less than 5 victim)								0%
Internal Spill (Minor)								0%
Internal Spill (Major)								0%
Radiation Exposure (Internal)								0%

[4] **Threat increase with percentage**


Radiation Exposure (External)
Radiological Terrorism
Average Score
0%
0%
0%

Summary of Hazard Analysis

		Natural Disaster	Technological Factor	Human Factor	HAZMAT	Total for the Facility
Probability		0.00	0.00	0.00	0.00	0.00
Severity		0.00	0.00	0.00	0.00	0.00
Specific Risk Relative Hazard		0.00	0.00	0.00	0.00	0.00
Risk Relative Hazard						
Threat Relative to Facility	1.00					
	0.90					
	0.80					
	0.70					
	0.60					
	0.50					
	0.40					
	0.30					
	0.20					
	0.10					
	0.10					
		Natural Disaster	Technological Factor	Human Factor	HAZMAT	

Probability and Hazard Severity Level			
Relative Risk to Facility	1.00		
	0.90		
	0.80		
	0.70		
	0.60		
	0.50		
	0.40		
	0.30		
	0.20		
	0.10		
	0.10		
		Probability	Severity

Note:

This is an example of a method that can be used to perform hazard analysis against potential radiation exposure. It should not be used as total representative to a comprehensive emergency preparedness program. Individuals or organizations using this method are fully responsible on the assessment of the hazard and does not diminish their responsibility for ensuring compliance with the Commission Laws.

Annex-III: Incident Reporting Form Annex-III: Incident Reporting Form

Incident Reporting for Radiation Activity/Facility

Incident date	_____ (dd-mm-yyyy)		Incident Time	_____ (AM/PM)	
Facility Type			Nature of Incidents		
	Irradiator			Undue/ Over exposure of worker/ patient/ public	
	Industrial Radiography			Source lost/ stolen/ theft	
	Nuclear gauge / Oil Well Logging			Spill/ dispersion of radioactive material	
	Education/Research			MORC/Orphan source found	
	Radiotherapy			Contamination	
	Diagnostic Radiology			Internal exposure due to ingestion/inhalation	
	Other			Transport accident	
				Any other	
Name and Location of facility/Site where incident occurred:		_____ _____ _____			
City			Contact Number:	_____	
Facility Authorized by NRRC: Yes No			Authorization Reference	_____ (For Authorized Activity/ Facility Only_)	
Incident Reporting Summary (Description of event)					
Reporting Personnel					
Name	Designation				
Contact Number: _____		Reporting Time _____ (AM/PM)		Signature with Date: _____	

This information shall be sent to:

Nuclear and Radiological Regulatory Commission

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