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FORMAT AND CONTENT OF RADIATION EMERGENCY PLAN FOR RADIATION FACILITIES AND ACTIVITIES

REGULATORY GUIDE

PAKISTAN NUCLEAR REGULATORY AUTHORITY

For Further Details

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PAKISTAN NUCLEAR REGULATORY AUTHORITY
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FORMAT AND CONTENT OF RADIATION EMERGENCY PLAN FOR RADIATION FACILITIES AND ACTVITIES

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1. INTRODUCTION

Ionizing radiations are utilized in diverse applications such as in medicine, industry, agriculture, research and power generation. These applications are designed and operated with highest safety standards for the protection of workers, public and the environment. However, possibility of an unlikely occurrence of incidents or accidents leading to a radiation emergency in these facilities or during activities cannot be completely ruled out. Therefore, arrangements for preparedness and response to a radiation emergency are required to be ensured by the licensees or applicants of radiation facilities and activities based on regulatory requirements and are documented in Radiation Emergency Plan (REP).

The "Regulations on Management of a Nuclear or Radiological Emergency – (PAK/914) (Rev. 1)" and the "Regulations for the Licensing of Radiation Facility(ies) other than Nuclear Installation(s) - (PAK/908) (Rev.1)" require submission of the REP by the specified licensees or applicants of radiation facilities and activities to PNRA for review and approval.

2. OBJECTIVE

This regulatory guide (RG) provides guidance to the licensees or applicants of radiation facilities and activities for development of radiation emergency plan as per format and content described in the RG.

3. SCOPE

This RG covers the REPs of radiation facilities in emergency preparedness category-III (EPC-III) and activities in emergency preparedness category-IV (EPC-IV) as specified in Regulations on Management of a Nuclear or Radiological Emergency – (PAK/914) (Rev. 1)"

4. FORMAT AND CONTENT OF RADIATION EMERGENCY PLAN

The licensees of radiation facilities and activities are required to develop the REP to ensure preparedness for and response to emergencies as per requirements of the "Regulations on Management of a Nuclear or Radiological Emergency – (PAK/914) (Rev. 1)". The extent of emergency preparedness and response (EPR) arrangements should be based on hazard assessment for each facility and activity.

The structure of the REP is given and explained in subsection 4.1 to 4.22. The explanation of relevant concepts and specific information to be included in the REP is provided in these subsections and it is applicable to both radiation facilities and activities in EPC-III and EPC-IV. However, the subsection 4.19 offers details on additional arrangements for EPC-IV only. The REP should be brief and should include important details as specified in subsequent sections. The REP should be signed or endorsed by the licensee of the record, prior to its submission to PNRA for approval.

4.1. Introduction

The applicant or the licensee should introduce the document along with the description of the radiation facility and activity; including, but not limited to, the following details:

i. Name, address and location(s) of the facility or department; specifying clearly whether the facility is a standalone entity or a part of larger setup;

ii. Type of the radiation facility and activity (e.g. medical centre; radiotherapy; nuclear medicine; industrial radiography; oil well logging; irradiators; importer, exporter or trader; or manufacturer of sources; etc.);

iii. Details of radioactive source(s) and generator(s) (e.g. name of radioisotopes, radioactivity, physical form, chemical form, configuration like fixed or mobile, specifications like milliamperes (mA)and kilovolts (kV), etc.); and

iv. Map of the facility or department, clearly demarcating radiation areas, assembly points and emergency escape routes.

4.2. Objective

The objective(s) of the REP should be clearly defined by the applicant or the licensee in this section. The objective of the REP should include implementation of the requirements of Regulations PAK/914 (Rev. 1) for response to a radiation emergency in a systematic, coordinated and effective manner.

4.3. Scope

The applicant or the licensee should define the scope of the plan and clearly specify the radiation facilities and activities under its jurisdiction for which this plan will be applicable during radiation emergencies.

4.4. Hazard Assessment

Hazard assessment of a radiation facility and activity should be performed prior to preparation of the REP. It should identify potential hazards and associated consequences for ensuring appropriate EPR arrangements. The following should be considered for hazard assessment of the radiation facility and activity:

i. Categorise the facility and activity in EPC-III or IV as per Annexure I;

ii. Specify the events that could result in a radiation emergency. For guidance, examples of potential events are provided in Annexure I;

iii. Evaluate the impact of radioactive sources during emergency including its chemical and physical form, and assess the quantity of potential radioactive releases and exposure pathways;

iv. Include potential consequences (e.g. medical, financial, psychological or social, etc.) of the emergency on workers, public and the environment based on identified emergency scenarios;

v. Identify hazards that may affect the effectiveness of response actions during emergency (e.g. fire, traffic congestion, pandemic, earthquake, flood, security event, etc.); and

vi. Include continuous reassessment of hazards during the preparedness and response in order to promptly identify, characterise or anticipate new hazards for taking necessary measures.

The hazard assessment should be revised prior to any change in the facility and activity that may affect the existing hazard assessment, or in case of availability of new information that may provide insight into the adequacy of existing arrangements.

4.5. Emergency Response Organisation

The licensee should establish and maintain an appropriate emergency response organisation (ERO) responsible for implementing EPR arrangements. The ERO should be provided with authority and responsibility for directing the emergency response with clearly specified and unified chain of command for performing of emergency response functions. ERO should have suitable number of qualified personnel at all times and take all reasonably practical measures to prevent accidents and mitigate their consequences, if they occur.

The ERO should be led by an emergency response director, who should be made responsible for overall management of emergency. The following important positions should be considered while establishing an ERO:

(a) Emergency response director;

(b) Radiation protection officer;

(c) Facility personnel engaged in operations;

(d) Security and access control group; and

(e) Logistics or administrative support group

A single employee can be assigned with multiple responsibilities depending upon the size of the organisation and emergency situation, without compromising the response effectiveness. The licensee should include following details on the ERO in the REP:

i. Organisational chart of the ERO for preparedness and response for a radiation emergency. A sample chart of ERO is given in Annexure II;

ii. Names and designation of persons included in the ERO and their contact details including both landline and mobile numbers during working and off-working hours; and

iii. The line of succession for decision making in case of unavailability of any person in the ERO.

4.6. Roles and Responsibilities

The roles and responsibilities of each member of the ERO should be clearly defined in the REP. All personnel having responsibilities in the plan should remain well-informed about their respective roles and responsibilities described in the plan. A brief description on the roles and responsibilities of the important components of the ERO is given in the following subsections.

4.6.1. Emergency Response Director

The emergency response director should have authority and responsibility for overall command and control of the emergency response at the facility and during the activities to ensure preparation and implementation of the REP. His responsibilities should include:

i. Coordination of all EPR activities;

ii. Coordination with all functional groups of the ERO during emergency;

iii. Deployment of the RPO at the site for assessing radiation conditions, mitigating the radiological consequences and managing the exposure of emergency workers, if required;

iv. Declaration, up-gradation, down-gradation and termination of radiation emergency;

v. Notification to and information sharing with PNRA; and

vi. Coordination with off-site response organisations.

4.6.2. Radiation Protection Officer

This section should include the responsibilities of radiation protection officer (RPO) for radiation monitoring and assessment during emergencies. For activities in category IV, the RPO should ensure that radiation monitoring and other response actions are being carried out at the site in coordination with off-site authorities. Following responsibilities may be discharged by RPO in coordination with personnel engaged in operation of the facility and activity and response to an emergency:

i. Immediate assessment of radiation levels, in order to determine the required protective actions and level of protection for the response personnel;

ii. Recommendation of inner cordoned off area and protective actions for workers and public;

iii. Contamination control and decontamination of persons and areas, if required;

iv. Personnel dose assessment;

v. Environmental monitoring, wherever applicable;

vi. Identification of need for additional assistance for radiation monitoring;

vii. Ensuring safety and security of the sources during emergency;

viii. Preparation of the REP and implementing procedures (to be referred in relevant sections of the plan with the list of procedures attached as an annexure to the plan) and guidance for full range of postulated emergencies;

ix. Conduct of preparedness activities including trainings and exercises and ensuring that all ERO personnel are familiar with their respective roles and responsibilities during an emergency;

x. Initiation of prompt search in case a dangerous source is lost, stolen or misplaced;

xi. Maintaining detailed records of radiation levels, doses received by personnel, and actions taken during the emergency; and

In case the RPO is acting as emergency response director, the RPO should also discharge the responsibilities assigned to him.

4.6.3. Security and Access Control Group

The roles and responsibilities of facility security and access control personnel should be described in this section. The facility security personnel should control the emergency situation according to the directives or recommendations of emergency coordinator and the RPO. The key responsibilities of security personnel during the emergency response should include the following:

i. Assisting the RPO for access control and establishment of security perimeter;

ii. Evacuation of facility personnel from the accident site;

iii. Establishment and control of assembly areas including personnel counting;

iv. Assisting response organizations such as law enforcement agencies and rescue services during emergency response; and

v. Ensuring continuous operability of physical protection system for security of radioactive sources.

4.6.4. Logistics or Administrative Support Group

This section of the plan should contain necessary details regarding responsibilities of logistics or administrative group of the facility during emergency response. The logistics or administrative support group should be responsible for ensuring the availability of facilities, services and materials required for emergency response. The key responsibilities of such group should include;

i. Ensuring availability of adequate resources and facilities such as water, electrical power, food supplies, storage locations for performing emergency response functions;

ii. Arrangements of transportation and availability of communication means for emergency teams; and

iii. Coordination for medical management of contaminated and overexposed individuals, e.g., first aid to affected individuals and specialised medical treatment, etc.

4.6.5. Facility Personnel Engaged in Operations

The personnel engaged in operation of the facility should be responsible to execute mitigatory actions promptly without impairing the performance of the safety functions. Their roles and responsibilities should include performing mitigatory actions at the facility or accident site, such as returning the source to a safe or shielded position, safe termination and suspension of normal operations, and prevention of escalation of emergency, etc. Where applicable, the mitigatory actions should be carried out under the guidance or instruction of the RPO in order to minimise radiation doses.

4.7. Identification and Notification of an Emergency

This section should include a description of arrangements for identification and notification of a radiation emergency. The emergency identification should be based on predefined emergency action levels (EALs), operational intervention levels (OILs) and observable conditions. The emergency identification should not be delayed by awaiting full understanding of the initiating event. The notification point for the emergency response should be readily available to ensure effective response. In this respect, details on the following should be included in the REP:

i. Predefined criteria for declaration of facility emergency or alert for EPC-III and declaration of radiological emergency for EPC-IV. The criteria may be based on abnormal conditions at the facility, radiation levels or security related hazards, etc. (guidance on classification of emergencies is provided in Annexure III);

ii. Establishment of a notification point to receive emergency notifications and initiate predefined actions for the emergency response including contact details of the notification point;

iii. Means of announcement of emergency at the facility and at site (a sample of predefined statements for such announcements is provided in Annexure IV);

iv. Arrangement for notification of emergency to PNRA immediately but not later than one hour after declaration of emergency and follow-up notifications upon any change in emergency situation;

v. Review of declared emergency class in light of any new information; and

vi. Arrangements for transition from normal operations to operations under emergency conditions at the facility without jeopardizing safety; for example, transition to emergency response should not impair the ability of operational staff to follow procedures for mitigatory actions.

4.8. Protective and other Response Actions

This section should include a description of protective and other response actions that are necessary for the protection of public and workers during emergency response. Such actions are carried out to avoid or reduce the radiation doses and to control the emergency situation. These may include evacuation of area, decontamination of personnel and area, medical examination and treatment, control of access, psychological counselling and public information, etc. These actions should be carried out based on a protection strategy, i.e., their implementation should be in such a way that they do more good than harm. For example, the evacuation of the affected area during an emergency should be carried out in a controlled and safe manner to avoid any possible injuries due to evacuation. Information on the following arrangements for taking protective and other response actions should be included in this section:

i. Type of protective and other response actions to be taken considering the type of emergency;

ii. Criteria for taking and discontinuing protective and other response actions, such as OILs, etc.; and

iii. Arrangements for monitoring the levels of contamination of people, vehicles and goods moving out of affected areas, in order to control the spread of contamination and, as applicable, their decontamination.

4.9. Instructions, Warnings and Communication with the Public

This section should describe the arrangements made to provide the members of public and interested parties, who may be affected by the emergency, with information and advice that is necessary for their protection. The expected actions should be explained in plain and understandable language (Urdu as well as local) to the public through diverse means of communication, such as, loudspeakers, megaphone, distribution of pamphlets, etc. Following details on communication should be included in this section:

i. Predefined statements for declaration and termination of emergency (a sample of predefined statements is provided in Annexure IV);

ii. Information and instructions regarding protective actions to the personnel affected by the emergency;

iii. Sharing of information with general public in plain and understandable language, if situation requires;

iv. Arrangements to identify and address queries, misconceptions, rumors, incorrect and misleading information during an emergency; and

v. Communication means for issuing instructions and warnings.

4.10. Protection of Emergency Workers and Helpers

This section should include arrangements for protection of emergency workers and helpers to minimise their exposure during an emergency. It should be ensured that no emergency worker receive effective dose in excess of 50 mSv. The emergency workers, who undertake such emergency response actions in which doses received might exceed an effective dose value of 50 mSv, should be designated in advance and, do so voluntarily only for the purposes of saving human life or preventing serious injury, when taking actions to prevent the development of catastrophic conditions that could significantly affect people and the environment or when taking actions to avert a large collective dose.

Female workers, who are aware that they are pregnant or who might be pregnant, should be excluded from taking part in emergency response actions in which doses received might exceed an effective dose value of 50mSv. Details on the following arrangements for protection of emergency workers and helpers should be included in this section:

i. Providing necessary instructions to perform their duties and associated risks during the emergency conditions before the conduct of their duties;

ii. Provision of appropriate protection in anticipated hazardous conditions, including respiratory protection and protective clothing;

iii. Dose limits for emergency workers and helpers to be followed during emergency and the process for implementing these limits;

iv. Designation of emergency workers at the preparedness stage and during response, considering their periodic health surveillance;

v. Registering and integrating those emergency workers who were not designated in advance during the emergency response; and

vi. Assessment of the individual doses received in a response including dose monitoring and recording.

4.11. Managing the Medical Response

This section should describe arrangements for medical response during a radiation emergency. The emergency medical response should be planned and organized based on hazard assessment of radiation emergencies. During the emergency response, life-saving actions must take priority in all situations and should not be delayed owing to radiation exposure assessment. The following arrangements should be elaborated in this section;

i. Provision of immediate first aid to affected individuals at the facility or accident location;

ii. Medical examination, screening and triage;

iii. Assessment of exposures of emergency worker including doses received (extremity doses and whole-body doses), and appropriate medical attention;

iv. Provision of information to emergency workers and helpers on the doses received and on any consequent health risks and precautionary or remedial measures;

v. Identification of individuals who could potentially have been exposed on the site at levels requiring appropriate medical attention;

vi. Provision of transport services for transfer of patients and information to paramedical staff/hospital for handling of contaminated individuals; and

vii. Dissemination of instructions to medical personnel on universal precautions in healthcare against infection when treating individuals with possible contamination, as appropriate. Such instruction may, for example, include advice to use personal protective equipment (PPE), practice hand hygiene, handle sharps safely, implement proper waste disposal, clean and disinfect surfaces, etc.

4.12. Managing Radioactive Waste

This section should describe arrangements for managing radioactive waste during a radiation emergency. The occurrence of radiation emergency can result in generation of radioactive waste due to dispersion of radioactive material and implementation of protective actions, like disposal of PPE, decontamination of vehicles and people, etc. The radioactive waste should be managed in a way that does not hinder emergency response functions. For a small-scale emergency at facilities in EPC-III, the radioactive waste can be managed using the routine radioactive waste management procedures. However, in case of emergency during an activity in EPC-IV, the radioactive waste should be stored outside the cordoned off area in a secure manner to prevent the spread of contamination, e.g., by wind or by rain, etc. The licensee should elaborate following arrangements in this section for safe handling of radioactive waste:

i. Assignment of responsibilities for management of radioactive waste during and after an emergency;

ii. Compliance with the requirements of the PNRA "Regulations on Radioactive Waste Management - (PAK/915) (Rev.1)"; and

iii. Instructions for the management of contaminated deceased person as a result of radiation emergency, with due account taken of religious and cultural practices.

4.13. Coordination with Response Organisations or Authorities

This section should describe arrangements for coordination with response organisations or authorities. If the nature of emergency response requires involvement of off-site organisations or authorities, then the REP should identify such authorities. The emergencies in facilities in EPC-III may or may not require involvement of off-site response organisations or authorities depending upon the scale of emergency. However, in case of emergency in EPC-IV, the response organisations such as police, emergency services departments, etc., will be involved. These organisations or authorities should be promptly informed to ensure an effective response.

The licensee should, in case of any radiation emergency, immediately notify National Radiation Emergency Coordination Centre (NRECC) in PNRA HQ, Islamabad. If notification of radiation emergency cannot be provided to NRECC due to any unforeseen reason then licensee should notify respective Regional Nuclear Safety Directorate (RNSD) and Regional Nuclear Safety Inspectorate (RNSI) of PNRA. The contact details of NRECC and the relevant RNSD and RNSI should be included in the REP of the facility and/or activity, as given in Annexure V. The notification regarding incidents should be made in accordance with the requirements of Regulation 11(8) of the "Regulations on Management of a Nuclear or Radiological Emergency – (PAK/914) (Rev. 1)". In addition, such notification should be made as per "Incident Reporting Proforma" provided in Annexure VI. The following arrangements for coordination with off-site organisations should be included in the plan:

i. Conditions under which assistance will be required from local response organisations;

ii. A list of response organisations or authorities along with their contact details that will be contacted during emergencies;

iii. Providing access to the incident location, and necessary instructions for protection;

iv. Obtaining on call advice and assistance from PNRA, if needed; and

v. Communication of following information to PNRA during the emergency response;

(a) Information provided to the public;

(b) Details of protective and other response actions implemented;

(c) Clinical symptoms of radiation exposure, or other similar indications; and

(d) Record of doses received by emergency workers.

4.14. Termination of a Radiation Emergency

This section should describe arrangements for termination of a radiation emergency. Radiation emergency is terminated when emergency situation is under control, no further radiation exposure is expected due to emergency situation, and all necessary protective and mitigatory actions have been implemented.

Non-radiological consequences such as psychological, social or economic, etc., may be considered in deciding the termination of an emergency. The licensee should ensure that once the emergency is terminated, all workers involved in emergency response should be subject to the requirements for radiation protection as prescribed in the PNRA "Regulations on Radiation Protection - (PAK/904) (Rev.1)". The emergency and normal doses for each emergency worker should also be maintained separately as per the aforementioned regulations. This section should describe following arrangements:

i. Authority and responsibility for termination of emergency for working and off-working hours;

ii. Criteria for the termination of an emergency;

iii. Notifications and announcements to be made for termination of emergency;

iv. Resumption of normal operations of the facility and/or activity; and

v. Adjustment of protective actions and other response actions for termination of an emergency.

The criteria for the termination of an emergency may include dose rate levels, completion of characterization of the radiological situation and implementation of all necessary protective actions. A final radiation survey to confirm that radiation levels are within required limits should be conducted before resuming normal operation.

4.15. Analyzing the Radiation Emergency

This section should describe arrangements for analyzing the radiation emergency and the emergency response, in order to identify necessary actions to avoid recurrence of such emergencies and to improve emergency response arrangements. Following arrangements should be described in the plan for analyzing the radiation emergency:

i. Root cause(s) of the emergency including investigation of what happened and analysis of the occurrence, and recommendations for corrective actions;

ii. Comprehensive interviews of all concerned personnel regarding the radiation emergency including the circumstances; and

iii. Conduct of the analysis and submission of the analysis report to PNRA within 60 days as per Regulations 21(4) of the “Regulations on Radiation Protection - (PAK/904) (Rev.1)”.

4.16. Logistical Support and Facilities for Emergency Response

This section should describe arrangements for logistical support and facilities for emergency response. All necessary emergency response facilities and equipment should be made available to emergency response teams. The licensee should consider provision of the following facilities, supplies and equipment to the emergency response teams, as appropriate, for immediate and effective response to radiation emergencies and include these arrangements in the REP:

i. Copies of the approved REP and relevant procedures;

ii. Appropriate communication arrangements at the notification point, for example, telephone lines, mobile phones and fax machines, etc.;

iii. PPE, e.g., lead aprons, face masks, gloves, shoe covers, paper suits, etc.;

iv. Active dose monitoring devices, e.g., pen dosimeter, electronic personal dosimeter (EPD), etc.;

v. Calibrated radiation detection or survey equipment, along with appropriate quantity;

vi. Decontamination arrangements or kit;

vii. Source handling and recovery tools, e.g., long tong, shielded container, etc.; and

viii. Any other necessary equipment, supply or facility.

4.17. Trainings, Drills and Exercises

This section should describe arrangements for trainings, drills and exercise. Training and education of response personnel is crucial for effective emergency management with the purpose to familiarize them with the implementation of REP and implementing procedures and the use of emergency equipment. Emergency exercises provide the opportunity to test the capabilities and readiness of emergency response personnel and emergency response arrangements. The following details should be included in the plan on arrangements regarding trainings, drills and exercises:

i. Demonstration of the emergency arrangements prior to acquisition of radiation source;

ii. Participation of designated emergency workers in training, retraining or refresher courses annually;

iii. Conduct of radiation emergency exercises at least once in a year in different times and seasons based on diverse scenarios;

iv. Provision of appropriate training to workers for response to an emergency at an unforeseen location, in case of facilities involved in off the site activities;

v. Periodic review and revision of training courses in the light of experience gained from conduct of emergency drills or exercises and response to real emergencies;

vi. Submission of exercise scenario or plan to PNRA at least thirty (30) days before the conduct of exercise for review and approval; and

vii. Participation of relevant response organisations in some of the emergency exercises, where needed.

4.18. Record Keeping

This section should describe the policy and strategy for keeping and maintaining necessary record and reports. The REP should include the process of record keeping for all incidents. The following types of record should be maintained and the arrangements for the same should be included in the plan:

i. Emergency workers' health surveillance and their dose records;

ii. Radiation monitoring, contamination and decontamination record of area and personnel;

iii. Inventory of radioactive waste generated, if applicable;

iv. Emergency drills or exercises and actual incidents or accidents;

v. Equipment calibration and maintenance record;

vi. Inventory of supplies and equipment required for emergency response; and

vii. Post-emergency report including analysis of the radiation emergency, corrective actions taken, etc.

4.19. Emergency Arrangements of Radioactive Sources for Activities in EPC-IV

This section should describe arrangements for response to radiation emergency at any unforeseen location, for example, during transport and radiation activities outside the facility, etc. Such activities are classified in EPC-IV. As feasible, the emergency response organisation of the licensee should work under the command of off-site response organisations in case of such emergencies. All facilities in EPC-III carrying out transport of radioactive sources and licensee carrying out activities outside the facility, such as industrial radiography, etc., that come in EPC-IV should include information on the following arrangements in this section:

i. Predefined criteria for declaration of radiological emergency at the site, which may be based on abnormal conditions at the site, radiation levels, security related hazards, predefined indicators or observables; e.g., labels, placards, UN marking, package damage, etc. (guidance on classification of emergencies is provided in Annexure III).

ii. Notification to and requesting support from emergency response organisations; e.g., fire brigades, law enforcement agencies, medical care, civil protection, radiological experts, etc.; and provision of necessary guidance regarding protective measures including use of PPE to the persons of these organisations;

iii. Implementation of protective actions; such as cordoning off the area and escape of personnel based on the predefined observables, e.g., unshielded or damaged potentially dangerous source, major spill from a potentially dangerous source, fire, explosion or fumes involving a dangerous source, etc.; and access control of the cordoned off area in coordination with emergency response organisations;

iv. Initiation of mitigatory actions; e.g., extinguishing fire, stabilizing and evacuating the victims, isolating the source, organising the traffic, moving vehicle containing radioactive sources to safe location, etc.; in coordination with emergency response organisations in order to quickly regain control of the situation and limit the consequences of emergency;

v. Initiation of a prompt search in an event of a lost radioactive source; and

vi. Deployment of a radiation monitoring team (may include RPO or radiological assessor) at the site for assessing radiation conditions, mitigating the radiological consequences and managing the exposure of emergency workers.

4.20. Revision of Radiation Emergency Plan

This section should include information related to the review and revision of the REP. The plan should be reviewed at least once in every five years and revised, if needed. Such review or revision should take into account any change in the assessed hazards, experience and lessons learnt from research, operation, emergency response and exercises, technological developments and experience feedback. The revised REP should be submitted to PNRA for approval.

4.21. References

In this section, licensee should enlist all the reference documents used for formulation of the REP, e.g., PNRA regulations, regulatory guides, documents of IAEA or other international organizations, etc.

4.22. Glossary and Abbreviations

In this section the licensee should include definitions of specific terms and abbreviations used in the REP.

4.23. Annexures

In this section licensee should enlist annexures to the REP, if any.

5. REFERENCES

1. Regulations on Radiation Protection – (PAK/904) (Rev.1), Pakistan Nuclear Regulatory Authority (PNRA), Islamabad, 2020.
2. Regulations for the Licensing of Radiation Facility(ies) other than Nuclear Installation(s) - (PAK/908) (Rev.1), Pakistan Nuclear Regulatory Authority (PNRA), Islamabad, 2019.
3. Regulations on Management of a Nuclear or Radiological Emergency - (PAK/914) (Rev.1), Pakistan Nuclear Regulatory Authority (PNRA), Islamabad, 2022.
4. Regulations on Radioactive Waste Management - (PAK/915) (Rev.1), Pakistan Nuclear Regulatory Authority (PNRA), Islamabad, 2019.
5. Arrangements for Preparedness for a Nuclear or Radiological Emergency, IAEA Safety Standards Series No. GS-G-2.1, International Atomic Energy Agency (IAEA), Vienna, 2007.
6. Method for Developing Arrangements for Response to a Nuclear or Radiological Emergency, IAEA EPR-METHOD, International Atomic Energy Agency (IAEA), Vienna, 2003.
7. Manual for First Responders to a Radiological Emergency, IAEA EPR First Responder, International Atomic Energy Agency (IAEA), Vienna, 2006.

6. GLOSSARY

Terms like *"activities", "decontamination" and "facilities"* shall have the same meaning as defined in the PNRA Regulations on Radiation Protection - (PAK/904) (Rev.1).

Terms like *"dangerous source", "Emergency", emergency action level (EAL)", "emergency plan", "emergency preparedness", "emergency response", "emergency worker", "first responders", "hazard assessment", "helper in an emergency", "inner cordoned off area", "licensee", "non-radiological consequences", "notification point", "nuclear or radiological emergency", "operational intervention level (OIL)", "preparedness stage", "protective action", "response organization", "sievert", "source", "unforeseen location" and "worker"* shall have the same meaning as defined in the PNRA Regulations on Management of a Nuclear or Radiological Emergency – PAK/914 (Rev. 1).

Rest of the terms are defined as follows:

i. "Assembly point" means locations where non-essential personnel at the facility are assembled; accounted for and sheltered or evacuated.

ii. "Drill" means an activity that develops a skill or capability or tests a single emergency procedure or task. The drill may test an individual's skill, the proficiency of a team, or the adequacy of procedures, equipment or facilities.

iii. "Exercise" means any type of drill, trial, tabletop, partial, full-scale and field exercise. The objectives of an exercise are to validate plans and procedures and to test performance, to provide an opportunity for training in a realistic situation and to explore and test new concepts and ideas for emergency arrangements.

7. ABBREVIATIONS, ACRONYMS, INITIALISMS AND UNITS

EALs	Emergency Action Levels
EPC	Emergency Preparedness Category
EPD	Electronic Personnel Dosimeter
ERO	Emergency Response Organisation
EPR	Emergency Preparedness and Response
IAEA	International Atomic Energy Agency
kV	Kilovolt
mA	Milliampere
mSv	Millisievert
NRECC	National Radiation Emergency Coordination Centre
OILs	Operational Interventional Levels
PNRA	Pakistan Nuclear Regulatory Authority
PPE	Personal Protective Equipment
REP	Radiation Emergency Plan
RNSD	Regional Nuclear Safety Directorate
RNSI	Regional Nuclear Safety Inspectorate
RPO	Radiation Protection Officer

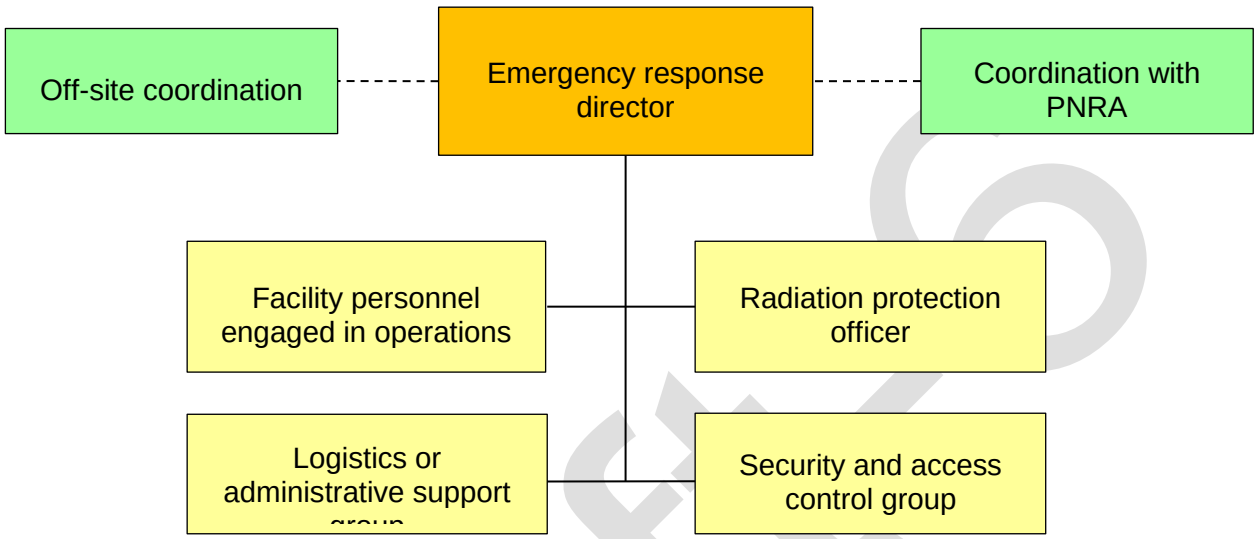
Annexure I

Categorization of Radiation Facilities or Activities in Emergency Preparedness Category III and IV, Potential Events and Emergency Class

EPC	Facility or Activity	Potential Events	Emergency Class
EPC-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, or for which such events have occurred in similar facilities.	• Full fledged medical centre • Radiotherapy centre • Nuclear medicine or cardiology centre • Nuclear gauges (up to category-III sources) • Blood irradiators • Agricultural irradiator • Industrial irradiators • Cargo or vehicle scanners with sources • Cargo or vehicle scanners with x-ray • Manufacturers of consumer products (having radioactive material as an integral part) • Manufacturers of sources (radioactive material and radiation generator) • Or any other facility as required by PAK/908 (Rev.1)	• Damage to a fixed dangerous sealed source (e.g., those used in gauges) • Loss of shielding or control of a large gamma emitter • Overexposure of worker, patient or public • Terrorist or criminal activity potentially resulting in hazardous conditions • Lost dangerous source • Theft of a dangerous source • Source in a fire • Any other	As per PAK/914 (Rev.1), emergencies at EPC-III facilities should be classified in following two categories; i. Facility Emergency ii. Alert
EPC-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 an unforeseen location	• Facilities in EPC-III conducting transport of radioactive material • Industrial radiography with sources • Industrial radiography with x-ray • Oil well logging (up to category-III sources) • Importers, exporters, or traders (dealing in radioactive material) • Or any other activity as required by PAK/908 (Rev.1)	• Disconnected or damaged source • Overexposure of worker, patient or public • Transport emergency • Terrorist or criminal activity potentially resulting in hazardous conditions • Lost dangerous source • Theft of a dangerous source • Source in a fire • Any other	As per PAK/914 (Rev.1), emergency for the activities should be classified as radiological emergency.

Annexure II

Example of Emergency Response Organisation



Annexure III

Classification of Radiation Emergencies

EPC	EPC-III		EPC-IV
Emergency Type	**Facility Emergency**	**Alert**	**Radiological Emergency**
Emergency Events	i. Loss of shielding or control ii. Rupture of a dangerous source iii. High doses on the site approaching generic criteria for protective action iv. Emergencies resulting in significant exposure or contamination of the public or staff on the site v. Terrorist or criminal activity potentially resulting in hazardous on-site conditions vi. Any other	i. Events involving an unknown or significant decrease in the level of protection of the public or on-site personnel, e.g., source stuck in the shielded position ii. Any other	i. Potential loss of control of a radioactive source, e.g., damage, loss of shielding, theft, lost, spill and fire, etc. ii. Transport accident involving radioactive sources iii. Law and order situation during transportation of radioactive sources iv. Any other

Annexure IV

Sample Predefined Statements for Declaration and Termination of Emergency

Declaration of Radiation Emergency

ATTENTION!

"This is a radiation emergency alert. Wait for the next announcement."

توجہ فرمائیں ! یہ ایک ریڈی ایشن ایمرجنسی الرٹ ہے۔ اگلے اعلان کا انتظار کریں۔

Announcements for Proceeding to Assembly Area

ATTENTION!

"This is a radiation facility emergency. All personnel should proceed to the assembly area immediately. Assembly area is located at …"

توجہ فرمائیں ! یہ ایک ریڈی ایشن فسیلیٹی ایمر جنسی ہے۔ تمام افراد فوراً اسمبلی ایریا پہنچ جائیں ۔

اسمبلی ایریا ------- ہے۔

Termination of Radiation Emergency

ATTENTION!

"Radiation emergency has been terminated."

توجہ فرمائیں ریڈی ایشن ایمرجنسی ختم ہو گئی ہے۔

Annexure V

Contact Details of PNRA

1. National Radiation Emergency Coordination Centre (NRECC), PNRA HQ, Islamabad

Phone:	051-9262019
Phone Backup:	051-2289210
Fax:	051-9260201
Fax Backup:	051-2289207
Officer In-charge (NRECC):	0300-8540319
Alternate Officer In-charge (NRECC):	0334-5131978
Toll Free Number	0800-77766
E-mail:	nrecc@pnra.org

Mailing Address: Officer In-charge NRECC, PNRA HQ, Mauve Area, G-8/1, Islamabad

2. Regional Nuclear Safety Directorate - I (RNSD-I), PNRA HQ, Islamabad

Phone Landline:	051-9257830
Phone Mobile:	0333-5005948
E-mail:	rnsd1@pnra.org

Mailing Address: Director RNSD-I, PNRA HQ, Mauve Area, G-8/1, Islamabad

3. Regional Nuclear Safety Inspectorate – IA (RNSI-IA), Peshawar

Phone Landline:	091-9330317
Phone Mobile:	0300-5361784
E-mail:	rnsi1a@pnra.org

Mailing Address: Head RNSI-IA, House No. 124, Street No. 9, Sector No. H-3, Phase-2, Hayatabad Town, Peshawar.

4. Regional Nuclear Safety Inspectorate – IB (RNSI-IB), Gilgit Baltistan

Phone Landline:	05811-930083
Phone Mobile:	0333-9990718
E-mail:	rnsi1b@pnra.org

Mailing Address: Head RNSI-IB, HRDC Complex, Near RPC Jutail, Gilgit

5. Regional Nuclear Safety Inspectorate – IC (RNSI-IC), Azad Jammu and Kashmir

Phone Landline:	0582-943904
Phone Mobile:	0333-5289056
E-mail:	rnsi1c@pnra.org

Mailing Address: Head RNSI-IC, Room# 01, 2nd Floor, Kutchery Plaza, Muzaffarabad, Azad Jammu & Kashmir.

6. Regional Nuclear Safety Directorate - II (RNSD-II), Chashma Site, Mianwali

Phone Landline:	0459-924294
Phone Mobile:	0331-0073215
E-mail:	rnsd2@pnra.org

Mailing Address: Director RNSD-II, Chashma Site, Kundian, Mianwali

7. Regional Nuclear Safety Inspectorate – IIA (RNSD-IIA), Multan

Phone Landline:	061-6350569
Phone Mobile:	0321-5822705
E-mail:	rnsi2a@pnra.org

Mailing Address: Head RNSI-IIA, House # 93, Western Fort Colony, Qasim Bela, Multan.

8. Regional Nuclear Safety Directorate - III (RNSD-III), Karachi

Phone Landline:	021-9926682
Phone Mobile:	0344-5632329
E-mail:	rnsd3@pnra.org

Mailing Address: Director RNSD-III, 42-C, 24th Commercial Street, Phase-II Extension, DHA, Karachi

9. Regional Nuclear Safety Directorate - IIIA (RNSD-IIIA), Quetta

Phone Landline:	081-9204433
Phone Mobile:	0334-9598925
E-mail:	rnsi3a@pnra.org

Mailing Address: Head RNSD-IIIA, House No. 514/A-17, Street No. 2, Madrassa Road, Quetta Cantt, Quetta

Annexure VI

INCIDENT REPORTING PROFORMA

(To be used in case of an emergency at a radiation facility or activity)

Incident date: ☐☐☐☐☐☐2 0☐☐ (dd-mm-yyyy)	Incident time: _____(AM/PM)
Facility/Activity Type: ☐ Full fledge medical centre ☐ Radiotherapy ☐ Nuclear medicine or cardiology ☐ Industrial radiography ☐ Blood/agricultural/industrial irradiators ☐ Nuclear gauges/oil well logging ☐ Education/research ☐ Cargo or vehicle scanners ☐ Manufacturers of sources ☐ Importer/Exporter/Trader ☐ Other_____ (Please specify)	**Nature of Incident:** ☐ Overexposure of worker/patient/public ☐ Source stuck/lost/stolen/theft ☐ Spill/dispersion of radioactive material ☐ Terrorist or criminal activity ☐ Internal or external contamination ☐ Damage to a fixed dangerous sealed source ☐ Transport emergency ☐ Loss of shielding ☐ Source in fire ☐ Any other_____ (Please specify)
Name and location of the facility/site where incident occurred: _____ _____ City: _____ Contact no.: _____	
License no.: _____	
Incident: (Brief description of event including basis for emergency declaration) (Use another sheet if required)	
Actions Taken/Planned	
Sender's Details: Name: _____ Designation: _____ Contact no.: _____ Reporting time: _____(AM/PM) Signature with date: _____	

Please send filled proforma to:

National Radiation Emergency Coordination Centre (NRECC)

PNRA HQ, Mauve Area, G-8/1, Islamabad

Phone: 051-9262019, Cell: 0300-8540319
Fax: 051-9260201, Email: nrecc@pnra.org

PAKISTAN NUCLEAR REGULATORY AUTHORITY
P.O. Box 1912, Islamabad
www.pnra.org