NRRC Technical Regulations

Nuclear Facilities Emergency Preparedness and Response

NRRC-R-14 Rev. 0.1

2024

هيئة الرقابة النووية والإشعاعية
Nuclear and Radiological Regulatory Commission

Nuclear Facilities Emergency Preparedness and Response

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Regulation

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Preamble

In accordance with the provisions of the Law of Nuclear and Radiological Control issued by Royal Decree No. (M/82) dated 25/7/1439 AH, and NRRC's Statute issued by the Ministers' Cabinet Resolution No. (334) dated 25/6/1439 AH, the NRRC prepared regulations that ensure control over radiological activities and practices as well as nuclear and radiological facilities.

This regulation has been prepared on the basis of International Atomic Energy Agency (IAEA) standards, international best practices, and in accordance with the Kingdom's international commitments. This regulation has been presented in "the Public Consultation Platform" for the public review, comments, and feedback.

This regulation has been approved by the NRRC's Board of Directors Resolution No. (R/1/1/2022) dated 20/04/2022.

This edition, NRRC-R-14 Rev. 0.1 (2024), of the regulation is revised and takes precedence over the previous publication, NRRC-R-14 (2022). In addition, the changes within this revision are editorial.

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Related Regulations

Chapter 1: Objective, Scope, and Definitions

Section 1: Objective

1. This regulation establishes the requirements for an adequate level of preparedness and response to a nuclear or radiological emergency at nuclear facilities that shall mitigate the consequences of a nuclear or radiological emergency if such an emergency arises despite all efforts made to prevent it.

Section 2: Scope

2. This regulation applies to preparedness and response to a nuclear or radiological emergency in all nuclear facilities under the licensee's responsibility with the potential for causing radiation exposure, environmental contamination, or concern on the part of the public, warranting protective actions and other response actions.

3. This regulation applies to preparedness and response to a nuclear or radiological emergency irrespective of the initiator of the emergency, whether the emergency follows a natural event, human error, mechanical or other failures, or a nuclear security event.

4. This regulation does not cover preparedness or response measures specific to nuclear security events for which requirements are provided in the Regulation on Nuclear Security (NRRC-R-11 Rev. 0.1).

5. This regulation applies to the licensee and focuses on on-site emergency arrangements.

Section 3: Definitions

Accident management program

An accident management program covers the preparatory measures, procedures and guidelines, and equipment that are necessary for preventing the progression of accidents, including accidents more severe than design basis accidents, and for mitigating their consequences if they do occur. The accident management program is documented and is periodically reviewed and, as necessary, revised.

Emergency arrangements

The integrated set of infrastructural elements, put in place at the preparedness stage, that are necessary to provide the capability for performing a specified function or task required in response to a nuclear or radiological emergency. These elements may include authorities and responsibilities, organization, coordination, personnel, plans, procedures, facilities, equipment or training.

Emergency classification

The process whereby an authorized official classifies an emergency in order to declare the applicable emergency class.

Emergency exposure situation

A situation of exposure that arises as a result of an accident, a malicious act or other unexpected event, and requires prompt action in order to avoid or reduce adverse consequences.

Emergency plan

A description of the objectives, policy and concept of operations for the response to an emergency and of the structure, authorities and responsibilities for a systematic, coordinated and effective response. The emergency plan serves as the basis for the development of other plans, procedures, and checklists.

Emergency planning zone

The precautionary action zone (PAZ) and the urgent protective action planning zone (UPZ).

Emergency preparedness

The capability to take actions that will effectively mitigate the consequences of an emergency for human life, health, property and the environment.

Emergency procedures

A set of instructions describing in detail the actions to be taken by emergency workers in an emergency.

Emergency response

The performance of actions to mitigate the consequences of an emergency for human life, health, property, and the environment.

Emergency response facility or location

This includes a facility or location necessary to support an emergency response for which specific functions are to be assigned at the preparedness stage and which need to be usable under emergency conditions.

Emergency worker

A person having specified duties as a worker in response to an emergency.

Existing exposure situation

This is a situation of exposure that already exists when a decision on the need for control needs to be taken.

First responders

The first members of an emergency service to respond at the site of an emergency.

Hazard assessment

This includes assessment of hazards associated with facilities within or beyond the borders of the Kingdom in order to identify:

a. The events and the associated areas for which protective actions and other response actions may be required within the Kingdom;

b. Actions that would be effective in mitigating the consequences of such events.

Helper in an emergency

Member of the public who willingly and voluntarily helps in the response to a nuclear or radiological emergency.

National Policy on Radioactive Waste Management (National Policy)

The set of established goals or requirements at the national level for the safe management of radioactive waste that defines national roles and responsibilities in the Kingdom, approved pursuant to Council of Ministers' Resolution no. 371, dated 4/7/1442H.

Planned exposure situation

The situation of exposure that arises from the planned operation of a source or from a planned activity that results in an exposure due to a source.

Precautionary action zone (PAZ)

An area around a facility for which emergency arrangements have been made to take urgent protective actions in the event of a nuclear or radiological emergency to avoid or to minimize severe deterministic effects off the site. Protective actions within this area are to be taken before or shortly after a release of radioactive material or an exposure, on the basis of prevailing conditions at the facility.

Response organization

An organization designated by the Kingdom as being responsible for managing or implementing any aspect of an emergency response.

Site area

A geographical area that contains an authorized facility, authorized activity or source, and within which the management of the authorized facility or authorized activity or first responders may directly initiate emergency response actions.

Urgent Protective Action

A Protective Action in the event of an Emergency which must be taken promptly (normally within hours) in order to be effective, and the effectiveness of which will be markedly reduced if it is delayed.

Urgent protective action planning zone (UPZ)

An area around a facility for which arrangements have been made to take urgent protective actions in the event of a nuclear or radiological emergency to avert doses off the site in accordance with international safety standards. Protective actions within this area are to be taken on the basis of environmental monitoring or, as appropriate, prevailing conditions at the facility.

Chapter 2: Responsibilities

Section 4: Responsibilities for Licensee

6. The licensee shall establish and maintain arrangements for on-site preparedness and response to a nuclear or radiological emergency for facilities or activities under its responsibility.

7. The licensee shall demonstrate and provide the NRRC with an assurance that emergency arrangements are in place for an effective on-site response to a nuclear or radiological emergency in relation to a nuclear facility or an activity under its responsibility.

8. The licensee shall establish, maintain, and demonstrate leadership concerning preparedness and response to a nuclear or radiological emergency.

9. The licensee shall prepare internal guidelines and emergency arrangements, including assigning responsibilities and ensuring their effective implementation to comply with the requirements established by this regulation.

Chapter 3: Planning of Emergency Arrangements

Section 5: Design Basis

10. The licensee shall plan for the emergency arrangements to ensure that emergencies are quickly brought under control, the safety of the individuals at the site area is assured, and timely action is taken to prevent or limit radiation exposure to the public in the emergency planning zone.

11. A hazard assessment shall be performed to provide a basis for a graded approach in preparedness and response to a nuclear or radiological emergency.

12. Protection strategies shall be developed, justified, and optimized at the planning stage by using scenarios based on the hazard assessment to avoid or minimize severe deterministic effects and reduce the likelihood of stochastic effects due to radiation exposure.

13. Planning shall be based on the analyses of the time-behavior progress of severe accident scenarios resulting in a potential radioactive release and taking into consideration the following:

    a. Variations in the state of the facility;

    b. The development of events as a function of time;

    c. The radiation situation at the facility;

    d. Radioactive releases;

    e. Radioactive release routes;

f. Weather conditions.

14. The emergency plan shall include arrangements for an emergency involving a combination of non-radiological and radiological hazards. The specific site conditions shall be taken into account in the emergency plan. The emergency plan shall include arrangements for threats caused by illegal activities.

15. As part of the accident management program and the emergency plan, the licensee shall make arrangements to expand the emergency arrangements to include the responsibility for long-term actions that consider the following:

    a. Availability of qualified personnel(s);

    b. Medical follow-up for emergency workers and helpers in an emergency;

    c. Management of radioactive waste.

16. For a site where several facilities are collocated, adequate arrangements shall be made to manage the emergency response at all the facilities if each is simultaneously under emergency conditions. This shall include arrangements to manage the deployment and protection of the response personnel on the site.

17. The emergency arrangements shall be consistent with the operation, fire protection, and nuclear security of a nuclear facility.

18. The emergency arrangements shall be compatible with the national plans for an accident at a nuclear facility.

19. Provision shall be made in the design of the buildings and the layout of the site to control the access of the operating personnel to the nuclear facility and/or equipment, including emergency response personnel and vehicles, with particular consideration given to barring the unauthorized entry of persons and goods into the facility.

20. The design basis shall be regularly assessed as required by the NRRC.

Section 6: Preparedness

21. The licensee shall prepare an emergency plan and establish the necessary organizational structure for the clear allocation of responsibilities, authorities, and arrangements for coordinating facility activities and cooperating with response organizations in a timely manner and throughout all phases of an emergency.

22. The licensee shall provide for the following:

    a. Prompt recognition and classification of emergencies, consistent with the criteria set for alerting the NRRC and relevant response organizations;

    b. Timely notification and alerting of response personnel;

    c. Ensuring the safety of all persons present on the site, including the protection of the emergency workers;

    d. Informing the authorities, including timely notification and subsequent provision of information, as required;

    e. Performing assessments of the current and foreseeable situation from the technical and radiological points of view (on- and off-site);

    f. Monitoring radioactive releases;

    g. Treatment and first aid of an adequate number of contaminated and/or overexposed workers/persons on-site;

    h. Facility management and damage control.

23. The preparedness arrangements shall include suitable, reliable, and diverse means of warning persons on the site, notifying the notification point, and communicating with off-site response organizations.

24. The emergency plan shall be based upon an assessment of reasonably foreseeable events and situations that may require protective measures on- or off-site. The plan shall:

a. Address long-lasting situations;

b. Clarify how site (and, if applicable, corporate) resources (human and material) common to installations are used;

c. Be coordinated involving all the bodies concerned;

d. Be capable of being extended should more severe events occur.

25. Arrangements shall be made for the timely monitoring and assessment of contamination, radioactive releases, and exposures to decide on or adjust the protective actions and other response actions that have to be taken or are being taken.

26. The nuclear facility shall include necessary emergency response facilities on-site. Information about important facility parameters and radiological conditions at the nuclear facility and in its immediate surroundings shall be provided to the emergency response facilities. Each emergency response facility shall be provided with means of communication with, as appropriate, the control room, the supplementary control room, and other important locations at the facility, as well as with on-site and off-site emergency response organizations. These capabilities shall be tested periodically.

27. A nuclear facility shall be provided with a sufficient number of escape routes, clearly and durably marked with reliable emergency lighting, ventilation, and other services essential to the safe use of these escape routes.

28. The design specifications for the emergency power supply, alternative power source, and alternative water supply at the nuclear facilities shall include the requirements for the capability, availability, and duration of the required power supply, capacity, and continuity.

29. The licensee shall coordinate with the relevant authorities to provide, as appropriate, Potassium Iodide (KI) tablets in advance to the public within the precautionary action zone.

Section 7: Classification of Emergency Situations

30. The licensee shall make arrangements for promptly classifying, based on the hazard assessment, a nuclear or radiological emergency warranting protective actions. This shall include a system for classifying all types of nuclear or radiological emergencies at nuclear facilities as follows or as amended by the NRRC.

    a. ***General emergency:*** for an emergency that warrants taking precautionary urgent protective actions, urgent protective actions, early protective actions, and other response actions on the site and off the site. Upon declaring this emergency class, appropriate actions shall promptly be taken on the basis of the available information relating to the emergency to mitigate the consequences of the emergency on the site and protect people on and off the site.

    b. ***Site area emergency:*** for an emergency that warrants taking protective actions and other response actions on the site and in the vicinity of the site. Upon declaring this emergency class, the following actions shall be taken promptly to:

        i. Mitigate the consequences of the emergency on the site and protect people on the site;

        ii. Increase the readiness to take protective actions and other response actions off the site, if necessary, based on observable conditions, reliable assessments, and/or monitoring results;

        iii. Conduct off-site monitoring, sampling, and analysis.

    c. ***Facility emergency:*** for an emergency that warrants taking protective actions and other response actions at the facility and on the site but does not warrant taking protective actions off the site. Upon

declaring this emergency class, actions shall promptly be taken to mitigate the consequences of the emergency and protect people at the facility and on the site. Emergencies in this class do not present an off-site hazard.

d. ***Alert:*** at facilities for an event that warrants taking actions to assess and mitigate the potential consequences at the facility. Upon declaring this emergency class, actions shall promptly be taken to assess and mitigate the potential consequences of the event and increase the readiness of the on-site response organizations.

31. At nuclear facilities, arrangements shall be made to review and, as appropriate, revise the declared emergency class in light of new information.

Section 8: Emergency Organization

32. The licensee shall have a management system and organization in place to ensure a timely response in an emergency situation. The tasks of people assigned to act during an emergency situation shall be defined in advance.

33. The licensee shall have personnel on-site at all times with the authority and responsibilities to classify and declare an emergency and, upon classification, to initiate promptly the appropriate on-site response.

34. A sufficient number of qualified personnel shall be available at all times to staff appropriate positions promptly following the declaration and notification of an emergency. Arrangements shall be established to ensure that sufficiently qualified personnel are available to staff appropriate emergency positions for extended situations.

35. Arrangements shall be made to ensure that emergency workers are, to the extent practicable, designated in advance and are fit for the intended duty.

36. Arrangements shall be made to provide technical assistance to operational staff, and teams to mitigate the consequences of an emergency shall be available.

37. The licensee shall identify those authorized to carry out the response functions assigned in the emergency plan.

38. The licensee emergency response shall be functional in cases where infrastructures at and around the site are severely disrupted.

39. Arrangements to support on-site actions shall be in place with considerations for large-scale destruction of infrastructure in the vicinity of the site due to external hazards.

40. Arrangements shall be implemented and maintained for requesting and obtaining external assistance in preparedness and response to a nuclear or radiological emergency.

Section 9: Emergency Plan and Instructions

41. The licensee shall prepare and submit an emergency plan and instructions for preparedness and response to a nuclear or radiological emergency.

42. Preparation of the emergency plan and instructions shall be coordinated with those bodies having responsibilities in an emergency, including public authorities and private enterprises, as relevant, and the plan and instructions shall be submitted to the NRRC. The plan and instructions shall be subject to review and update in light of the experience gained.

Section 10: Facilities, Devices, and Equipment

43. An appropriate emergency infrastructure shall be designated for responding to events on-site and coordinating with off-site authorities throughout different phases of an emergency response.

44. An "On-site Emergency Control Center," which is separated from the main control room, shall be provided for on-site emergency management staff. Important information about the plant and radiological conditions in and around the site shall be available in the on-site emergency control center. The on-site emergency control center shall have the appropriate means of communication

with the control room, any supplementary control room, other important points on-site, and the on- and off-site emergency response organizations.

45. Emergency infrastructure shall be suitably located, designed, and protected to:

    a. Remain operational for accident conditions to be managed (including design extension conditions with core melting) from these facilities;

    b. Allow protection from radiation and control of radiation exposure of emergency workers.

46. Instruments, tools, equipment, documentation, and communication systems for use in emergencies, including necessary mobile equipment and consumables, whether located on-site or off-site, shall be stored, maintained, tested, and inspected sufficiently frequently so that they will be available and operational during DBA (Design Basis Accident) and DEC (Design Extension Conditions). Access to these storage locations shall remain possible even in case of extensive infrastructure damage.

47. In emergency situations, the licensee shall be prepared to carry out radiation monitoring in the site area and the precautionary action zone. The licensee shall also take meteorological measurements and be capable of assessing the dispersion of radioactive substances and the resulting radiation exposure of the public in the emergency planning zone during an emergency situation.

48. To prepare for an emergency situation, the licensee shall have appropriate staff alarm systems, places of assembly in the site area, evacuation arrangements, the necessary personnel protective equipment, radiation measuring instruments, and iodine tablets available.

49. Facilities, instruments, tools, equipment, documentation, and communication systems to be used in an emergency, including those needed for off-site communication and the accident management program, shall be kept available.

They shall be maintained in good operational condition in such a manner that they are unlikely to be affected by, or made unavailable by, accidents.

50. All personal protective equipment, including equipment for use in an emergency, shall be maintained in proper condition and tested at regular intervals.

Section 11: Protecting Emergency Workers and Helpers in an Emergency

51. The licensee shall ensure that arrangements are in place for the protection of emergency workers and the protection of helpers in an emergency for the range of anticipated hazardous conditions in which they might have to perform response functions.

52. The licensee shall ensure that all practicable means are used to minimize the exposures of emergency workers and helpers in an emergency and to optimize their protection.

53. The licensee shall provide helpers in an emergency with instructions on how to perform the tasks under emergency conditions immediately before the conduct of their specified tasks.

54. The licensee shall ensure that emergency workers who undertake emergency response actions in which doses received might exceed an effective dose of 50 mSv, or as established by the NRRC, do so voluntarily and have been clearly and comprehensively informed in advance of associated health risks and available protective measures.

55. Emergency workers not designated as such in advance shall not be the first emergency workers chosen for taking action, which could result in their doses exceeding the guidance values of dose for lifesaving actions that are established by the NRRC.

56. Helpers in an emergency shall not be allowed to take action that could result in receiving doses exceeding an effective dose of 50 mSv or as established by the NRRC.

Chapter 4: Action Preparedness

Section 12: Commissioning of a Nuclear Power Plant

57. Appropriate arrangements shall be established from the time that nuclear fuel is first brought to the site, and the emergency plan and all emergency arrangements shall be completed before the commencement of fuel loading.

58. The emergency plan and preparedness response system shall be tested and validated in exercises before the commencement of the nuclear facility operation.

Section 13: Training and Exercise

59. Arrangements shall be made to identify the knowledge, skills, and abilities needed for personnel to perform their assigned response functions.

60. All personnel at the nuclear facility and all other on-site persons shall be instructed in the arrangements designed for them to be notified of an emergency and their actions when informed of an emergency.

61. Training shall include basic and task-specific emergency training and periodic refresher training on an appropriate schedule. The licensee shall ensure that all emergency response personnel meet the training obligations.

62. The emergency plan shall be regularly exercised at least annually. Some exercises shall be integrated to include security arrangements. Some exercises shall also include the off-site organizations concerned. For sites with multiple nuclear installations, some exercises shall address situations affecting multiple facilities on the site. Exercises shall also include the use and connection of mobile equipment, if any.

63. The licensee shall evaluate and report the emergency exercises systematically based on the emergency arrangements, and the emergency plan shall be subject to review and update in light of experience gained.

64. A training program for emergencies shall be established and implemented to ensure that facility staff and, as required, staff from other participating organizations possess the essential knowledge, skills, and attitudes required to accomplish non-routine tasks under stressful emergency conditions.

Section 14: Quality Management Program, Development, and Evaluation

65. As part of its management system, the licensee shall establish a program to ensure the availability and reliability of all supplies, equipment, communication systems and facilities, plans, procedures, and other arrangements necessary to perform functions in a nuclear or radiological emergency.

66. The program shall also include periodic and independent appraisals.

67. Arrangements shall be made to maintain, review, and update the emergency plan, procedures, and other arrangements and to incorporate lessons from research, operating experience, and emergency exercises.

68. The nuclear or radiological emergency situations and the emergency response shall be analyzed in order to identify actions to be taken, avoid other emergencies, and improve emergency arrangements.

Chapter 5: Action in Emergency Situation

Section 15: Action

69. The licensee shall be responsible for implementing the emergency plan and shall be prepared to take any necessary action for effective response.

70. The licensee shall promptly decide on and take actions on the site that are necessary to mitigate the consequences of a nuclear or radiological emergency involving a facility under its responsibility.

71. The licensee shall make arrangements to ensure protection and safety for all persons on the site in a nuclear or radiological emergency.

72. For facilities, arrangements shall be made:

    a. To promptly recognize and classify a nuclear or radiological emergency;

    b. To promptly declare an emergency class upon classification and initiate a coordinated and preplanned on-site response;

    c. To inform all employees and all other on-site persons of the actions that should be taken in the event of an emergency;

    d. To communicate with the appropriate notification point and provide sufficient information for an effective off-site response.

73. Arrangements shall be made to alert off-site responsible authorities promptly.

74. On-site radioactive waste arising from a nuclear or radiological emergency, including radioactive waste arising from associated protective actions and other response actions, shall be identified, characterized, and categorized in due time and managed safely and effectively as required by the NRRC and the National Policy.

Section 16: Communication

75. The licensee shall ensure that suitable, reliable, and diverse means of communication are available at all times, under the full range of emergency conditions, for use in taking protective actions and other response actions on the site and for communication with off-site officials responsible for taking protective actions and other response actions off the site or within any emergency planning zones.

Section 17: Command in Operations

76. The licensee is responsible for nuclear and radiation safety at the nuclear facility. In an emergency situation, the emergency manager of the nuclear facility, as

specified in the emergency plan, shall initiate and direct the work of the emergency response organization at the nuclear facility.

77. The emergency management of the nuclear facility shall ensure that personnel familiar with nuclear and radiation safety are designated to assist the management of rescue operations.

Section 18: Termination of an Emergency Situation

78. The emergency plan shall define the criteria governing the termination or reduction of measures taken due to an on-site emergency situation. A precondition for the termination of an emergency situation is that the nuclear facility has been brought into a safe state, releases of radioactive substances do not exceed the thresholds set for normal operation, and the necessary recovery measures are initiated.

79. Once the emergency is terminated, all workers undertaking relevant work shall be subject to the relevant requirements for occupational exposure in existing and planned exposure situations; individual monitoring, environmental monitoring, and health surveillance shall be conducted subject to the requirements for planned exposure situations or existing exposure situations, as appropriate.

Section 19: Measures Pertaining to Informing the Public

80. The licensee shall supply the NRRC and the response organizations with advance instructions for the public in the emergency planning zone on preparing for an emergency situation. In the event of an emergency situation, the licensee shall coordinate with the relevant authorities to warn the public within the precautionary action zone.

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