NRRC Technical Regulations

Operations of Nuclear Facilities

NRRC-R-09 Rev. 0.1

2024

هيئة الرقابة النووية والإشعاعية
Nuclear and Radiological Regulatory Commission

Operations of Nuclear Facilities

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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-09 Rev. 0.1 (2024), of the regulation is revised and takes precedence over the previous publication, NRRC-R-09 (2022). In addition, the changes within this revision are editorial.

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Chapter 1: Objective, Scope, and Definitions

Section 1: Objective

1. This regulation establishes the general requirements for the safe operations of nuclear facilities.

Section 2: Scope

2. The regulation covers the conduct of operation for all nuclear facilities. It addresses the direct operational activities of nuclear facilities as well as closely related functions and procedures.

3. The regulation shall be applied from the commencement of operation. For nuclear facilities other than disposal facilities, the regulation shall be applied until nuclear fuel or nuclear material is removed from the facility. For disposal facilities, the regulation shall be applied until closure. The requirements of this regulation shall be applied during nuclear testing.

4. This regulation is supplemented by the Regulation on Radiation Safety (NRRC-R-01 Rev. 0.1), the Regulation on Licensing and Regulatory Oversight of Nuclear Facilities (NRRC-R-03 Rev. 0.1), the Regulation on Leadership and Management for Safety (NRRC-R-04 Rev. 0.1), the Regulation on Construction and Commissioning of Nuclear Facilities (NRRC-R-08 Rev. 0.1), the Regulation on Decommissioning of Nuclear Facilities (NRRC-R-10 Rev. 0.1), the Regulation on Nuclear Security (NRRC-R-11 Rev. 0.1), the Regulation on Nuclear Material Accountancy and Control (NRRC-R-12 Rev. 0.1), and the Regulation on Nuclear Facilities Emergency Preparedness and Response (NRRC-R-14 Rev. 0.1).

Section 3: Definitions

Commencement of operation

The operation of a nuclear power plant or a research reactor is considered to begin when the first loading of nuclear fuel into the reactor begins. For other nuclear facilities, the operation is considered to begin when nuclear material is introduced into the nuclear facility.

Commissioning

Commissioning is the process where the structures, systems, and components (SSCs) of facilities and activities, after being constructed, are made operational and verified to be in accordance with the design and that they meet the required performance criteria. Commissioning may include both non-nuclear and nuclear testing.

Configuration management

The process of identifying and documenting the characteristics of a facility's structures, systems, and components (including computer systems and software) and of ensuring that changes to these characteristics are properly developed, assessed, approved, issued, implemented, verified, recorded, and incorporated into the facility documentation.

Control room operators

Authorized personnel who are directly in control of the facility.

Design-basis accident

A design-basis accident is a postulated accident leading to accident conditions for which a facility is explicitly designed in accordance with established design criteria and for which releases of radioactive material are kept within acceptable limits.

Design extension conditions

These are postulated accident conditions that are not considered for design-basis accidents but that are considered in the design process of the facility in accordance

with the best-estimate methodology and for which releases of radioactive material are kept within acceptable limits.

Direct operational activities

Direct operational activities shall refer to all activities that directly concern the systems, structures, and components of a nuclear facility.

Non-nuclear testing

Commissioning testing conducted before the commencement of operation.

Nuclear testing

Commissioning testing conducted after the commencement of operation.

Nuclear reactor

In this regulation, a nuclear reactor means both research reactors and commercial reactors used for electricity and/or heat production.

Operational limits and conditions

A set of rules setting forth parameter limits, the functional capability, and the performance levels of equipment and personnel approved by NRRC for the safe operation of an authorized facility.

Research reactor

A nuclear reactor used mainly for the generation and utilization of neutron flux and ionizing radiation for research and other purposes, including experimental facilities associated with the reactor and storage, handling and treatment facilities for radioactive material on the same site that are directly related to the safe operation of the research reactor.

Severe accident

Accident conditions more severe than a design-basis accident and involving significant fuel degradation.

Validation

The process of determining whether a product or service is adequate to satisfactorily perform its intended function.

Verification

The process of determining whether the quality or performance of a product or service is as stated, as intended, or as required.

Chapter 2: Principles for Safe Operation

Section 4: Principles and Basic Requirements for the Conduct of Operations

5. In a decision-making process related to the operation of a nuclear facility, the priority shall be given to safety.

6. The safety of operational activities shall be assessed and improved on a continuous basis.

7. All routine and non-routine operational activities shall be assessed and controlled based on a graded approach for potential nuclear or radiological risks.

8. All activities important to safety shall be carried out in accordance with documented procedures. The procedures and instructions described in the management system, and safety culture, shall be followed in the operation of a facility.

9. The licensee shall ensure that the operability of systems, structures, and components are systematically monitored and verified.

10. Prompt measures shall be taken to bring the nuclear facility to a safe and stable operational state when an event occurs in which parameters deviate from the limits and conditions for normal operation. Appropriate remedial actions shall be taken. The operating organization shall review and evaluate the event, and the NRRC shall be notified of such event.

11. The nuclear facility shall not be returned to service following an unplanned shutdown unless the start-up is demonstrated to be safe.

Chapter 3: Organization for Operation

Section 5: Organizational Aspects

12. Functional responsibilities, lines of authority, and lines of internal and external communication for the safe operation of a facility in all operational states and in accident conditions shall be established and documented as prescribed by NRRC.

13. The organization, qualifications, and number of operating personnel shall be adequate for the safe and reliable operation of the facility during all operational states and in accident conditions. The succession planning shall be an established practice for the operating personnel.

14. The persons to be appointed as control room operators shall be approved as established by the Regulation on Leadership and Management for Safety (NRRC-R-04 Rev. 0.1) and the Regulation on Licensing and Regulatory Oversight of Nuclear Facilities (NRRC-R-03 Rev. 0.1).

15. Adequate training facilities, including a representative simulator, appropriate training materials, and facilities for technical training and maintenance training, shall be made available for the training of operating personnel. Simulator training shall incorporate training for operational states and accident conditions.

16. For control room operators, initial and periodic training shall include training on a representative full-scope simulator.

17. Aspects of the working environment that influence human performance factors (such as workload or fatigue) and the effectiveness and fitness of personnel for duty shall be identified and controlled. Tools for enhancing human performance shall be used as appropriate to support the responses of operating personnel.

Chapter 4: Management of Operational Safety

Section 6: Operational Limits and Conditions (OLCs)

18. The OLCs shall be developed to ensure that the facility is being operated in accordance with the design assumptions and intent as documented in the Safety Analysis Report.

19. The OLCs shall define the conditions that must be met to prevent situations that might lead to accidents and, if occurred, mitigate the consequences of such events.

20. All OLCs shall be substantiated by a written statement of the reason for their adoption and shall be submitted to the NRRC for approval as established by the Regulation on Licensing and Regulatory Oversight of Nuclear Facilities (NRRC-R-03 Rev. 0.1).

21. The OLCs shall be reviewed and revised as necessary in consideration of experience, developments in technology and approaches to safety, and changes in the facility.

22. The process for making modifications or departing from the OLCs shall be defined. Modifications or departures shall be described and adequately justified by means of safety analyses and independent safety reviews. For departing, the process shall include provisions for returning the plant to normal operation within the OLCs. Any modifications to or any planned departures from the OLCs shall be submitted to the NRRC for approval prior to their implementation.

23. The OLCs shall cover all operational states, any intermediate conditions between these states, and temporary situations arising due to maintenance and testing.

24. The OLCs shall include the following:

    a. Safety limits;

    b. Limiting settings for safety systems;

c. Limits and conditions for normal operation;

d. Surveillance and testing requirements;

e. Action statements for deviations from normal operation.

25. Control room operators shall be highly knowledgeable of the OLCs and their technical bases. The persons who make decisions related to the OLCs shall be aware of the significance of their decisions to the safety of the facility.

26. The operating organization shall ensure that an appropriate surveillance program is established and implemented to ensure compliance with the OLCs and that its results are evaluated, recorded, and retained.

27. The operating organization shall ensure that the facility is operated in accordance with the set of OLCs.

28. In cases of deviation from the OLCs, remedial actions shall be taken immediately to re-establish compliance with the requirements. A process shall be established to ensure that deviations from OLCs are documented and reported in an appropriate manner and that appropriate actions are taken to prevent such deviations in the future.

Section 7: Operating Procedures

29. Operating procedures shall be developed to be applied comprehensively for nuclear testing, normal operation, anticipated operational occurrences, and accidents.

30. Emergency operating procedures, with other specific procedures or guidelines when applicable, shall be provided to cover design extension conditions. The aim shall be to re-establish or compensate for the loss of safety functions and to set out actions to prevent severe fuel damage for nuclear reactors and facilities hosting spent fuel.

31. For nuclear reactors and facilities hosting spent fuel, guidelines or procedures shall be developed for the management of severe accidents.

32. Both event-based and symptom-based approaches shall be used as appropriate. The related analyses and justifications shall be documented.

33. The set of procedures and guidelines shall be suitable to manage accident conditions that simultaneously affect several inventories of radioactive material and shall take potential interactions between the different inventories into account.

34. The set of procedures and guidelines shall be such that they are able to be implemented even if all nuclear facilities on a site are under accident conditions, taking into account the dependencies between the systems and common resources.

35. Appropriate practices shall be put in place for the preparation, revision, updating, review, validation, approval, and implementation of operating procedures with due regard to the purpose and special characteristics of each procedure.

36. The set of procedures and guidelines shall be kept updated to ensure that they remain acceptable for their purpose.

37. The set of procedures and guidelines shall be verified and validated in the form in which they will be used, as far as practicable, to ensure that they are administratively and technically correct for the facility, compatible with the environment in which they will be used, and compatible with the human resources available.

38. The approach used for facility-specific validation and verification shall be documented. The effectiveness of incorporating human factors and engineering principles in procedures and guidelines shall be judged when validating them. The validation of emergency operating procedures shall be based on representative simulations, using a simulator, where appropriate.

Section 8: Configuration and Modification Management

39. The operating organization shall establish and implement a system for configuration management to ensure consistency between design requirements, physical configuration, and documentation.

40. The operating organization shall establish and implement a system for modification management to ensure that all modifications, either permanent or temporary, are properly identified, screened, designed, evaluated, authorized, implemented, and recorded. Safety-related design modifications during the operation stage shall be approved by the NRRC.

41. The consequences of modifications for human tasks and performance shall be systematically analyzed. For all modifications, human and organizational factors shall be adequately considered.

42. Temporary modifications shall be limited in time and number to minimize the cumulative safety significance. The operating organization shall periodically review temporary modifications to determine whether they are still needed.

43. Temporary modifications shall be clearly identified at their location and at any relevant control position. The operating organization shall establish a formal system for informing relevant personnel, in a timely manner, of temporary modifications and their consequences for the operation and safety of the facility.

44. A comprehensive work planning and control system shall be implemented to ensure that work for the purposes of maintenance, testing, surveillance, and inspection is properly authorized, carried out safely, and documented in accordance with established procedures.

45. A marking system shall be maintained at the facility, according to which all systems, structures, and components of the facility are identified and marked.

Section 9: Operational Safety Programs and Practices

46. The operating organization shall establish an operating experience program to learn from events at the facility and events in the nuclear industry and other industries worldwide.

47. The operating organization shall establish procedures and criteria for reviewing and reporting events significant to safety. The event reports shall be submitted to the NRRC.

48. The operating organization shall have an Ageing Management Program to identify all aging mechanisms relevant to structures, systems, and components important to safety, determine their possible consequences, and determine necessary activities in order to maintain the operability and reliability of these SSCs over the entire operating lifetime of the facility. The Ageing Management Program shall be approved by NRRC.

49. The habitability and good condition of the control room shall be maintained. All safety-related operational locations outside the control room shall also be kept operable.

50. The operating organization shall prepare and implement documented programs of maintenance, testing, surveillance, inspection, and maintaining required equipment qualification of SSCs important to safety to ensure that their availability, reliability, and functionality remain in accordance with the design over the lifetime of the facility.

51. The operating organization shall make arrangements to ensure fire safety, providing measures to prevent fire accidents, detect and extinguish any fire accidents quickly, and prevent the spread of fire and its effects within or to any area that may affect the safety of the nuclear facility.

52. The operating organization shall establish and implement arrangements to ensure the effective performance, planning, and control of work activities during outages.

53. For nuclear reactors, the operating organization shall be responsible and shall make arrangements for all activities associated with core management and on-site fuel handling.

54. For nuclear facilities other than nuclear reactors, all operations with fissile material shall be carried out to maintain an adequate margin of subcriticality.

55. Spent fuel and other high-level waste (HLW) shall be managed to ensure that the criticality and removal of residual heat generated during management are adequately addressed.

56. A chemistry program shall be developed prior to normal operation and shall be in place during the commissioning program. The chemistry program shall provide the necessary information and assistance for chemistry and radiochemistry to ensure safe operation, the long-term integrity of structures, systems, and components, and the minimization of radiation levels.

57. The operating organization shall establish and shall periodically review and, as necessary, revise the accident management program.

58. The operating organization shall develop and implement programs to maintain a high standard of material conditions, housekeeping, and cleanliness in all working areas.

59. The operating organization shall establish and implement a program to ensure that safety-related risks associated with non-radiation-related hazards to personnel involved in activities at the plant are kept as low as reasonably achievable.

60. Where applicable, the operating organization shall establish and implement a comprehensive program for ensuring the long-term safe operation of the plant beyond a time frame established in the license conditions, design limits, safety standards, and/or regulations.

61. If an extended shutdown is planned or occurs, the operating organization shall establish and implement arrangements to ensure safe management, planning, effective performance, and control of work activities during the extended shutdown.

62. The operating organization shall establish and maintain a system for the control of records and reports. Records of operation, including maintenance and surveillance, shall be kept available from initial testing, including relevant off-site tests. All records shall be kept readable, complete, identifiable, and easily retrievable. Retention times for records and reports shall be commensurate with their level of importance for the purposes of operation and licensing and for future decommissioning.

63. The operating organization shall prepare a report of operation. The report shall include at least operational data, including data on the facility's output and performance, events important to safety, modifications to the facility or the organization, reports of radiation protection, environmental radiation safety, and spent fuel and radioactive waste management. The report shall be submitted to the NRRC annually or as determined by the NRRC.

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