NUCLEAR SAFETY AND RADIATION PROTECTION ACT NO.19 OF 1995

DRAFT NIGERIAN SAFETY OF OPERATIONS OF NUCLEAR POWER PLANTS REGULATIONS

MARCH 2021

In exercise of the powers conferred on it by Section 47 of the Nuclear Safety and Radiation Protection Act No.19 of 1995 and of all other powers enabling it in that behalf, THE NIGERIAN NUCLEAR REGULATORY AUTHORITY, with the approval of the President; hereby makes the following Regulations.

MARCH 2021

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PART I – GENERAL

Objective

1.1. The objective of these regulations is to establish the requirements which, in the light of experience and the present state of technology, must be satisfied to ensure the safe operation of nuclear power plants in Nigeria. These regulations are governed by the safety objective and safety principles that are established in the IAEA Fundamental Safety Principles and, where possible, best international practices.

Scope

1.2. The requirements in these regulations deal with the safe, effective, thorough and professional operation of a nuclear power plant. It covers operation up to the removal of nuclear fuel from the plant, including maintenance and modifications made throughout the lifetime of the plant. It covers the preparation for decommissioning but not the decommissioning phase itself. Normal operation and anticipated operational occurrences, as well as accident conditions, are taken into account. Where necessary, the Authority will issue a separate decision as to the applicability of these Regulations to other nuclear facilities.

Safety Objective and Safety Principles

1.3. The operation of a nuclear installation may have associated risks that the site personnel may bore by people living near the installation and/or by the whole society. The environment may also suffer harm if radioactive material were to be released, particularly during accidents. Consequently, it is necessary to limit the radiation risks to which people and the environment are subject for all reasonably foreseeable circumstances.

Safety objective

The fundamental safety objective is to protect people and the environment from harmfl effects of ionising radiation.

Safety principles related to operation of nuclear power plants

Principle 1: Responsibility for safety

> The prime responsibility for safety must rest with the person or Organisation responsible for facilities and activities that give rise to radiation risks.

Principle 3: Leadership and management for safety

> Effective leadership and management for safety must be established and sustained in organisations concerned with, and facilities and activities that give rise to, radiation risks.

Principle 5: Optimisation of protection

> Protection must be optimised to provide the highest level of safety that can reasonably be achieved.

Principle 6: Limitation of risks to individuals

> Measures for controlling radiation risks must ensure that no individual bears an unacceptable risk of harm.

Principle 7: Protection of present and future generations

> People and the environment, present and future, must be protected against radiation risks.

Principle 8: Prevention of accidents

> All practical efforts must be made to prevent and mitigate nuclear or radiation accidents.

Principle 9: Emergency preparedness and response

> Arrangements must be made for emergency preparedness and response for nuclear or radiation incidents.

The requirements derived from these principles shall be applied to minimise and control the radiation risks to workers and site personnel, the public and the environment.

PART II - MANAGEMENT AND ORGANISATIONAL STRUCTURE OF THE OPERATING ORGANISATION

Responsibilities of the Operating Organisation

2.1. The Operating Organisation shall have the prime responsibility for safety in the operation of a nuclear power plant.

2.2. The prime responsibility for safety shall be assigned to the Operating Organisation of the nuclear power plant. This prime responsibility shall cover all the activities relating to the operation directly and indirectly. It includes the responsibility for supervising the activities of all other related groups, such as designers, suppliers, manufacturers and constructors, employers and contractors, as well as the responsibility for operation of nuclear power plant(s) by the Operating Organisation itself. The Operating Organisation shall discharge this responsibility in accordance with its management system. The management system shall include the following activities:

(a) Policymaking for all areas of safety,
(b) Allocation of responsibilities with corresponding lines of authority and communication,
(c) Operating functions which include executive decision making and actions for the operation of a plant for all operational states and accident conditions.
(d) Support activities, which include obtaining, from both on-site and off-site organisations, including contractors, the technical and administrative services, and the use of facilities necessary perform the operating functions.
(e) For sites with shared safety-related resources with multiple units or with more than one Operating Organisation, the arrangements for the use of such shared resources shall be clearly defined.
(f) Review activities, which include monitoring and assessing the performance of the operating functions and supporting functions regularly.
(g) Reviewing functions shall also include review of the overall safety performance of the Organisation to assess the effectiveness of management for safety and to identify opportunities for improvement. In addition, a safety review of the plant shall be performed periodically, including design aspects, to ensure that the plant is operated in conformance with the approved design and safety analysis report and to identify possible safety improvements.
(h) Design integrity, which includes maintaining a formally designated entity that has overall responsibility for the continuing integrity of the plant design throughout its lifetime, and managing the interfaces and lines of communication with the responsible designers and equipment suppliers contributing to this continuing integrity.

Management system

2.3. The Operating Organisation shall establish, implement, assess and continually improve an integrated management system.

2.4. The Operating Organisation shall ensure through the establishment and use of a management system that the plant is operated in a safe manner and within the limits and conditions specified in the safety assessment and established in the authorisation.

2.5. The management system shall integrate all the elements of management so that processes and activities that may affect safety are established and conducted coherently with other requirements, including requirements in respect of leadership, protection of health, human performance, protection of the environment, security and quality, and so that other requirements or demands do not compromise safety.

2.6. The management system of the Operating Organisation shall provide for arrangements to ensure safety in activities performed by external support organisations. Responsibility for activities performed by external support organisations and their overall control and supervision rests with the Operating Organisation.

2.7. The Operating Organisation shall establish a system for the supervision of work performed by support organisations. It shall be the responsibility of the Operating Organisation to ensure that the personnel of external support organisations who perform activities on structures, systems important to safety or activities affecting safety are qualified to perform their assigned tasks.

2.8. The overall contracted activity shall be clearly specified in writing and shall be approved by the Operating Organisation prior to its commencement. The Operating Organisation shall ensure long term access to knowledge of the plant design and manufacturing, and construction throughout the lifetime of the plant.

2.9. The Operating Organisation, in accordance with the regulatory requirements, shall submit or make available to the Authority all necessary documents and information. The Operating Organisation shall develop and implement a procedure for reporting events to the Authority in accordance with the established criteria and the National regulations.

2.10. The Operating Organisation shall provide the Authority with all necessary assistance to enable it to perform its duties, including enabling unhindered access to the plant and providing documentation.

Structure and functions of the Operating Organisation

2.11. The structure of the Operating Organisation and the functions, roles and responsibilities of its personnel shall be established and documented.

2.12. Functional responsibilities, lines of authority, and lines of internal and external communication for the safe operation of a plant in all operational states and accident conditions shall be clearly specified in writing. Authority for the safe operation of the plant shall be delegated to the plant management. In this case, the necessary resources and support shall be provided.

2.13. Documentation of the plant's organisational structure and of the arrangements for discharging responsibilities shall be made available to the plant staff and to the Authority. The

structure of the Operating Organisation shall be specified so that all roles that are critical for safe operation are specified and described. Proposed organisational changes to the structure and associated arrangements, which might be of importance to safety, shall be analysed in advance by the Operating Organisation. Proposals for such organisational changes shall be submitted to the Authority for approval.

Staffing of the Operating Organisation

2.14. The Operating Organisation shall be staffed with competent managers and sufficient qualified personnel for the safe operation of the plant.

2.15. The Operating Organisation shall be responsible for ensuring that the necessary knowledge, skills, attitudes and safety expertise are sustained at the plant and that long term objectives for human resources policy are developed and are met.

2.16. The Organisation, qualifications and number of operating personnel shall be adequate for the safe and reliable operation of the plant in all operational states and accident conditions. Succession planning shall be an established practice for the operating personnel. The recruitment and selection policy of the Operating Organisation shall be directed at retaining competent personnel to cover all aspects of safe operation. A long term staffing plan aligned to the long term objectives of the Operating Organisation shall be developed in anticipation of the future needs of the Operating Organisation for personnel and skills.

2.17. The shift team shall be staffed to ensure that sufficient authorised operators are present to operate the plant in accordance with the operational limits and conditions. The shift staffing patterns, shift cycles and controls on working hours shall provide sufficient time for the training of shift personnel. Distractions to control room operators shall be minimised. To avoid overburdening control room operators and to allow them to focus on their responsibilities for safety, activities shall be scheduled to reduce simultaneous activities as far as possible.

2.18. The implementation of the shift system shall be monitored, and the suitability of the shift system in terms of the safe operation of the nuclear facility shall be assessed on a regular basis and whenever changes are made to the shift system.

2.19. A staff health policy shall be instituted and maintained by the Operating Organisation to ensure the fitness for duty of personnel. Attention shall be paid to minimise conditions causing stress, set restrictions on overtime and set requirements for rest breaks. The health policy shall cover the prohibition of alcohol consumption and drug abuse.

Safety Policy

2.20. The Operating Organisation shall establish and implement operational policies that give safety the highest priority.

2.21. The operational policy established and implemented by the Operating Organisation shall give safety the utmost priority, overriding the demands of production and project schedules. The safety policy shall promote a strong safety culture, including a questioning attitude and a commitment to excellent performance in all activities important to safety. Managers shall promote an attitude of safety consciousness among plant staff

2.22. The safety policy shall stipulate clearly the leadership role of the highest level of management in safety matters.

2.23. Senior management shall communicate the provisions of the safety policy throughout the Organisation. Safety performance standards shall be developed for all operational activities and shall be applied by all site personnel.

2.24. All personnel in the Organisation shall be made aware of the safety policy and their responsibilities to ensuring safety. The safety performance standards and the expectations of the management for safety performance shall be clearly communicated to all personnel, and it shall be ensured that they are understood by all those involved in their implementation.

2.25. Critical aspects of the safety policy shall be communicated to external support organisations, including contractors, so that the Operating Organisation's requirements and expectations for the safety-related activities of external support organisations, including contractors, will be understood and met.

2.26. The safety policy of the Operating Organisation shall include commitments to perform periodic safety reviews of the plant throughout its operating lifetime in compliance with the regulatory requirements. Operating experience and significant new safety-related information from relevant sources, including information on agreed corrective actions and necessary improvements that have been implemented, shall be taken into account.

2.27. The safety policy of the Operating Organisation shall include a commitment to achieving enhancements in operational safety. The strategy of the Operating Organisation for enhancing safety and finding more effective ways of applying and, where feasible, improving existing standards shall be continuously monitored and supported by means of a clearly specified programme with clear objectives and targets.

Operational limits and conditions

2.28. The Operating Organisation shall ensure that the plant is operated in accordance with the set of operational limits and conditions.

2.29. The Operational Limits and Conditions (OLC) shall be so prepared that the nuclear power plant is operated in accordance with the design bases specified in the safety analysis report as well as in accordance with its licence conditions.

2.30. The operational limits and conditions shall form an important part of the basis for the authorisation of the Operating Organisation to operate the plant. The plant shall be operated within the operational limits and conditions to prevent situations arising that could lead to anticipated operational occurrences or accident conditions and to mitigate the consequences of such events if they do occur.

2.31. The operational limits and conditions shall reflect the provisions made in the final design as described in the safety analysis report. The operational limits and conditions shall be submitted to the Authority for assessment and approval before the commencement of operation. All operational limits and conditions shall be substantiated by a written statement of the reason for their adoption.

2.32. The correctness of the requirements outlined in the Operational Limits and Conditions shall be justified by plant design solutions, safety analyses and, where applicable, the results of commissioning tests.

2.33. The operational limits and conditions shall be reviewed and revised as necessary in consideration of experience, developments in technology and approaches to safety, and changes in the plant.

2.34. The operational limits and conditions shall include requirements for normal operation, including shutdown and outage stages, and shall cover actions to be taken and limitations observed by the operating personnel.

2.35. The operational limits and conditions 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.

2.36. Operating personnel directly responsible for the conduct of operations shall be trained in and shall be thoroughly familiar with the operational limits and conditions in order to comply with the provisions contained therein.

2.37. The Operating Organisation shall ensure that an appropriate surveillance programme is established and implemented to ensure compliance with the operational limits and conditions and that its results are evaluated, recorded and retained.

2.38. The plant shall be returned to a safe 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 Organisation shall undertake a review and evaluation of the event and notify the Authority in accordance with the established event reporting system.

2.39. A process shall be established to ensure that deviations from operational limits and conditions are documented and reported in an appropriate manner, and that appropriate actions are taken in response. Responsibilities and lines of communication for responding to such deviations shall be clearly specified in writing.

2.40. The process for amending or departing from the Operational Limits and Conditions shall be defined. Such amendments or departures shall be described and adequately justified by means of safety analyses and an independent safety review. Any amendments to or departures from the Operational Limits and Conditions shall be submitted to Authority for approval prior to their implementation.

2.41. In the event that the nuclear power plant is found to be at a state not consistent with the Operational Limits and Conditions, remedial actions shall be taken immediately in order to re-establish compliance with the requirements of the Operational Limits and Conditions. Such occurrences shall be investigated and the necessary corrective and preventive action taken. Such occurrences shall be reported to the Authority.

2.42. The Operating Organisation shall not intentionally exceed the operational limits and conditions. Where circumstances necessitate plant operation outside the operational limits and conditions, clear formal instructions for such operations shall be developed on the basis of safety analysis.

2.43. The requirements and limits outlined in the Operational Limits and Conditions shall be based on deterministic analyses. The comprehensiveness and sufficient balance of the requirements and operational limits shall be verified by means of a probabilistic risk analysis (PRA).

2.44. The Operational Limits and Conditions shall be specific to each plant unit. The Operational Limits and Conditions shall be clear and unambiguous, and any special terminology used shall be defined.

2.45. The Operational Limits and Conditions shall unambiguously define the operational states of the nuclear power plant unit concerned.

2.46. The Operational Limits and Conditions shall cover all operational states, including power operation, shutdown and refuelling, any intermediate conditions between these states, and temporary situations arising out of service and testing.

2.47. Any faults in components governed by the Operational Limits and Conditions shall be repaired without delay.

2.48. The Operational Limits and Conditions shall specify the requirements established for operating the nuclear power plant unit concerned, covering:

(a) the process parameter limits that are critical in terms of the integrity of barriers, derived from the analyses serving as the design basis;
(b) the limits for the activation of protection and limitation systems;

(c) the basic requirements for safety systems to be complied with in different operational states, limit values, allowed deviations, operability requirements, the actions to be taken, and the time allowed to complete these actions;
(d) the testing frequency, staggering, operational state, and the related instructions;
(e) any preventive maintenance giving rise to inoperability;
(f) the administrative requirements;
(g) the justifications for the requirements specified above.

2.49. The safety limits shall be established using a conservative approach in order to take uncertainties in the safety analyses into account to a sufficient degree of certainty.

2.50. Adequate margins shall be ensured between the limits and actuation settings for safety systems established in the Operational Limits and Conditions in order to avoid any inadvertent actuation of safety systems.

2.51. The Operational Limits and Conditions shall specify the minimum staffing levels for the nuclear power plant in the control room area and on the plant site during the different operational states, as well as the conditions pertaining to the shift system. Additionally, the requirements concerning the availability of the on-call safety engineer and the response time within which he or she must arrive at the control room shall be specified.

2.52. The Operational Limits and Conditions shall state the administrative and technical requirements for starting up the nuclear power plant unit following an outage or transient.

2.53. The fulfilment of the requirements stated in the Operational Limits and Conditions shall be verified and documented prior to any planned change of the nuclear power plant unit's operational state.

Qualification and training of personnel

2.54. The Operating Organisation shall ensure that all activities that may affect safety are performed by suitably qualified and competent persons.

2.55. The Operating Organisation shall clearly define the requirements for qualification and competence to ensure that personnel performing safety-related functions are capable of safely performing their duties. Reactor and turbine Operators shall require formal authorisation or a licence.

2.56. Suitably qualified personnel shall be selected and shall be given the necessary training and instruction to enable them to perform their duties correctly for different operational states of the plant and in accident conditions, in accordance with the appropriate procedures.

2.57. The management of the Operating Organisation shall be responsible for the qualification and the competence of plant staff. Managers shall participate in determining the needs for training and in ensuring that operating experience is taken into account in the training. Managers

and supervisors shall ensure that production needs do not unduly interfere with the conduct of the training programme.

2.58. A suitable training programme shall be established and maintained for the training of personnel before assignment to safety-related duties. The training shall emphasise the importance of safety in all aspects of plant operation and promote safety culture. The refresher training shall also include retraining provision for personnel who have had extended absences from their authorised duties.

2.59. Performance-based programmes for initial and continuing training shall be developed and put in place for each major group of personnel. Training programmes shall promote attitudes that help to ensure that safety issues receive the attention that they warrant.

2.60. The training programmes shall be assessed and improved by means of periodic review. In addition, a system shall be put in place for the timely modification and updating of the training facilities, computer models, simulators and materials to ensure that they adequately reflect current plant conditions and operating policy and that any differences are justified.

2.61. Operating experience at the plant, as well as relevant experience at other plants, shall be appropriately incorporated into the training programme. It shall be ensured that training is conducted on the root cause(s) of the events and the determination and implementation of corrective actions to make their recurrence less likely.

2.62. All training positions shall be held by adequately qualified and experienced persons who provide the requisite technical knowledge and skills and have credibility with the trainees. Qualification requirements shall be established for the training instructors. Instructors shall be technically competent in their assigned areas of responsibility, have the necessary instructional skills, and be familiar with routines and work practices at the workplace. Qualification requirements shall be established for the training instructors.

2.63. 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 plant operational states and accident conditions.

Performance of safety-related activities

2.64. The Operating Organisation shall ensure that safety-related activities are adequately analysed and controlled to ensure that the risks associated with harmful effects of ionising radiation are kept as low as reasonably achievable.

2.65. All routine and non-routine operational activities shall be assessed for potential risks associated with harmful effects of ionising radiation. The level of assessment and control shall depend on the safety significance of the task.

2.66. All activities important to safety shall be carried out in accordance with written procedures to ensure that the plant is operated within the established operational limits and conditions. Acceptable margins shall be ensured between normal operating values and the established safety system settings to avoid undesirably frequent actuation of safety systems.

2.67. No experiments shall be conducted without adequate justification. If there is a need to conduct a non-routine operation or test that is not covered by existing operating procedures, a specific safety review shall be performed, and a special procedure shall be developed and subject to approval of the Authority.

2.68. Written communication shall be preferred, and oral communication shall be minimised. If oral communication is used, attention shall be given to ensuring that oral instructions are clearly understood.

2.69. Aspects of the working environment that influence human performance factors 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.

2.70. The Operating Organisation shall encourage plant personnel to have a questioning attitude and make appropriate and conservative decisions to minimise risk and maintain the plant in a safe condition.

2.71. The responsibilities and authorities for restarting a reactor after an event leading to an unplanned shutdown, scram or major transient, or to an extended period of maintenance, shall be clearly established in writing. An investigation shall be carried out to determine the cause of the event, and corrective actions shall be taken to make its recurrence less likely. Prior to the restart or the resumption of full power of the affected plant, the Operating Organisation shall carry out necessary remedial actions, including inspection, testing and repair of damaged structures, systems and components, and shall revalidate the safety functions that might be challenged by the event. Restart conditions and criteria shall be established and followed after the timely implementation of the necessary corrective actions.

2.72. If a probabilistic assessment of risk is to be used for decision-making purposes, the Operating Organisation shall ensure that the risk analysis is of appropriate quality and scope for decision-making purposes. The risk analysis shall be performed by appropriately skilled analysts and shall be used in a manner that complements the deterministic approach to decision making in compliance with applicable regulations and plant licence conditions.

Monitoring and review of safety performance

2.73. The Operating Organisation shall establish a system for continuous monitoring and periodic review of the safety of the plant and of the performance of the Operating Organisation.

2.74. An adequate audit and review system shall be established by the Operating Organisation to ensure that the safety policy of the Operating Organisation is being implemented effectively and that lessons are being learned from its own experience and from the experience of others to improve safety performance.

2.75. Self-assessment by the Operating Organisation shall be an integral part of the monitoring and review system. The Operating Organisation shall perform systematic self-assessment to identify achievements and to address any degradation in safety performance.

2.76 Where practicable, suitable objective performance indicators shall be developed and used to enable senior managers to detect and react to shortcomings and deterioration in the management of safety.

2.77 Monitoring of safety performance shall include the monitoring of: Monitoring personnel performance; attitudes to safety; response to infringements of safety; and violations of operational limits and conditions, operating procedures, regulations and licence conditions. The monitoring of plant conditions, activities and attitudes of personnel shall be supported by systematic walk-downs of the plant by the plant managers.

2.78. The persons and Organisation performing quality assurance functions shall have sufficient authority and organisational independence to identify problems relating to quality and to initiate, recommend and verify the implementation of solutions. These persons and organisations shall report to a high level of management.

2.79. The appropriate corrective actions shall be determined and implemented as a result of the monitoring and review of safety performance. Progress in taking the corrective actions shall be monitored to ensure that actions are completed within the appropriate timescales. The completed corrective actions shall be reviewed to assess whether they have adequately addressed the issues identified in audits and reviews.

Control of plant configuration

2.78. The Operating Organisation shall establish and implement a system for plant configuration management to ensure consistency between design requirements, physical configuration and plant documentation.

2.79. Controls on plant configuration shall ensure that changes to the plant and its safety-related systems are properly identified, screened, designed, evaluated, implemented and recorded. Proper controls shall be implemented to handle changes in plant configuration that result from maintenance work, testing, repair, operational limits and conditions, and plant refurbishment; and from modifications due to ageing of components, obsolescence of technology, operating experience, technical developments and results of safety research.

Management of modifications

2.80. The Operating Organisation shall establish and implement a programme to manage modifications.

2.81. A modification programme shall be established and implemented to ensure that all modifications are properly identified, specified, screened, designed, evaluated, authorised, implemented and recorded. Modification programmes shall cover: structures, systems and components; operational limits and conditions; procedures; documents; and the structure of the Operating Organisation. Modifications shall be characterised on the basis of their safety significance. Modifications shall be subject to the approval of the Authority, in accordance with their safety significance and in line with regulatory requirements.

2.82. Modification control shall ensure the proper design, safety assessment and review, control, implementation and testing of all permanent and temporary modifications. Consequences of the modification for human tasks and performance shall be systematically analysed. For all plant modifications, human and organisational factors shall be adequately considered.

2.83. Temporary modifications shall be limited in time and number to minimise the cumulative safety significance. Temporary modifications shall be clearly identified at their location and any relevant control position. The Operating Organisation shall establish a formal system for informing relevant personnel in good time of temporary modifications and of their consequences for the operation and safety of the plant.

2.84. The plant management shall establish a system for modification control to ensure that plans, documents and computer programs are revised in accordance with modifications.

2.85. Before commissioning a modified plant or putting the plant back into operation after modifications, personnel shall be trained, as appropriate, and all relevant documents necessary for plant operation shall be updated.

Periodic safety review

2.86. Systematic safety assessments of the plant, in accordance with the regulatory requirements, shall be performed by the Operating Organisation throughout the plant's operating lifetime, with due account taken of operating experience and significant new safety-related information from all relevant sources.

2.87. Safety reviews such as periodic safety reviews or safety assessments under alternative arrangements shall be carried out at least once every ten (10) years throughout the lifetime of the plant. Safety reviews shall address, in an appropriate manner: the consequences of the cumulative effects of plant ageing and plant modification; equipment requalification; operating experience, including national and international operating experience; current national and international standards; technical developments; organisational and management issues; and site-related aspects.

2.88 The Operating Organisation shall report to the Authority as required, in a timely manner, the confirmed findings of the safety review that have implications for safety.

2.89. On the basis of the results of the systematic safety assessment, the Operating Organisation shall implement any necessary corrective actions and reasonably practicable modifications for compliance with applicable standards with the aim of enhancing the safety of the plant by further reducing the likelihood and the potential consequences of accidents.

Equipment qualification

2.90. The Operating Organisation shall ensure that a systematic assessment is carried out to provide reliable confirmation that safety-related items are capable of the required performance for all operational states and accident conditions.

2.91. Appropriate concepts and the scope and process of equipment qualification shall be established, and effective and practicable methods shall be used to upgrade and preserve equipment qualification. A programme to establish, confirm and maintain required equipment qualification shall be launched from the initial phases of design, supply and installation of the equipment. The effectiveness of equipment qualification programmes shall be periodically reviewed.

Ageing management

2.92. The Operating Organisation shall ensure that an effective ageing management programme is implemented to ensure that required safety functions of systems, structures and components are fulfilled over the entire operating lifetime of the plant.

2.93. The ageing management programme shall determine the consequences of ageing and the activities necessary to maintain the operability and reliability of structures, systems and components. A systematic approach shall be taken to provide for the development, implementation and continuous improvement of ageing management programmes. The ageing management programme shall be coordinated with, and be consistent with, other relevant programmes, including the programme for periodic safety review.

2.94. Long term effects arising from operational and environmental conditions shall be evaluated and assessed as part of the ageing management programme. Account shall be taken in the programme of the safety relevance of structures, systems and components.

Records and reports

2.95. The Operating Organisation shall establish and maintain a system for the control of records and reports.

2.96. The Operating Organisation shall identify the types of record and report relevant for the safe operation of the plant. Records of operation, including maintenance and surveillance, shall be kept available from initial testing during the start-up of each plant system important to safety.

2.97. The records of operation shall be retained in proper archives for the periods required by the Authority. 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 plant licensing and for future decommissioning.

Programme for long term operation

2.98. The Operating Organisation shall establish and implement a comprehensive programme for ensuring the long term safe operation of the plant beyond a time-frame established in the licence conditions, design limits, safety standards and/or regulations.

2.99. The justification for long term operation shall be prepared on the basis of the results of a safety assessment, with due consideration of the ageing of structures, systems and components. The justification for long term operation shall utilise the results of periodic safety review and shall be submitted to the Authority for approval on the basis of an analysis of the ageing management programme, to ensure the safety of the plant throughout its extended operating lifetime.

PART III - OPERATIONAL SAFETY PROGRAMMES

3.1. The Operating Organisation shall ensure that the implementation of safety and security requirements satisfies both safety and security objectives.

3.2. The Operating Organisation shall be responsible for managing the implementation of safety requirements and security requirements by ensuring close cooperation between safety managers and security managers, with the objective of minimising risks.

3.3. Safety and security measures shall be designed and implemented in such a manner that they do not compromise each other. The Operating Organisation shall establish mechanisms to resolve potential conflicts and to manage safety–security interfaces.

Emergency preparedness

3.4. The Operating Organisation shall prepare an emergency plan for preparedness for, and response to, a nuclear or radiological emergency.

3.5. Emergency arrangements shall cover the capability of maintaining protection and safety in the event of an accident; mitigating the consequences of accidents if they do occur; protection of site personnel and the public; protection of the environment; coordinating response organisations, as appropriate; and communicating with the public in a timely manner. Emergency arrangements shall include arrangements for:

(a) the prompt declaration of an emergency;
(b) timely notification and alerting of response personnel;
(c) assessment of the progress of the emergency, its consequences and any measures that need to be taken on the site; and
(d) the necessary provision of information to other National authorities.

Commented [A1]: To be define by the emergency unit (Mr. Saiyyadi)

3.6. 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.

3.7. The Operating Organisation shall develop an emergency plan and establish the necessary organisational structure, with assigned responsibilities for managing an emergency, and shall contribute to the development of off-site emergency procedures.

3.8. The Operating Organisation shall ensure that the emergency plan covers all non-radiological and radiological hazards under its responsibility. Account shall be taken in the emergency plan of the specific site conditions. Preparation of the emergency plan shall be coordinated with those bodies having responsibilities in an emergency, including public authorities and private enterprises, as relevant, and the plan shall be submitted to the Authority as required. The plan shall be subject to review and updating in the light of experience gained.

3.9. A training programme shall be established and implemented for emergencies to ensure that plant staff and staff from other participating organisations possess the essential knowledge, skills and attitudes required to accomplish non-routine tasks under stressful emergency conditions.

3.10. The emergency plan shall be tested and validated in exercises before the commencement of fuel loading. Emergency preparedness training, exercises and drills shall be planned and conducted at suitable intervals to improve the efficiency of response.

3.11. Facilities, instruments, tools, equipment, documentation and communication systems to be used in an emergency 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. The Operating Organisation shall ensure that relevant information on safety parameters is available in the emergency response facilities and locations, as appropriate, and that communication between the control rooms and these facilities and locations is effective in the event of an accident. These capabilities shall be tested periodically.

3.12. Emergency operating procedures covering postulated accidents and design extension conditions shall be prepared for nuclear power plants. These procedures shall provide instructions for bringing the plant to a controlled state. Procedures shall be specified for leading the plant from a controlled state to a safe state.

3.13. The emergency operating procedures for postulated accidents and design extension conditions shall be symptom-based, or a combination of symptom-based and event-based procedures. If safety functions cannot be maintained with the active procedures, symptom-based procedures shall be used. The severe accident management guidelines shall be symptom-based.

3.14. The emergency and abnormal operating procedures shall be supported by analyses performed with realistic assumptions. Furthermore, the applicability of the procedures shall also be analysed in different system and component failure situations. The procedures shall be accompanied by background material illustrating the strategy underlying the procedure; the assumptions used in the preparation of the procedure; references to the analyses carried out in the preparation of the procedure; and other relevant background information.

3.15. The emergency and abnormal operating procedures, severe accident management guidelines, and any related instructions shall constitute a coherent set with consistent practices.

3.16. The emergency and abnormal operating procedures shall enable the operator to quickly identify the relevant procedure for responding to the plant state at hand. Entry and exit conditions shall be defined in the operating procedures for enabling operators to select the appropriate operating procedure, navigate the different operating procedures, and proceed from operating procedures to severe accident management guidelines when necessary.

3.17. The emergency and abnormal operating procedures and the severe accident management guidelines shall be verified and validated for ensuring that they are administratively and technically correct for the nuclear power plant unit concerned and compatible with the environment in which they are to be used.

Accident management programme

3.18. The Operating Organisation shall document, periodically review and as necessary, revise its accident management programme.

3.19. An accident management programme shall be established that covers the preparatory measures, procedures and guidelines, and equipment that are necessary for preventing the progression of accidents. The accident management programme shall be documented and shall be periodically reviewed and, as necessary, revised.

3.20. For a multi-unit nuclear power plant site, concurrent accidents affecting all units shall be considered in the accident management programme. Trained and experienced personnel, equipment, supplies and external support shall be made available for coping with concurrent accidents. Potential interactions between units shall be considered in the accident management programme.

3.21. In developing the accident management programme and its procedures, the possibility of regional infrastructure being degraded and of adverse working conditions for operators, as well as the possibility of operating conditions for equipment being degraded, shall be taken into account so as to ensure that actions expected for accident management will be feasible and will be able to be taken in a timely and reliable manner.

3.22. The Operating Organisation shall provide the operating staff with appropriate competence, systems and technical support before the commencement of fuel loading and shall validate and test periodically as far as practicable in exercises used in training and drills. In addition, arrangements shall be made, as part of the accident management programme and the emergency plan, to expand the emergency arrangements, where necessary, to include the responsibility for long term actions.

3.23. Guidelines for managing severe accidents shall be prepared for nuclear power plants. The guidelines shall provide a description of the measures for mitigating the consequences of severe accidents.

Radiation protection

3.24. The Operating Organisation shall establish and implement a radiation protection programme.

3.25. The Operating Organisation shall ensure that the radiation protection programme is in compliance with the requirements of Nigerian Basic Ionizing Radiation Regulations (NiBIRR). The radiation protection programme shall be reviewed and updated periodically in line with international and national requirements. The Operating Organisation shall verify that the radiation protection programme is being properly implemented and that its objectives are being met by means of surveillance, inspections and audits.

3.26. The radiation protection programme shall ensure that for all operational states, doses due to exposure to ionising radiation at the plant or doses due to any planned radioactive releases or discharges from the plant are kept below authorised limits and are as low as reasonably achievable.

3.27. The Operating Organisation shall ensure that all plant personnel understand and acknowledge their individual responsibility for putting into practice the measures for controlling exposures that are specified in the radiation protection programme. Particular emphasis shall be given to the training of all site personnel to be aware of radiological hazards and the necessary protective measures.

3.28. All site personnel, including contractors working in a controlled area or regularly present in a supervised area, shall have their occupational exposures assessed in accordance with the requirements of the NiBIRR. Dose records shall be kept and shall be made available to personnel on demand and the Authority.

3.29. The radiation protection programme shall include the workers' health surveillance of site personnel who may be occupationally exposed to radiation for ascertaining their physical fitness and for giving advice in cases of accidental overexposure. This workers' health surveillance shall consist of a preliminary medical examination followed by periodic checkups.

3.30. The radiation protection programme shall ensure control over radiation dose rates for exposures due to activities in areas where there is radiation arising from or passing through structures, systems and components. The programme shall make arrangements to maintain these doses as low as reasonably achievable and also addresses plant chemistry activities as well as exposures due to radioactivity of substances in the fuel coolant and associated fluids.

Management of radioactive waste

3.31. The Operating Organisation shall establish and implement a programme for the management of radioactive waste.

3.32. Adequate operating practices shall be implemented to ensure that the generation of radioactive waste is kept to the minimum practicable in terms of both activity and volume.

3.33. The Operating Organisation shall ensure that the radioactive waste management programme includes the characterisation, classification, processing, transport, storage, and disposal of radioactive waste and regular updating of the inventory of radioactive waste.

3.34. The Operating Organisation shall establish and implement a programme for the management of radioactive waste. Processing and storage of radioactive waste shall be strictly controlled in a manner consistent with the requirements for the predisposal management of radioactive waste. Records shall be maintained for waste generation and waste classification, as well as for the processing, storage and disposal of waste.

3.35. The Operating Organisation shall establish and implement procedures consistent with national requirements, international standards, and licence terms and conditions for the monitoring and control of discharges of radioactive effluents. The procedure shall be made available to the Authority. The volume and activity of radioactive discharges to the environment shall be reported periodically to the Authority.

3.36. The Operating Organisation shall ensure that a programme is established and implemented for monitoring the environment in the vicinity of the plant site to assess radiological consequences of any radioactive releases to the environment. Results from this monitoring shall be made available to the public and the Authority.

Fire safety

The Operating Organisation shall make arrangements for ensuring fire safety.

3.37. The arrangements for ensuring fire safety made by the Operating Organisation shall cover adequate management for fire safety, preventing fires from starting, detecting and extinguishing quickly any fires that do start, preventing the spread of those fires that have not been extinguished, and providing protection from fire for structures, systems and components that are necessary to shut down the plant safely.

3.38. The Operating Organisation shall develop a comprehensive fire hazard analysis for the plant, which shall be periodically reviewed and updated.

3.39. In the arrangements for firefighting, special attention shall be paid to cases for which there is a risk of release of radioactive material in a fire. Appropriate measures shall be established for the radiation protection of firefighting personnel and the management of releases to the environment.

3.40. The Operating Organisation shall be responsible for ensuring that appropriate procedures, equipment and staff are in place for effectively coordinating and cooperating with all firefighting services involved. Periodic joint fire drills and exercises shall be conducted to assess the effectiveness of the fire response capability.

3.41. Fire protection and firefighting systems shall be designed to ensure that damage to, or inadvertent operation of, these systems does not significantly impair the capabilities of the structures, systems and components necessary for safe shutdown.

Non-radiation-related safety

3.42. The Operating Organisation shall establish and implement a programme 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.

3.43. All personnel, suppliers, contractors and visitors shall be trained and shall possess the necessary knowledge of the non-radiation-related safety programme and its interface with the nuclear and radiation safety programme and shall comply with its safety rules and practices. The Operating Organisation shall provide support, guidance and assistance for plant personnel in the area of non-radiation-related hazards.

Feedback of operating experience

3.44. The Operating Organisation shall establish an operating experience programme to learn from events at the plant and events in the nuclear industry and other related industries.

3.45. The Operating Organisation shall establish and implement a programme to report, collect, screen, analyse, trend, document and communicate operating experience at the plant in a systematic way. It shall obtain and evaluate available information on relevant operating experience at other nuclear installations to draw and incorporate lessons for its own operations, including its emergency arrangements. It shall also encourage the exchange of experience within national and international systems for the feedback of operating experience. Relevant lessons from other industries shall also be taken into consideration.

3.46. Events with safety implications shall be investigated in accordance with their actual or potential significance to identify their direct and root causes. Plant event reports and non-radiation-related accident reports shall identify tasks for which inadequate training may be contributing to equipment damage, excessive unavailability of equipment, the need for unscheduled maintenance work, the need for repetition of work, unsafe practices or lack of adherence to approved procedures.

3.47. Information on operating experience shall be examined by competent persons for any precursors to, or trends in, adverse conditions for safety so that any necessary corrective actions can be taken before serious conditions arise.

3.48. As a result of the investigation of events, clear recommendations shall be developed for the responsible managers, who shall take appropriate corrective actions in due time to avoid any recurrence of the events. Corrective actions shall be prioritised, scheduled and effectively implemented and shall be reviewed for their effectiveness. Operating personnel shall be briefed on events of relevance and shall take the necessary corrective actions to make their recurrence less likely.

3.49. The Operating Organisation shall be responsible for instilling safety culture among plant personnel that encourages the reporting of all events, including low-level events and near misses, potential problems relating to equipment failures, shortcomings in human performance, procedural deficiencies or inconsistencies in documentation that are relevant to safety.

3.50. The Operating Organisation shall maintain liaison with support organisations involved in the design, construction, commissioning and operation of the plant in order to feedback

information on operating experience and to obtain advice in the event of equipment failure or in other events.

3.51. The operating experience programme shall be periodically evaluated to determine its effectiveness and to identify any necessary improvements.

PART IV - PLANT OPERATIONS

Operating procedures

4.1. Operating procedures shall be developed that apply comprehensively for normal operation, anticipated operational occurrences and accident conditions, in accordance with the policy of the Operating Organisation and the requirements of the Authority.

4.2. The procedures shall cover all aspects of plant operations, including:

(a) administrative procedures pertaining to the actions of the shift team;
(b) the operation of the plant and its systems, including shutdown, annual outage, and start-up;
(c) the alignment of the plant and its systems;
(d) inspection and testing;
(e) the continuous monitoring of the plant;
(f) emergencies and disturbances as well as the management of severe accidents;
(g) alarm response;
(h) temporary modifications or additions.

4.3. The level of detail for a specific procedure shall be appropriate, and the guidance provided in the procedures shall be clear and concise and, to the extent possible, it shall be verified and validated.

4.4 The procedures and reference material shall be clearly identified and shall be readily accessible in the control room and in other operating locations if necessary and be available to the Authority, as required. Strict adherence to written operating procedures shall be an essential element of safety policy at the plant.

4.5 The procedures and reference material shall be clearly identified and be readily accessible in the control room and in other operating locations and made available to the Authority. Strict adherence to written operating procedures shall be an essential element of safety policy at the plant.

4.6. Procedures shall be developed for normal operation to ensure that the plant is operated within the operational limits and conditions.

4.7. Procedures shall be developed and validated for use in the event of anticipated operational occurrences and design basis accidents.

4.8. Guidelines or procedures shall be developed for the management of accidents more severe than the design basis accidents.

4.9. Operating procedures and supporting documentation shall be issued under controlled conditions and shall be subject to approval and periodically reviewed and revised as necessary to ensure their adequacy and effectiveness. Procedures shall be updated in a timely manner in the light of operating experience and the actual plant configuration.

4.10. A system shall be established to administer and control an effective operator aids programme. The control system for operator aids shall prevent the use of non-authorised operator aids and any other non-authorised materials. The control system for operator aids shall be used to ensure that operator aids contain correct information and that they are updated, periodically reviewed and approved.

Operation control rooms and control equipment

4.11 The Operating Organisation shall ensure that the operation control rooms and control equipment are maintained in a suitable condition.

4.12. The habitability and good condition of control rooms shall be maintained. Where the design of the plant foresees additional or local control rooms that are dedicated to the control of processes that could affect plant conditions, clear communication lines shall be developed for ensuring an adequate transfer of information to the operators in the main control room.

4.13. The supplementary control room or remote shutdown panel and all other safety-related operational panels outside the control room shall be kept operable and free from obstructions, as well as from non-essential material that would prevent immediate operation. The Operating Organisation shall periodically confirm that the supplementary control room and all other safety-related operational panels are in the proper state of operational readiness, including proper documentation, communications, alarm systems and habitability.

4.14. The plant information system shall be such that off-normal conditions are easily recognisable by the operators. The Operating Organisation shall establish procedures for operators to manage the response to alarms. The number of alarms shall be minimised for any analysed operational state, outage or accident condition of the plant.

4.15. The documents used for the control room duties shall be defined, approved, and kept up-to-date.

Material conditions and housekeeping

4.16. The Operating Organisation shall develop and implement programmes to maintain a high standard of material conditions, housekeeping and cleanliness in all working areas.

4.17. Administrative controls shall be established to ensure that operational premises and equipment are maintained, well lit and accessible and that temporary storage is controlled and limited. Equipment that is degraded shall be identified and reported, and deficiencies shall be corrected in a timely manner.

4.18. An exclusion programme for foreign objects shall be implemented and monitored, and suitable arrangements shall be made for locking, tagging or otherwise securing isolation points for systems or components to ensure safety.

4.19. The Operating Organisation shall ensure that the identification and labelling of safety equipment and safety-related equipment, rooms, piping and instruments are accurate, legible and well maintained and that they do not introduce any degradation.

Chemistry programme

4.20. The Operating Organisation shall establish and implement a chemistry programme to provide the necessary support for chemistry and radiochemistry.

4.21. The Operating Organisation shall develop chemistry programme prior to normal operation and shall be in place during the commissioning programme. The chemistry programme shall provide the necessary information and assistance for chemistry and radiochemistry for ensuring safe operation, long term integrity of structures, systems and components, and minimisation of radiation levels.

4.22. The chemistry surveillance shall be conducted at the plant to verify the effectiveness of chemistry control in plant systems and to verify that structures, systems and components important to safety are operated within the specified chemical limit values.

4.23. The chemistry monitoring and data acquisition systems together with laboratory analyses shall provide accurate measuring and recording of chemistry data and shall provide alarms for relevant chemistry parameters. Records shall be kept available and be easily retrievable.

4.24. The use of chemicals in the plant, including chemicals brought in by contractors, shall be kept under close control, and appropriate control measures shall be put in place to ensure that the use of chemical substances and reagents does not adversely affect equipment or lead to its degradation.

Core management and fuel handling

4.25. The Operating Organisation shall be responsible and make arrangements for all activities associated with core management and with on-site fuel handling.

4.26. Provision shall be made to ensure that only fuel that has been appropriately manufactured is loaded into the core. In addition, the fuel design criteria and fuel enrichment shall be in accordance with design specifications and subject to approval by the Authority. The same requirements shall be applied before the introduction of fuel of a new design or of a modified design into the core.

4.27. The Operating Organisation shall be responsible for the development of the specifications and procedures for the procurement, verification, receipt, accounting and control, loading, utilisation, relocation, unloading and testing of fuel and core components. A fuelling programme shall be established in accordance with the design assumptions, and details shall be submitted to the Authority. Following refuelling, it shall be confirmed by means of calculations and measurements that the performance of the core meets the safety criteria. It shall also be confirmed that all core alterations comply with approved configurations.

4.28. The Operating Organisation shall be responsible for establishing a safe reactivity management programme under a strong management system for quality. Decisions on, and the planning, evaluation, conduct and control of, all operations or modifications involving the fuel that are liable to affect reactivity control shall be undertaken using approved procedures and respecting predefined operational limits for the core.

4.29. A comprehensive core monitoring programme shall be established.

4.30. Reactivity manipulations shall be made in a deliberate and carefully controlled manner to ensure that the reactor is maintained within prescribed operational limits and conditions and that the desired response is achieved.

4.31. The operating procedures for reactor start-up, power operation, shutdown and refuelling shall include the precautions and limitations necessary to maintain fuel integrity and to comply with the operational limits and conditions throughout the lifetime of the fuel.

4.32. Radiochemistry data that are indicative of fuel cladding integrity shall be systematically monitored and analysed for trends.

4.33. Appropriate methods shall be established to identify any anomalous changes in the activity of coolant and to perform data analysis for fuel defects to determine their nature and severity, their location, their probable root causes and the necessary corrective actions.

4.34. Handling procedures shall be developed for fuel and core components to ensure the controlled movement of unirradiated and irradiated fuel, proper storage on the site and preparation for transport from the site. The plans for storage of unirradiated and irradiated fuel shall be submitted to the Authority for approval.

4.35. The packaging, carriage and transport of unirradiated and irradiated fuel shall be carried out in accordance with the Nigeria Transportation Regulations for Radioactive Material and IAEA Safety Standards Series No. SSR-6, Regulations for the Safe Transport of Radioactive Material.

4.36. The Operating Organisation shall ensure that only an authorised, trained and qualified person is present and responsible for control and handling of the fuel on the site in accordance with written procedures before any fuel handling takes place. Access to fuel storage areas shall be limited to authorised personnel.

4.37. Detailed auditable accounts shall be maintained as required for the storage, irradiation and movement of all fissile material, in accordance to Nigerian Nuclear Safeguards Regulation.

PART V - MAINTENANCE, TESTING, SURVEILLANCE AND INSPECTION

Maintenance, testing, surveillance and inspection programmes

5.1. The Operating Organisation shall ensure that effective programmes for maintenance, testing, surveillance and inspection are established and implemented.

5.2. Maintenance, testing, surveillance, and inspection programmes shall be established, including predictive, preventive, and corrective maintenance activities. These maintenance activities shall be conducted to maintain availability during the service life of structures, systems and components by controlling degradation and preventing failures.

5.3. In the event that failures do occur, maintenance activities shall be conducted to restore the capability of failed structures, systems and components to function within acceptance criteria. The Operating Organisation shall ensure that its surveillance programmes are in compliance with established operational limits and conditions and for detecting and correcting any abnormal condition before it can give rise to significant consequences for safety.

5.4. The Operating Organisation shall develop procedures for all maintenance, testing, surveillance and inspection tasks that shall be prepared, reviewed, modified when required, validated, approved and distributed in accordance with procedures established under the management system.

5.5. The Operating Organisation shall ensure that data on maintenance, testing, surveillance, and inspection are recorded, stored, and analysed to confirm that the operating performance is in accordance with the design intent and with requirements for the reliability and availability of equipment.

5.6. The Operating Organisation shall determine the frequency of maintenance, testing, surveillance and inspection of individual structures, systems and components on the basis of:
(a) The importance to safety of the structures, systems and components, with insights from probabilistic safety assessment taken into account;
(b) Their reliability in, and availability for, operation;
(c) Their assessed potential for degradation in operation and their ageing characteristics;
(d) Operating experience;
(e) Recommendations of vendors.

5.7. The Operating Organisation shall take a comprehensive and structured approach to identify failure scenarios to ensure proper management of maintenance activities, using methods of probabilistic safety analysis.

5.8. The Operating Organisation shall take new approaches that could result in significant changes to current strategies for maintenance, testing, surveillance and inspection only after careful consideration of the implications for safety and after appropriate authorisation from the Authority.

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

5.10. An adequate work control system shall be established for the protection and safety of personnel and the protection of equipment during maintenance, testing, surveillance and inspection. Pertinent information shall be transferred at shift turnovers and at pre-job and post-job briefings on maintenance, testing, surveillance and inspection.

5.11. The work control system shall ensure that plant equipment is released from service for maintenance, testing, surveillance or inspection only with the authorisation of designated operations department staff and in compliance with the operational limits and conditions. The work control system shall also ensure that permission to return equipment to service following maintenance, testing, surveillance and inspection is given by the operating personnel. Such permission shall be given only after the completion of a documented check that the new plant configuration is within the established operational limits and conditions and, where appropriate after functional tests have been performed.

5.12. Coordination shall be maintained between different maintenance groups for mechanical, electrical, instrumentation and control, and civil equipment. Coordination shall also be maintained between maintenance groups, operations groups, and support groups for fire protection, radiation protection, physical protection and non-radiation-related safety.

5.13. The Operating Organisation shall make arrangements with the external grid operator to ensure that appropriate procedures are applied in maintaining the connections of the plant to the external grid.

5.14. A management system for managing and correcting deficiencies shall be established and shall be used to ensure that operating personnel are not overly burdened. This system shall also ensure that safety at the plant is not compromised by the cumulative effects of these deficiencies.

5.15. The Operating Organisation shall ensure that maintenance work during power operation is carried out with adequate defence in depth. Probabilistic safety assessment shall be used to demonstrate that the risks are not significantly increased.

5.16. Corrective maintenance of structures, systems and components shall be performed as promptly as practicable and in compliance with operational limits and conditions. Priorities shall be established, with account taken first of the relative importance to safety of the defective structures, systems and components.

5.17. The Operating Organisation shall establish maintenance programmes for non-permanent equipment to be used for accidents more severe than design basis accidents in order to maintain high reliability of this equipment. The Operating Organisation shall carry out periodic training and exercises in handling the equipment and connecting it to the nuclear power plant.

5.18. The Operating Organisation shall establish suitable arrangements to procure, receive, control, store and issue materials, spare parts and components for ensuring that their characteristics are consistent with applicable safety standards and with the plant design.

Outage management

5.19. The Operating Organisation shall establish and implement arrangements to ensure the effective performance, planning and control of work activities during outages.

5.20. Outage planning shall be a continuing, improving process involving past, present, next scheduled and future outages. Reference points shall be determined and shall be used to track pre-outage work.

5.21. In the process of planning and performing outage activities, priority shall be given to safety-related considerations. Special attention shall be given to maintaining the plant configuration in accordance with the operational limits and conditions.

5.22. The Operating Organisation shall be responsible for issuing programmes and procedures for outage management and for the provision of adequate resources for ensuring safety during shutdown operations.

5.23. The tasks, authorities and responsibilities of the groups and persons involved in preparing, conducting or assessing outage schedules and activities shall be set out in writing and shall be followed by all the plant staff and contractor staff involved.

5.24. The interfaces between the group responsible for outages and other groups, on the site and off the site, shall be clearly defined. Operating personnel shall be kept informed of current activities for maintenance, modification and testing.

5.25. Optimisation of radiation protection, optimising of non-radiation-related safety, waste reduction and control of chemical hazards shall be essential elements of outage programmes and planning, and this shall be clearly communicated to relevant plant staff and contractors.

5.26. A comprehensive review shall be performed after each outage to draw lessons to be learned.

5.27. With a view to unplanned repair outages, a list shall be kept at the nuclear power plant of the maintenance, inspection, repair, and modification work scheduled for the next outage.

5.28. With regard to refuelling and maintenance outages and extensively planned repair outages, The Operating Organisation shall

(a) define the executing Organisation and prepare the instructions to guide its operations;
(b) specify any special requirements for training, radiation protection, emergency response, fire protection, nuclear safeguards, and nuclear security;
(c) prepare a plan for work assignments that have a significant bearing on safety;
(d) prepare a plan for work assignments that have a bearing on radiation exposure and provide an estimate of the collective radiation dose of the workers;

(e) prepare a plan for work assignments and inspections related to fuel and control rods.

5.29. The Operating Organisation shall apply from the Authority for a permit to start up the nuclear power plant unit after refuelling, maintenance, and other extensive repair outages. The start-up permit application shall be submitted to the Authority for approval approximately one week prior to the planned start-up date. If any changes essential to start-up readiness take place in the information submitted while the application is being reviewed by the Authority, further information to supplement the application shall be promptly provided by the Operating Organisation. The application shall

(a) provide a summary of the completion of safety-significant tasks during the outage;
(b) indicate any significant defects detected during the outage and the then-current status of such defects;
(c) identify the tasks to be performed as reported to the Authority by the Operating Organisation but postponed to a later date and state the reasons for such postponement;
(d) indicate any unfinished tasks, tests, and inspections to be performed prior to plant start-up.

5.30. The verification of the start-up readiness of a nuclear power plant unit shall be carried out in compliance with the written procedures and duly documented. In addition to the unit responsible for the plant's operation, other organisational units responsible for the execution of outages shall also participate in the verification of the plant's start-up readiness. The verification of the plant's start-up readiness shall be supplemented by an independent safety inspection.

5.31. The Operating Organisation shall request from the Authority an inspection to verify start-up readiness in order to start up the nuclear power plant unit after refueling, maintenance, and other extensive repair outages. The request for the inspection shall be submitted to the Authority on a timely basis before the planned verification of start-up readiness. Sufficient time shall be reserved for the inspection to be conducted by the Authority.

5.32. The Operating Organisation shall request from the Authority an inspection to verify start-up readiness in the event of transients if the operation of safety systems has not been consistent with the assumptions made in the plant's deterministic safety analyses concerning the minimum performance of the systems in postulated accidents, or if the behaviour of the nuclear power plant unit cannot be demonstrated to have been safe. In such a case, the Operating Organisation shall provide the Authority with an explanation of the causes, the safety significance of the abnormalities observed, and the preconditions for the safe start-up of the plant before the inspection to verify start-up readiness is conducted.

5.33. The Operating Organisation shall provide the Authority officer performing the inspection to verify start-up readiness with the documents necessary for ascertaining that

(a) any unfinished tasks specified in the start-up permit application have been brought to completion;
(b) any requirements specified in the Authority's decision concerning the start-up have been duly met;
(c) the periodic tests specified in the Operational Limits and Conditions have been successfully completed;

(d) the licensee has verified start-up readiness in compliance with the plant procedures and found it acceptable;
(e) in the event of a transient defined in requirement 5.32, the cause of the transient has been determined to the required extent and immediate corrective actions have been taken.

PART VI - PREPARATION FOR DECOMMISSIONING

Preparation for decommissioning

6.1. The Operating Organisation shall prepare a decommissioning plan and maintain it throughout the lifetime of the plant to demonstrate that decommissioning can be accomplished safely and in such a way as to meet the specified end state.

6.2. The decommissioning plan shall be updated in accordance with changes in regulatory requirements, modifications to the plant, advances in technology, changes in the need for decommissioning activities and changes in national policies.

6.3. A human resource programme shall be developed for ensuring that sufficient motivated and qualified personnel are available for the safe operation of the plant up to final shutdown, for conducting activities in a safe manner during the preparatory period for decommissioning and for safely carrying out the decommissioning of the plant. In the preparatory period for decommissioning, the Operating Organisation shall maintain a high level of operational safety until the nuclear fuel has been removed from the plant.

6.4. For a multiple unit plant, the Operating Organisation shall put in place appropriate measures to ensure that common systems and common equipment remain fully available to support the safe operation of all the generating units.

6.5. Experience and knowledge with regard to contaminated or irradiated structures, systems and components gained in modification and maintenance activities at the plant shall be recorded and retained to facilitate the planning of decommissioning. Complete and reviewed information shall be compiled to be transferred to the Organisation responsible for managing the decommissioning phase.

6.6. The implications for safety of the activities in the transitional phase prior to the commencement of decommissioning shall be assessed and shall be managed so as to avoid undue hazards and to ensure safety.

PART VII - OFFENCES AND PENALTIES

7.1. Any person who contravenes any of the provisions of these regulations commits an offence.

7.2. Any person who commits an offence under these regulations shall be liable to the penalties as established in the enforcement policy issued by the Authority and other applicable extant laws.

7.3. The Authority shall impose penalties such as suspension, revocation of authorisation, imposing administrative fine, closure of facility or any combination of these.

7.4. Any person or body corporate who, being a holder of authorisation under these regulations, commits an offence shall be liable to prosecution in the court of law and upon conviction be liable to pay fines not exceeding N10, 000, 000 for an individual and not exceeding N100, 000, 000 for a corporate body or be given a jail term not exceeding ten years or both. These fines may be revised by the Authority as necessary.

Appeal

7.5. Any person to whom these regulations apply may appeal to the Board of the Authority if he/she is not satisfied with the decision made against him/her.

INTERPRETATION

"Accident conditions" means deviations from normal operation more severe than anticipated operational occurrences, including design basis accidents and severe accidents.

"Act" means Nuclear Safety and Radiation Protection Act No.19 of 1995.

"Anticipated operational occurrence" means an operational process deviating from normal operation which is expected to occur at least once during the operating lifetime of a facility but which, in view of appropriate design provisions, does not cause any significant damage to items important to safety or lead to accident conditions.

"Audit" means activities carried out to determine that requirements are met and that processes are adequate and effective, and to encourage managers to implement improvements, including safety improvements.

"Authority" means Nigerian Nuclear Regulatory Authority (NNRA) established under Section 1 of the Nuclear Safety and Radiation Protection Act 19 of 1995.

"Authorisation" means the granting by the Authority of written permission for an operator to perform specified activities. Authorisation could include, for example, licensing, certification, registration, etc.

"Authorised limit" means a limit on a measurable quantity established or formally accepted by the regulatory authority (See limit)

"Ageing" means a general *process* in which characteristics of a *structure, system or component* gradually change with time or use.

"Ageing Management" means engineering, operations, and maintenance actions to control within acceptable limits the ageing degradation of structures, systems and components.

"Anticipated transient without scram (ATWS)" means a nuclear reactor, an *accident* for which the *initiating event* is an *anticipated operational occurrence* and in which the *system* for fast *shutdown* of the reactor fails to function.

"Commissioning" means the process during which systems and components of facilities and activities, having been constructed, are made operational and verified to be in accordance with the design and to have met the required performance criteria.

"Common cause failure" means failure of two or more structures, systems or components due to a single specific event or cause.

"Confinement" means prevention or control of releases of radioactive material to the environment in operation or accidents.

"Containment" means methods or physical structures designed to prevent or control the release and dispersion of radioactive substances.

"Controlled area" means a defined area in which specific protection measures and safety provisions are or could be required for controlling normal exposures or preventing the spread of contamination during normal working conditions and preventing or limiting the extent of potential exposures.

"Critical Assembly" means an assembly containing fissile material intended to sustain a controlled fission chain reaction at a low power level, used to investigate reactor core geometry and composition.

"Corrective Maintenance" *means a*ctions that restore, by *repair*, overhaul or replacement, the capability of a failed *structure, system or component* to function within *acceptance criteria*.

"Decommissioning" means all administrative and technical steps other than disposal facility, taken to allow the removal of some or all of the regulatory controls from a facility.

"Design basis" means the range of conditions and events taken explicitly into account in the design of a facility, according to established criteria, such that the facility can withstand them without exceeding authorised limits by the planned operation of safety systems.

"Design Basis Accident (DBA)" means accident conditions against which a nuclear facility is designed according to established design criteria and for which the damage to the fuel and the release of radioactive material are kept within authorised limits.

"Disposal" means the emplacement of waste in an appropriate facility without the intention of retrieval.

"Dose limit" means the value of the effective dose or the equivalent dose to individuals from controlled practices that shall not be exceeded.

"Events" means any occurrence unintended by the operator, including operating error, equipment failure or other mishaps, and deliberate action on the part of others, the consequences or potential consequences of which are not negligible from the point of view of protection or safety.

"Emergency" means a non-routine situation that necessitates prompt action, primarily to mitigate a hazard or adverse consequences for human life and health, property and the environment.

"Emergency response" means the performance of actions to mitigate the consequences of an *emergency* for human life and health, property and the *environment*.

"Emergency preparedness" means the capability to take actions that will effectively mitigate the consequences of an *emergency* for human life and health, property and the *environment*.

"Facilities and activities" means facilities including nuclear facilities, irradiation installations, mining and milling facilities, waste management facilities and any other place where radioactive materials are produced, processed, used, handled, stored or disposed of — or where radiation generators are installed — on such a scale that consideration of protection and safety is required. Activities include the production, use, import and export of radiation sources for industrial, research and medical purposes, the transport of radioactive materials, the mining and processing of radioactive ores and closeout of associated facilities, clean-up of sites affected by residues from past activities and radioactive waste management activities such as the discharge of effluents.

"Failure" means the inability of a structure, system or component to function within acceptance criteria.

"Fuel assembly" means a set of fuel elements and associated components which are loaded into and subsequently removed from a reactor core as a single unit.

"Fuel element" means a rod [or other forms] of nuclear fuel, its cladding and any associated components necessary to form a structural entity.

"Fuel handling" means the movement, storage, transfer, packaging and transport of fresh and irradiated fuel.

"Graded Approach" means a process or method in which the stringency of the control measures and conditions to be applied is commensurate, to the extent practicable, with the likelihood and possible consequences of, and the level of risk associated with, a loss of control for a system of control, such as a regulatory system or a safety system.

"Initiating event" means an identified *event* that leads to *anticipated operational occurrences* or *accident conditions*.

"Item important to safety" *means an* item that is part of a *safety group* and/or whose malfunction or *failure* could lead to *radiation exposure* of the *site personnel* or *members of the public*.

"Licence" means a legal document issued by the Authority granting authorisation to perform specified activities related to a facility or activity. The holder of a current licence is termed a licensee.

"Limit" means the value of a quantity used in certain specified activities or circumstances that must not be exceeded.

"Maintenance" means the organised activity, both administrative and technical, of keeping structures, systems and components in good operating condition, including both preventive and corrective aspects.

"Management system" means a set of interrelated or interacting elements (a system) to establish policies and objectives and enable the objectives to be achieved efficiently and effectively.

"Modification" means the alteration of a system, component or structure in such a way that it no longer meets all the requirements set for earlier designs.

"Monitoring" means a continuous or periodic measurement of radiological or other parameters or determination of the status of a system. Sampling may be involved as a preliminary step to measurement.

"Normal operation" means operation within specified operational limits and conditions.

"Nuclear fuel" means f*issionable nuclear material* in the form of fabricated elements for loading into the reactor core of a civil nuclear power plant or *research reactor*.

"Nuclear Security" means the prevention and detection of, and response to, theft, sabotage, unauthorised access, illegal transfer or other malicious acts involving nuclear material, other radioactive substances or their associated facilities.

"Operational Limits and Conditions (OLCs)" means a set of rules setting forth parameter limits, the functional capability and the performance levels of equipment and personnel approved by the Authority for safe operation of an authorised facility.

"Operating Organisation" means any person or Organisation applying for authorisation or authorised to operate authorised facilities and responsible for its safety.

"Operational states (or operating conditions)" means states defined under normal operation and anticipated operational occurrences.

"*Operational quantities*" means quantities used in practical applications for monitoring and investigations that involve *external exposure*.

"*Operating personnel*" means individual *workers* engaged in the *operation* of an *authorised facility* or the conduct of an *authorised activity*.

"Operator" means any *person or Organisation* applying for *authorisation* or authorised and/or responsible for *safety* when undertaking *activities* or in relation to any *nuclear facilities* or *sources* of *ionising radiation*.

"Operations area" means a geographical area that contains an authorised facility. It is enclosed by a physical barrier to prevent unauthorised access and by means of which the management of the authorised facility can exercise direct authority.

"Periodic safety review" means a systematic reassessment of the *safety* of an existing *facility (or activity)* carried out at regular intervals to deal with the cumulative effects of *ageing*, modifications, operating experience, technical developments and *siting* aspects and aimed at ensuring a high level of *safety* throughout the *service life* of the *facility (or activity).*

"***Periodic testing"*** means Inspections, operability checks and calibrations carried out on parameter values, structures, systems and components to verify compliance with operational limits and conditions and to ensure adequacy of the safety status of the reactor.

"Preventive maintenance" means actions that detect, preclude or mitigate degradation of a functional structure, system or component to sustain or extend its useful life by controlling degradation and failures to an acceptable level.

"Protection (or radiation protection)" means the protection of people from the effects of exposure to ionising radiation and the means for achieving this.

"Protection system" means a system that monitors the operation of a reactor and which, on sensing an abnormal condition, automatically initiates actions to prevent an unsafe or potentially unsafe condition. The 'system' in this case encompasses all electrical and mechanical devices and circuitry, from sensors to actuation device input terminals.

"Probabilistic safety assessment (PSA)" means a comprehensive, structured approach to identifying *failure scenarios*, constituting a conceptual and mathematical tool for deriving numerical estimates of *risk*.

"Qualification" means the process of determining whether a *system* or *component* is suitable for operational use.

"Qualified equipment" means equipment certified as having satisfied *equipment qualification requirements* for the conditions relevant to its *safety function(s)*.

"Quality control (QC)" means part of *quality management* intended to verify that *structures, systems and components* correspond to predetermined *requirements*.

"Quality assurance" means planned and systematic actions necessary to provide adequate confidence that an item, process or service will satisfy given requirements for quality, for example, those specified in the licence.

"Recording level" means a level of dose, exposure or intake specified by the Authority at or above which values of dose, exposure or intake received by workers are to be entered in their individual exposure records.

"Repair" means action on a non-conforming product to make it acceptable for its intended use.

"Reliability" means the probability that a *system* or *component* or an item will meet its minimum performance requirements when called upon to do so, for a specified period of time and under stated *operating conditions*.

"Safety actuation system" means the collection of equipment required to accomplish the necessary safety actions when initiated by the protection system.

"Safety culture" means the assembly of characteristics and attitudes in organisations and individuals which establishes that, as an overriding priority, protection and safety issues receive the attention warranted by their significance.

"Safety function" means a specific purpose that must be accomplished for safety.

"Safety limits" means limits on operational parameters within which an authorised facility has been shown to be safe. Safety limits are operational limits and conditions beyond those for normal operation.

"Safety-related item" means an item important to safety which is not part of a safety system.

"Safety system settings" means the levels at which protective devices are automatically actuated in the event of anticipated operational occurrences or accident conditions to prevent safety limits from being exceeded.

"Safety system" means a system important to safety, provided to ensure the safe shutdown of the reactor or residual heat removal from the core or to limit the consequences of anticipated operational occurrences and design basis accidents. Safety systems consist of the protection system, the safety actuation systems and the safety system support features.

"Safety Analysis Report (SAR)" means a document provided by the Operating Organisation to the Authority containing information concerning the facility, its design, safety analysis and provisions to minimise the risk to the public, the operating personnel and the environment

"Self-assessment" means routine and continuing process conducted by management at all levels to evaluate the effectiveness of performance in all areas of their responsibility. This includes review, surveillance and discrete checks, which are focused on preventing or identifying and correcting management problems that hinder the achievement of the Organisation's objectives, particularly safety objectives.

"Severe accident" means accident conditions more severe than a design basis accident and involving significant core degradation.

"Single failure" means a failure that results in the loss of capability of a component to perform its intended safety function(s) and any consequential failure(s) which result from it.

"Site area" means a geographical area that contains an authorised facility and within which the management of the authorised facility may directly initiate emergency actions. This area is often identical to the operations area, except in situations (e.g. Research Reactors, irradiation installations) where the authorised facility is on a site where other activities are being carried out beyond the operations area, but where the management of the authorised facility can be given some degree of authority over the whole site area. The site boundary is the boundary of the site area.

"Structures, Systems and Components (SSCs)" means a general term encompassing all of the elements (items) of a facility or activity which contribute to protection and safety, except human factors.

"Supervised area" means a defined area not designated a controlled area but for which occupational exposure conditions are kept under review, even though specific protection measures and safety provisions are not normally needed.

"Safety indicator" means a quantity used in *assessments* as a measure of the radiological impact of a *source* or of a *facility or activity* or the performance of *protection and safety* provisions, other than a prediction of *dose* or *risk*.

"Shutdown" means the cessation of *operation* of a *facility*.

Made in Abuja this ……..day of ……..2021

DOCTOR YAU USMAN IDRIS

Director General/Chief Executive Officer