

**NUCLEAR REGULATORY AUTHORITY,
GHANA**



**DRAFT OPERATION REGULATIONS FOR NUCLEAR INSTALLATIONS IN
GHANA**

NRA_OPERATIONS_DRAFT

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In exercise of the powers conferred on the Minister responsible for the Nuclear Regulatory Authority (NRA) by Section 91(2b, 2o and 2p) of the Nuclear Regulatory Authority Act, 2015 (Act 895), these regulations are made on this day of.....

Preliminary provisions

Application

1. These regulations apply to nuclear installations in Ghana.

Responsible Parties

2. The authorised person shall address the following functions of an integrated management system while establishing its organisational structure:
 - (a) policy making for all areas of safety which includes:
 - (i) setting management objectives;
 - (ii) establishing policy for safety;
 - (iii) developing management and staff who value learning, have skills in creating, acquiring, and transferring knowledge, and can adapt the organisation on the basis of new knowledge and insights; and
 - (iv) promoting a strong safety culture. Strategies and management objectives shall be developed in accordance with the policy to put the policy into effect.
 - (b) allocation of responsibilities with corresponding lines of authority and communication, for
 - (i) approving the contents of management programmes;
 - (ii) developing procedures and instructions, where necessary, and having a strict policy of adherence to these procedures and instructions;
 - (iii) setting policies on fitness for duty; and
 - (iv) establishing a programme to make the necessary changes to any of these functions based on the performance in achieving objectives;
 - (c) operating functions, which include executive decision making and actions for the operation of a plant for all operational states and accidents conditions;
 - (d) supporting functions, which include obtaining, from both on-site and off-site organisations including contractors, the technical and administrative services, and the

- use of facilities necessary to perform the operating functions. For sites with shared safety related resources (e.g., sites with multiple units), the arrangements for the use of such shared resources shall be clearly defined;
- (e) reviewing functions, which include monitoring and assessing the performance of the operating and supporting functions on a **regular basis**. 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 (SAR), and to identify possible safety improvements; and
 - (f) 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.
3. An authorised person shall establish liaison with the Authority and with relevant organisations to ensure a common understanding of, and to ensure compliance with, safety, security and safeguards requirements.

Integrated Management System.

4. The authorised person shall establish, implement, assess, and continually improve an integrated management system as required in the *Integrated Management System Regulations*.

Staffing of the Authorised person.

5. The authorised person shall ensure that
- (a) the organisation, qualifications and number of operating personnel are adequate for the safe and reliable operation of the plant in all operational states and in accident conditions. Succession planning is established as a practice for the operating personnel with a recruitment and selection policy directed at retaining competent personnel to cover all aspects of safe operation;
 - (b) a long-term staffing plan aligned with long term objectives of the authorised person are developed in anticipation of future needs of personnel and skills;

- (c) the shift teams are staffed to ensure that sufficient authorised operators are present to operate the plant in accordance with the Operating Limits and Conditions;
- (d) the shift staffing patterns, shift cycles and controls on working hours provide sufficient time for the training of shift personnel with minimised distractions to control room operators;
- (e) the activities are scheduled to reduce simultaneous activities as far as possible to avoid overburden of control room operators and to allow them to focus on their responsibilities for protection safety and security;
- (f) all personnel of the authorised person whose duties may affect safety and security are medically examined on appointment and at intervals subsequently as required to ensure their fitness for the duties and responsibilities assigned to them and,
 - (i) attention is paid to minimise conditions causing stress; and
 - (ii) to set restrictions on overtime and requirements for rest breaks are maintained.

Management of Operational Safety

Safety Policy

6. (1) An authorised person shall
 - (a) establish and implement operational policies with safety and security given the utmost priority, overriding the demands of production and project schedules; and
 - (b) ensure managers promote an attitude of safety and security consciousness among plant personnel.
- (2) The safety and security policy of the authorised person shall
 - (a) promote a strong safety and security culture, including a questioning attitude, trustworthiness, and a commitment to excellent performance in all activities important to safety and security;
 - (b) include commitments to perform periodic safety reviews of the plant throughout its operational lifetime with consideration of operating experience and significant new safety and security related information from relevant sources, including information on agreed corrective actions and on necessary improvements that have been implemented; and

- (c) include a commitment to achieve enhancement in operational safety.
- (3) An authorised person shall
 - (a) have a strategy for enhancing safety and security; and
 - (b) find effective ways of applying, and where feasible improving existing standards that is continuously monitored and supported by means of a clearly specified programme with clear objectives and targets.

Performance of Safety Related Activities.

- 7. (1) An authorised person shall
 - (a) 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;
 - (b) assess all routine and non-routine operational activities for the potential risks associated with harmful effects of ionising radiation with the level of assessment and control commensurate with the safety significance of the task; and
 - (c) ensure that all activities important to safety and security are carried out in accordance with approved procedures with acceptable margins maintained between normal operating values and the established safety and security system settings to avoid undesirably frequent actuation of safety and security systems.
- (2) The authorised person shall ensure that
 - (a) if there is a need to conduct a non-routine operation, test, or experiment (research or test reactors) which can affect safety and is not covered by existing operating procedures, it is subject to the Authority's approval;
 - (b) the specific OLCs are determined, and a special procedure is prepared;
 - (c) if during non-routine operation, any of the specific operational limits or conditions are violated, corrective action is taken immediately, and the event reviewed; and
 - (d) experiments (research or test reactors) are not conducted unnecessarily or without adequate justification.
- (3) The authorised person shall ensure that written communication is preferred with minimal spoken communication and if spoken communication is used, attention is given to ensure that spoken instructions are clearly understood.
- (4) The authorised person shall ensure that

- (a) aspects of the working environment that influence human performance factors (such as workload or fatigue) and the effectiveness and fitness of personnel for duty is identified and controlled; and
 - (b) tools for enhancing human performance are used as appropriate to support the responses of operating personnel.
- (5) The authorised person shall encourage plant personnel to have a questioning attitude and to make appropriate and conservative decisions, to minimise risk and to maintain the plant in a safe condition.
- (6) The authorised person shall ensure
 - (a) the utilisation of probabilistic assessment of risk for decision making;
 - (b) that the risk analysis is of appropriate quality and scope; and
 - (c) that the risk analysis is performed by appropriate skilled analysts and used in a manner that complements the deterministic approach to decision making, in compliance with applicable regulations and license conditions in terms of
 - i. scope, content, and quality;
 - ii. updating the PSA model and analyses;
 - iii. the delivery of PSA to the Authority (for performing independent analysis); and
 - iv. mandatory use of PSA where applicable.

Monitoring and Review of Safety Performance.

- 8. (1) The authorised person shall
 - (a) establish a system for continuous monitoring and periodic review of the safety of the plant and its performance; and
 - (b) establish an adequate audit and review system to ensure that the safety policy of the authorised person 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) The authorised person shall
 - (a) use self-assessment as an integral part of the monitoring and review system;
 - (b) perform systematic self-assessment to identify achievements and to address any degradation in safety performance; and

- (c) where practicable, develop suitable objective safety performance indicators, agreed with the Authority, and used to enable senior managers to detect and to react to shortcomings and deterioration in the management of safety.
- (3) The authorised person shall ensure that
 - (a) monitoring of safety performance includes
 - i. the monitoring of personnel performance;
 - ii. attitudes to safety;
 - iii. response to infringements of safety; and
 - iv. violations of operating limits and conditions, operating procedures, regulations, and licence conditions; and
 - (b) the monitoring of plant conditions, activities and attitudes of personnel is supported by systematic walk-downs of the plant by the plant managers.
- (4) The authorised person shall ensure that
 - (a) personnel and organisation performing quality assurance functions have sufficient authority and organisational independence to identify problems relating to quality and to initiate, to recommend and to verify the implementation of solutions; and
 - (b) these personnel and organisations report to a high level of management such that the necessary authority and organisational independence are provided, including sufficient independence from costs and schedules when considering safety related matters.
- (5) The authorised person shall ensure that
 - (a) the appropriate corrective actions are determined and implemented as a result of the monitoring and review of safety performance;
 - (b) progress in taking the corrective actions is monitored to ensure that actions are completed within the appropriate timescales; and
 - (c) the completed corrective actions are reviewed to assess whether they have adequately addressed the issues identified in audits and reviews.

Control of Plant Configuration.

- 9. The authorised person shall ensure that
 - (a) the plant management establishes and implement a system for plant configuration management to ensure consistency between design requirements, physical configuration and plant documentation;

- (b) controls on plant configuration ensures that changes to the plant and its safety related systems are properly identified, screened, designed, evaluated, implemented, and recorded; and
- (c) proper controls are implemented to handle changes in plant configuration that result from maintenance work, testing, repair, OLCs 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.

10.(1) The authorised person shall ensure that

- (a) the plant management establishes and implement a programme for management of modifications and any changes to the Modifications Programme and its procedures, are subject to the Authority's approval.
- (b) the modification programme ensures that all modifications are properly identified, specified, screened, designed, evaluated, authorised, implemented, and recorded.
- (c) modification programmes cover structures, systems, and components, OLCs, procedures; documents; and the organisational structure of the authorised person;
- (d) modifications are characterised based on their safety significance, how many categories of modifications there would be, and the basis for categorisation; and
- (e) the plant management establishes a system for modification control to ensure that plans, documents, and computer programs, are revised in accordance with the approved modifications.

(2) The authorised person shall ensure that

- (a) proposed modifications to structures, systems, and components important to safety, which affect the bases on which the licence was issued, to the OLCs, and to organisational aspects and other documents, originally approved by the Authority, are submitted to the Authority for approval before implementation;
- (b) any other modifications are submitted to the Authority for prior approval, if so required; and
- (c) any additional documentation if required by the Authority is submitted as well as submit new versions of SAR and OLCs after implementation of modifications and report on the implementation of the change.

- (3) The authorised person shall
- (a) establish a mechanism to ensure proper design, safety assessment and review, control, implementation and testing of all permanent and temporary modifications;
 - (b) systematically analyse the consequences of the modification for human tasks and performance;
 - (c) ensure that for all plant modifications, human and organisational factors are addressed; and
 - (d) ensure that the requirements of the plant Safety Analysis Report (SAR) and applicable regulations are met.
- (4) The authorised person shall provide a minimum scope of the modification in the safety assessment which include;
- (a) description of the reason for the modification;
 - (b) design of the modification;
 - (c) assessment of the expected collective dose of the personnel during the implementation of modification;
 - (d) reviews and assessments of modifications and corrective actions undertaken in the past;
 - (e) categorisation of the modification and needed approvals;
 - (f) education and training of the personnel;
 - (g) effect on the fire hazard analysis;
 - (h) impact on the physical protection;
 - (i) fabrication, installation and testing following the implementation of the modification;
 - (j) updating of the documentation; and
 - (k) plan of the monitoring of implemented modification and the evaluation of feedback information.
- (5) The authorised person shall ensure that
- (a) temporary modifications are limited in time and number to minimise the cumulative safety significance;

- (b) temporary modifications are clearly identified at their location and at any relevant control position;
 - (c) the plant management establishes a formal system for informing relevant personnel well in time of temporary modifications and of their consequences for the operation and safety of the plant; and
 - (d) a record of temporary modifications is available in the Main Control Room (MCR).
- (6) The authorised person shall ensure that
- (a) the design and implementation of modification addresses Operation Experience Feedback (OEF) (internal and external);
 - (b) there is an independent assessment of modification; including assessing for its impact to safety by competent persons not involved in the design of the modification;
 - (c) plant modifications and testing are performed in accordance with the plant's work control system and appropriate testing procedures;
 - (d) Prior to commissioning a modified plant or putting a plant back into operation after modifications, personnel are trained, as appropriate, and all relevant documents necessary for plant operation are updated and maintained; and
 - (e) an annual report containing a brief description of any changes, tests, and experiments, including a summary of the safety evaluation of each is submitted to the Authority,

in the first quarter of the following year.

Ageing Management.

11. (1) The authorised person shall ensure that the ageing management programme includes the following items as a minimum:

- (a) an outline of the proactive strategy for ageing management and prerequisites for its implementation;
- (b) safety significant SSCs of the Nuclear Installation that could be affected by ageing assumptions, methods, acceptance criteria, and data used to account for the effects of SSC ageing in the safety analysis, including any time-limited assumptions and failure data for probabilistic safety assessments;

- (c) critical service conditions, operational limits and conditions, and any other parameters to be monitored and/or controlled that affect aging assumptions used in safety analyses or equipment qualification; and
 - (d) data and information to be collected for ageing management to confirm safety analysis assumptions and acceptance criteria continue to be met.
- (2) The authorised person shall ensure that
- (a) the ageing management programme established and implemented during the design phase are followed to ensure that required safety functions structures, systems and components are fulfilled over the entire operating lifetime of the plant;
 - (b) the ageing management programme determines the consequences of ageing and the activities necessary to maintain the operability and reliability of structures, systems and components;
 - (c) the ageing management programme is coordinated with and consistent with other relevant programs, including the programme for Periodic Safety Review (PSR); and
 - (d) a systematic approach is taken to provide for the development, implementation, and continuous improvement of ageing management programmes.
- (3) The authorised person shall ensure that
- (a) long term effects arising from operational and environmental conditions (i.e., temperature conditions, radiation conditions, corrosion effects or other degradations in the plant that may affect the long-term reliability of plant equipment or structures) are evaluated and assessed as part of an ageing management programme, considering, the safety relevance of structures, systems and components; and
 - (b) any changes made to the ageing management programme is approved by the Authority.

Records and Reports.

12. (1) The authorised person shall

- (a) establish and maintain a system for the control of records and reports that are in compliance with Integrated Management System Regulations Section 10(17).

- (b) ensure that the management of records includes records in respect of:
- (i) design specifications;
 - (ii) safety analysis;
 - (iii) equipment and material supplied;
 - (iv) as-built installation drawings;
 - (v) manufacturer's documentation;
 - (vi) construction and installation documentation;
 - (vii) commissioning documents;
 - (viii) plant operational data;
 - (ix) events and incidents;
 - (x) amounts and movements of fissile, fertile, radioactive, and other special materials;
 - (xi) data from maintenance, testing, surveillance and inspection;
 - (xii) history and data of modifications;
 - (xiii) quality assurance;
 - (xiv) qualifications, positions, medical examinations, and trainings of site personnel;
 - (xv) plant chemistry;
 - (xvi) occupational exposure;
 - (xvii) radiation surveys;
 - (xviii) discharges of effluents;
 - (xix) environmental monitoring;
 - (xx) storage and transport of radioactive waste;
 - (xxi) periodic safety reviews; and
 - (xxii) decommissioning documents.

(2) The authorised person shall

- (a) have a document management system which ensures that only the latest version of each document is used by personnel; and

- (b) ensure off-site storage of essential documents, such as the emergency plan, for use in the event of an emergency is considered as part of the document management system.
- (3) The authorised person shall ensure that
 - (a) periodic summary reports on matters relating to safety are provided to the Authority as required; and
 - (b) reports and records relevant to reviews carried out, after abnormal events and accidents, is kept as required and made available to the Authority.

Programme for Long Term Operation.

13. (1) The authorised person shall establish and implement, where applicable, a comprehensive programme for ensuring the long-term safe operation of the plant beyond a time frame established in the licence conditions, design limits and applicable regulations.

- (2) The authorised person shall ensure that
 - (a) justification for long term operation is prepared on the basis of the results of a safety assessment, with due consideration of the ageing of structures, systems and components; and
 - (b) the justification for long term operation utilises the results of Periodic Safety Review and is submitted to the Authority for approval, based on an analysis of the ageing management programme..
- (3) The authorised person shall ensure that the comprehensive programme for long term operation addresses:
 - (a) preconditions including the current licensing basis, safety upgrading and verification, and operational programmes;
 - (b) scope setting for all structures, systems, and components important to safety;
 - (c) categorisation of structures, systems, and components regarding degradation and ageing processes;
 - (d) validation of safety analyses made based on time limited assumptions;
 - (e) review of ageing management programmes; and
 - (f) implementation programme for long term operation.

Requirements for Immediate Notification

General Requirements.

14.(1) The authorised person shall notify the Authority:

- (a) of the declaration of any of the emergency classes as specified in its approved emergency plan; and
- (b) of those non-emergency events, specified in regulation 15 of these regulations that occurred within three (3) years of the date of discovery.
- (c) via telephone or any other method which can ensure that notification is made to the Authority, as soon as practicable.
- (d) immediately but not later than one (1) hour after the declaration of one of the emergency classes.

(2) When reporting under regulation 14 of these regulations, the authorised person shall identify:

- (a) the emergency class declared; and
- (b) the non-emergency event requiring a notification under regulation 15

Non-Emergency Events.

15. (1) One (1) Hour Reports: If not reported as a declaration of an emergency class under requirement 19 of this regulation, the authorized person shall notify the Authority as soon as practical and in all cases within one (1) hour of the occurrence of any deviation from the plant's OLCS authorised in operating license.

(2) Four (4) Hour Reports: If not reported under requirement 14 or 15(1) of these regulations, the authorised person shall notify the Authority as soon as practicable and, in all cases, within four (4) hours of the occurrence of any of the following:

- (a) the initiation of any reactor shutdown required by the plant's OLCs;
- (b) any event that results or should have resulted in Emergency Core Cooling Systems (ECCS) discharge into the reactor coolant system as a result of a valid signal except when the actuation results from and is part of a pre-planned sequence during testing or reactor operation.
- (c) any event or condition that results in actuation of the Reactor Protection System (RPS) when the reactor is critical except when the actuation results from and is part of a pre-planned sequence during testing or reactor operation; and

- (d) any event or situation, related to the health and safety of the public or onsite personnel, or protection of the environment, for which a news release is planned or notification to other government agencies has been or will be made including an onsite fatality or inadvertent release of radioactively contaminated materials.

(3) Eight (8) Hour Reports: If not reported under requirement 14, or 15(1), or 15(2) of these regulations, the authorised person shall notify the Authority as soon as practical and in all cases within eight (8) hours of the occurrence of any of the following:

- (a) any event or condition that results in:

- (i) the condition of the NPP, including its principal safety barriers, being seriously degraded; or
- (ii) the NPP being in an unanalysed condition that significantly degrades plant safety.

- (b) any event or condition that results in valid actuation of any of the systems listed below, except when the actuation results from and is part of a pre-planned sequence during testing or reactor operation:

- (i) RPS including reactor scram and reactor trip.
- (ii) general containment isolation signals affecting containment isolation valves in more than one system or multiple Main Steam Isolation Valves (MSIVs).
- (iii) ECCS including high-head, intermediate-head, and low-head injection systems and the low-pressure injection function of residual or decay heat removal systems.
- (iv) auxiliary or emergency feed water system.
- (v) containment heat removal and depressurisation systems, including containment spray and fan cooler systems; and
- (vi) emergency AC electrical power systems including Emergency Diesel Generators (EDGs).
- (vii) Systems for transferring residual heat from structures, systems, and components important to safety to ultimate heat sinks.

- (c) any event or condition that at the time of discovery could have prevented the fulfilment of the safety function of structures or systems that are needed to:

- (i) shutdown the reactor and maintain it in a safe shutdown condition.
 - (ii) remove residual heat; and
 - (iii) mitigate the consequences of an accident.
- (d) events covered in regulation paragraph 15(3)(c) may include one or more procedural errors, equipment failures, and discovery of design, analysis, fabrication, construction, and procedural inadequacies. However, individual component failures need not be reported pursuant to requirement paragraph 15(3)(c) , if redundant equipment in the same system was operable and available to perform the required safety function.
- (e) any event requiring the transport of a radioactively contaminated person for an off-site medical treatment.
- (f) any event that results in a major loss of emergency assessment capability, off-site response capability, or off-site communications capability (e.g., significant portion of control room indication, or off-site notification system).

(4)The authorised person shall ensure that

- (a) 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, is clearly established.
- (b) an investigation is carried out to determine the cause of the event, by means of root cause analyses wherever necessary, and corrective actions are taken to make its recurrence less likely.
- (c) prior to the restart or the resumption of full power of the affected plant, the plant management carry out necessary remedial actions, including inspection, testing and repair of damaged structures, systems, and components, and revalidate the safety functions that might be challenged by the event; and
- (d) restart conditions and criteria are established and followed after the timely implementation of the necessary corrective actions.

Follow-up Notification.

16.(1) The authorised person shall with respect to the notifications made under requirements 14and 15 of these regulations, in addition to making the required initial notification, during the course of the event:

- (a) immediately report:
 - (i) any further degradation in the level of safety of the plant or other worsening plant conditions, including those that require the declaration of any of the emergency classes, if such a declaration has not been previously made;
 - (ii) any change from one emergency class to another;
 - (iii) a termination of the emergency class;
 - (iv) the results of ensuring evaluations or assessments of plant conditions;
 - (v) the effectiveness of response or protective measures taken; and
 - (vi) information related to plant behaviour that is not understood; and
- (b) maintain an open and continuous communication channel with the Authority.

Event Report System of an Authorised Person

Reportable Events

17.(1) An authorised person shall,

- (a) for any event of the type described herein, submit a notification report within forty-eight (48) hours if not reported under regulation 15 containing at least
 - (i) name of the plant,
 - (ii) date and time of the event,
 - (iii) event title and classification,
 - (iv) plant status prior to and after the event,
 - (v) brief description of the event,
 - (vi) actions taken after the event,
 - (vii) effect of the event on the plant, and
 - (viii) information regarding reporting officer.
- (b) submit in addition, an Authorised Person Event Report (APER) within sixty (60) days after the discovery of the event; and
- (c) report any event regardless of the plant mode or power level and the significance of the structure, system, or component that initiated the event.

(2) The authorised person shall report

- (a) the death of any person at the nuclear installation including anywhere within the exclusion area boundary as specified in the FSAR approved by the Authority.
- (b) the major injury or death of any person incurred as a result of the operation of the plant.

- (c) the occurrence of an event that has resulted, or that is likely to result, in the exposure of a person or organ or tissue to radiation in excess of the applicable radiation dose limits.
- (d) the misuse, by any person, of anything that is intended to protect the health or safety of persons or the environment from risks associated with the operation of the plant.
- (e) the completion of any plant shutdown required by the plant's OLCs.
- (f) any operation or condition which was prohibited by the plant's OLCs except when:
 - (i) the OLCs are administrative in nature;
 - (ii) the event consisted solely of a case of a late surveillance test where the oversight was corrected, the test was performed, and the equipment was found to be capable of performing its specified safety functions; or
 - (iii) the OLCs were revised prior to discovery of the event such that the operation or condition was no longer prohibited at the time of discovery of the event.
- (g) any deviation from the plant's OLCs authorised in operating license.
- (h) any event or condition that resulted in:
 - (i) the condition of the plant, including its principal safety barriers, being seriously degraded; or
 - (ii) the plant being in an unanalysed condition that significantly degraded plant safety.
- (i) any natural phenomenon or other external condition that posed an actual threat to the safety of the plant or significantly hampered site personnel in the performance of duties necessary for the safe operation of the plant.
- (j) any event or condition that resulted in manual or automatic actuation of any of the systems listed in regulation 17(3) of this regulation, except when:
 - (i) the actuation resulted from and was part of a pre-planned sequence during testing or reactor operation; or
 - (ii) the actuation was invalid and:
 1. occurred while the system was properly removed from service; or
 2. occurred after the safety function had been already completed.
- (k) an event that results in an acute and unrecoverable loss of more than one hundred kilograms (100 kg) of heavy water (for CANDU type reactors).

(3) The authorised person shall report any event:

- (a) or condition that could have prevented the fulfilment of the safety function of structures or systems that are needed to:
 - (i) shutdown the reactor and maintain it in a safe shutdown condition.
 - (ii) remove residual heat.
 - (iii) control the release of radioactive material; or
 - (iv) mitigate the consequences of an accident.
- (b) where a single cause or condition caused at least one (1) independent train or channel to become inoperable in multiple systems or two (2) independent trains or channels to become inoperable in a single system designed to:
 - (i) Shutdown the reactor and maintain it in a safe shutdown condition.
 - (ii) Remove residual heat.
 - (iii) Control the release of radioactive material; or
 - (iv) Mitigate the consequences of an accident.

(4) The authorised person shall report

- (a) any airborne radioactive release that, when averaged over a period of one (1) hour, resulted in airborne radionuclide concentrations in an unrestricted area that exceeded twenty (20) times the authorised discharge limits.
- (b) any liquid effluent release that, when averaged over a period of half (1/2) an hour, exceeds twenty (20) times the authorised discharge limits specified at the point of entry into the receiving waters (i.e., unrestricted area) for all radionuclides except tritium and dissolved noble gases.
- (c) any event or condition that as a result of a single cause could have prevented the fulfilment of a safety function for two (2) or more trains or channels in different systems that are needed to
 - (i) shutdown the reactor and maintain it in a safe shutdown condition.
 - (ii) remove residual heat.
 - (iii) control the release of radioactive material; or
 - (iv) mitigate the consequences of an accident.
- (d) events that may include cases of procedural error, equipment failure, and discovery of a design, analysis, fabrication, construction, or procedural inadequacy. However, authorized persons are not required to report an event, if the event results from:

- (i) A shared dependency among trains or channels that is a natural or expected consequence of the approved plant design; or
- (ii) Normal and expected wear or degradation.

(5) The authorised person shall report any event that posed an actual threat to the safety of the plant or significantly hampered site personnel in the performance of duties necessary for the safe operation of the plant including fires, toxic gas releases, or radioactive releases.

Contents of the Authorised Person Event Report (APER)

18.(1) The authorised person shall ensure that the APER contains

- (a) a brief abstract describing the major occurrences during the event, including all component or system failures that contributed to the event and significant corrective action taken or planned to prevent recurrence.
- (b) a preliminary **INES** evaluation of the event.
- (c) a clear, specific, narrative description of what occurred so that knowledgeable readers conversant with the design of commercial plants, but not familiar with the details of a particular plant, can understand the complete event.
- (d) a narrative description which includes the following specific information as appropriate for the particular event:
 - (i) plant operating conditions before the event.
 - (ii) status of structures, components, or systems that were inoperable at the start of the event and that contributed to the event including any reasons.
 - (iii) dates and approximate times of occurrences.
 - (iv) the cause of each component or system failure or personal error, if known.
 - (v) the failure mode, mechanism, and effect of each failed component, if known.
 - (vi) for failures of components with multiple functions, include a list of systems or secondary functions that were also affected.
 - (vii) for failure that rendered a train of a safety system inoperable, an estimate of the elapsed time from the discovery of the failure until the train was returned to service.
 - (viii) the method of discovery of each component or system failure or procedural error.

- (ix) discussion of causes and circumstances of each human performance related root cause.
 - (x) automatically and manually initiated safety system responses; and
 - (xi) the manufacturer and model number and any other identification of each component that failed during the event.
- (e) an assessment of the safety consequences and implications of the event including
- (i) the availability of systems or components that could have performed the same function as the components and systems that failed during the event; and
 - (ii) for events that occurred when the reactor was shut down, the availability of systems or components that are needed to maintain safe shutdown conditions, remove residual heat, control the release of radioactive material, or mitigate the consequences of the event.
- (f) a description of any corrective actions planned as a result of the event, including those to reduce the probability of similar events occurring in the future and
- (i) the corrective actions based on the in-depth analysis of the event.
 - (ii) this analysis done using graded approach.
 - (iii) for less important events the analysis can be simplified, identifying the main and contributing causes for the event; and
 - (iv) for a safety related event, root cause analysis shall be performed using one of the internationally accepted methodologies.
- (g) reference to any previous similar events considering both external and internal OEFs.
- (h) the name and telephone number of a person within the authorised person's organisation who is knowledgeable about the event or involved in the investigation process of the event and can provide additional information concerning the event and the plant's characteristics.

Operational Safety Programmes

Consideration of objectives of nuclear security in safety programmes

19.(1) The authorised person shall

- (a) ensure that the implementation of safety requirements and security requirements satisfies both safety objectives and security objectives.

- (b) 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 and threats.
- (c) Demonstrate the steps taken to ensure that security and safety are complementary, as many of the measures designed to ensure one will also serve to ensure the other.
- (d) design and implement safety and security measures in such a manner that they do not compromise each other; and
- (e) establish mechanisms to resolve potential conflicts and to manage safety–security interfaces.

Emergency Preparedness.

20. The authorised person shall

- (a) develop an emergency plan that meets the requirements of the Emergency Preparedness and Response Regulation
- (b) establish the necessary organizational structure, with assigned responsibilities for managing emergencies,
- (c) contribute to the development of off-site emergency procedures.

Accident Management Programme.

21.(1) The authorised person shall

- (a) establish an accident management programme which shall be periodically reviewed and revised, if necessary and an accident management programme shall include the preparatory measures, procedures and guidelines, and equipment that are necessary for preventing the progression of accidents, including design extension accidents, and for mitigating their consequences.
- (b) for a multi-unit nuclear installation site, address concurrent accidents affecting all units in the accident management programme and
 - (i) make available trained and experienced personnel, equipment, supplies and external support for coping with concurrent accidents; and
 - (ii) address potential interactions between units in the accident management programme.

(2) The authorised person shall ensure that

- (a) the accident management programme includes instructions for the utilisation of available equipment (safety related equipment as far as possible, but also items not important to safety and mobile equipment);
- (b) the accident management programme includes contingency measures, such as an alternative supply of cooling water and electrical power, to mitigate the consequences of accidents, including any necessary equipment and this equipment to be located and maintained so as to be functional and readily accessible when needed;
- (c) the accident management programme includes the technical and administrative measures necessary to mitigate the consequences of an accident.
- (d) the accident management programme shall include training necessary for implementation of the programme;
- (e) in developing the accident management programme and its procedures, the possibility of degradation of the following is considered to ensure that actions expected for accident management are feasible and taken in a timely and reliable manner:
 - (i) regional infrastructure;
 - (ii) working conditions, e.g., elevated radiation levels, elevated temperatures, lack of lighting, limited access to the plant from off the site, for operating personnel; and
 - (iii) operating conditions for equipment.

(3) The authorised person shall ensure that

- (a) arrangements for accident management provides the operating personnel with appropriate competence, systems and technical support;
- (b) these arrangements and guidance are available before the initial fuel loading, validated and then periodically tested as far as practicable in exercises and used in training and drills; and
- (c) arrangements are made, as part of the accident management programme and emergency plan, to expand the emergency response arrangements, where necessary, to include the responsibility for long term actions.

(4) The authorised person shall ensure that

- (a) a comprehensive set of procedures and guidelines, including emergency operating procedures (EOPs) and severe accident management guidelines (SAMGs) are provided, covering accident conditions initiated during all operational states

- (b) EOPs provide instructions for recovering the plant state to a safe condition;
- (c) EOPs, with other specific procedures or guidelines when applicable, are provided to cover design basis accidents and DEC conditions without severe fuel damage (DEC A or DEC 1); and
- (d) the EOPs re-establish or compensate for lost safety functions and set out actions to prevent severe fuel damage in the core or in the spent fuel storage;
- (e) SAMGs, with other specific procedures or guidelines when applicable, is provided to mitigate the consequences of severe accidents for the cases where the responses to events including the measures provided by EOPs have not been successful in the prevention of severe fuel damage;
- (f) the set of procedures and guidelines are suitable to manage accident conditions that simultaneously affect the plant and spent fuel storages and address potential interactions between reactor and spent fuel storages ;
- (g) EOPs are developed in a systematic way and is supported by realistic, and plant specific analysis performed for this purpose;
- (h) EOPs are consistent with other operational procedures, such as alarm response procedures and SAMGs;
- (i) SAMGs address strategies to cope with scenarios identified by the severe accident analyses and that these analyses are designed to identify:
 - (i) the plant vulnerabilities to severe accident phenomena;
 - (ii) assessment of plant capabilities; and
 - (iii) the development of accident management measures, including containment protection; and
- (j) EOPs for design basis accidents rely on adequately qualified equipment and instrumentation, while EOPs for DEC conditions as well as SAMGs rely primarily on adequately qualified equipment.
- (5) The authorised person shall ensure that
 - (a) the approach used for plant-specific validation and verification are documented;
 - (b) the effectiveness of incorporating human factors engineering principles in procedures and guidelines are judged when validating them; and
 - (c) The validation is based on representative simulations, using a simulator, where appropriate.

Radiation Protection.

22.(1) The authorised person shall

- (a) establish and implement a radiation protection programme to ensure that, for all operational states, doses due to exposure to ionising radiation at the plant or due to any planned radioactive releases (discharges) from the plant are kept below authorised limits and be as low as reasonably achievable;
- (b) ensure that the radiation protection programme meets requirements of the *Basic Ionising Radiation Control and Licensing Regulations*;
- (c) verify, by means of surveillance, inspections and audits, that the radiation protection programme is being properly implemented and that its objectives are being met and undertakes corrective actions, if necessary; and
- (d) ensure that the programme is reviewed periodically and updated if required in the light of experience and submitted to the Authority for approval.

(2) The authorised person shall ensure that the radiation protection programme

- (a) addresses 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, such as in inspection, maintenance and fuel handling;
- (b) addresses plant chemistry activities as well as exposures due to radioactivity of substances in the fuel coolant, liquid or gas, and associated fluids; and
- (c) makes arrangements to maintain radiation doses as low as reasonably achievable;

(3) The authorised person shall ensure that

- (a) the programme is based on a prior assessment and covers but not limited to the following:
 - (i) classification of areas and access control, including local information on actual dose rates and contamination levels;
 - (ii) co-operation in establishing operating and maintenance procedures when radiological hazards are anticipated and providing direct assistance when required;
 - (iii) instrumentation and equipment for monitoring;
 - (iv) equipment for personal protection;
 - (v) on-site radiological monitoring and surveys;

- (vi) decontamination of personnel, equipment, and structures; and
 - (vii) environmental radiological surveillance and monitoring.
- (b) the radiation protection function has sufficient independence and resources to be able to enforce and to advice on radiation protection regulations, standards and procedures, and safe working practices.
- (c) the implementation of the radiation protection programme administered by a qualified Radiation Protection Officer (RPO) as per criteria mentioned in regulation 25 of the licensing of Nuclear Installation regulation.
 - (i) shall advise the plant management; and
 - (ii) shall have the authority to participate in establishing and enforcing the radiation protection programme.
- (d) all site personnel understand and acknowledge their individual responsibility for putting into practice the exposure control measures that are specified in the radiation protection programme and consequently, particular emphasis is given to training of these site personnel so that they are aware of radiological hazards and of necessary protective measures.
- (e) all site personnel, including contractors, who are working in a controlled area or who are regularly present in a supervised area, have their occupational exposures assessed in accordance with the regulatory requirements with dose records kept and made available to site personnel, on demand, and to the Authority.
- (f) the radiation protection program includes health surveillance of site personnel who may be occupationally exposed to radiation to ascertain their physical fitness and for giving advice in case of accidental overexposure, and the health surveillance consist of a preliminary medical examination followed by periodic checkups.

Radioactive Waste Management.

23.(1) The authorised person shall

- (a) establish and implement a programme for the management of radioactive waste in accordance with the Radioactive Waste Management Regulation; and
 - (b) ensure that adequate operating practices are implemented to ensure that the generation of radioactive waste is kept to the minimum practicable in terms of both activity and volume.
- (2) The authorised person shall ensure that

- (a) the programme for the management of radioactive waste includes the characterization, classification, processing (i.e., pre-treatment, treatment and conditioning), transport, storage and disposal of radioactive waste, as well as regular updating of the inventory of radioactive waste.
 - (b) processing and storage of radioactive waste are strictly controlled in a manner consistent with the requirements for the predisposal management of radioactive waste; and
 - (c) records are maintained for waste generation and waste classification, as well as for the processing, storage, and disposal of waste.
- (3) The authorised person shall ensure that
- (a) the plant management establish and implement procedures consistent with the Authority's Regulations and license conditions for the monitoring and control of discharges of radioactive effluents; and
 - (b) the volume and activity of radioactive discharges to the environment is reported periodically to the Authority.
- (4) The authorised person shall
- (a) establish and implement a programme for monitoring the environment in the vicinity of the plant site, to assess the radiological consequences of any radioactive releases to the environment; and
 - (b) ensure that the result from this environmental monitoring is made available to the public and in particular to the public living in the vicinity of the plant site.

Fire Safety.

24.(1) The authorised person shall ensure that

- (a) arrangements for ensuring fire safety made by the plant management consist of
 - (i) adequate management for fire safety;
 - (ii) preventing fires from starting;
 - (iii) detecting and quickly extinguishing any fires that do start;
 - (iv) preventing the spread of those fires that have not been extinguished;
 - and
 - (v) providing protection from fire for structures, systems and components that are necessary to shut down the plant safely;
- (b) such arrangements include, but are not limited to:
 - (i) application of the principle of defence in depth;

- (ii) control of combustible materials and ignition sources, during outages;
 - (iii) inspection, maintenance, and testing of fire protection measures;
 - (iv) establishment of a manual firefighting capability;
 - (v) assignment of responsibilities and training of plant personnel; and
 - (vi) assessment of the impact of plant modifications on fire safety measures;
- (c) a comprehensive fire hazard analysis is developed for the plant and shall be periodically reviewed and, if necessary, updated;
- (d) in the arrangements for firefighting, special attention is paid to cases for which there is a risk of release of radioactive material in a fire; and
- (e) appropriate measures are established for the radiation protection of firefighting personnel and the management of releases to the environment.
- (2) The authorised person shall ensure that
- (a) the plant management is responsible for ensuring that appropriate procedures, equipment, and staff are in place for effectively coordinating and cooperating with all firefighting services involved; and
 - (b) the plant management is responsible for ensuring that periodic joint fire drills and exercises are conducted to assess the effectiveness of the fire response capability.
- (3) The authorised person shall ensure that fire protection systems and firefighting systems are designed to ensure that damage to, or inadvertent operation of, these systems do not significantly impair the capabilities of the structures, systems, and components necessary for safe shutdown.

Physical Protection.

25.(1) The authorised person shall

- (a) establish and implement a physical protection programme in accordance with the *Nuclear Security Regulations*;
- (b) take measures to prevent or deter unauthorised access to, intrusion into, theft of, surface attack on and internal or external sabotage of safety related systems and nuclear materials;

- (c) be responsible for managing and implementing the requirements by ensuring close cooperation among relevant managers, with the objective of minimising risk;
- (d) ensure that safety and physical protection measures are designed and implemented in a manner that they do not compromise each other; and
- (e) establish mechanisms to resolve potential conflicts and to manage safety and physical protection interfaces.

(2) The authorised person shall ensure that all reasonable precautions are taken to prevent individuals from deliberately carrying out unauthorised actions that could jeopardize safety.

Non-Radiation Related Safety Programme.

26. The authorised person shall ensure that

- (a) plant management establish and implement a non-radiation related safety 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;
- (b) plant management ensure that the non-radiation related safety programme include
 - (i) arrangements for the planning, implementation, monitoring and review of the relevant preventive and protective measures;
 - (ii) it is integrated with the nuclear and radiation safety programme; and
 - (iii) training for all personnel, suppliers, contractors, and visitors (where appropriate) and have the necessary knowledge of the non-radiation related safety programme and its interface with the nuclear and radiation safety programme and comply with its safety rules and practices; and
- (c) support, guidance, and assistance for plant personnel in the area of non-radiation related hazards are provided.

Equipment Qualification.

27. (1) The plant management shall ensure that

- (a) 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 for accident conditions; and

- (b) effective and practicable methods are used to upgrade and preserve equipment qualification.

(1) The authorised person shall

- (a) establish and implement equipment qualification programme to confirm and maintain required equipment qualification throughout the design life of the plant including initial phases of design, supply, and installation of the equipment; and
- (b) ensure that the effectiveness of equipment qualification programme is periodically reviewed.

(2) The authorised person shall ensure that

- (a) the scope and details of the equipment qualification process, in terms of required inspection areas, methods of non-destructive testing, possible defects inspected for, and required effectiveness of inspection, are documented, and submitted to the Authority for review and approval; and
- (b) relevant national and international experience are also considered.

(3) The authorised person shall ensure that

- (a) the SSC-qualification programme includes collection, documentation, and maintenance of information to confirm the capability of SSCs to achieve their design functions over the entire design service life;
- (b) the qualification programme considers operating conditions such as vibration, temperature, pressure, water-jet impacts, electromagnetic disturbances, irradiation, moisture, earthquake, and combinations thereof;
- (c) operating conditions cover
 - (i) normal operating conditions over the entire design service life;
 - (ii) conditions of abnormal operation; and
 - (iii) the conditions during accidents for those SSCs that are necessary for monitoring or controlling emergency;
- (d) the qualification programme ensures that SSCs important to safety, in the case of changes, preserve their qualification.

Feedback of Operating Experience.

28.(1) The authorised person shall

- (a) ensure Operating Experience Feedback (OEF) programme is implemented and maintained during all the installation lifecycle phases (siting, design, construction, commissioning, operation, modification and decommissioning);
- (b) establish an operating experience feedback programme to learn from events at the plant and events in the nuclear industry and other industries worldwide;
- (c) ensure the programme covers reporting, collection, screening, analysing, trending, documenting, and communicating operating experience at the plant in a systematic way;
- (d) ensure the programme obtains and evaluates available information on relevant operating experience at other plants to draw and incorporate lessons for its own operations including its emergency arrangements;
- (e) document and keep Operating Experience (OE) gathered from
 - (i) normal and abnormal operation;
 - (ii) analysis of operating experience;
 - (iii) corrective actions;
 - (iv) feedback information on corrective actions; and
 - (v) other important information related to radiation or nuclear safety
 with due consideration of the aspects of accessibility, systematic searching, transparency, and clear presentation to the personnel involved in monitoring operational experience;
- (f) ensure the programme encourages the exchange of experience within national and international systems for the feedback of operating experience and takes into consideration relevant lessons from other industries as necessary;
- (g) ensure the operating experience programme is periodically evaluated to determine its effectiveness and to identify necessary improvements; and
- (h) ensure any modifications to the operational experience feedback programme is approved by the Authority.

(2) The authorised person shall ensure that

- (a) events with safety implications are investigated in accordance with their actual or potential significance;
- (b) events with significant implications for safety are investigated to identify their direct and root causes, including causes relating to equipment design, operation, maintenance, or human and organisational factors;

- (c) the results of such investigations are included as appropriate in relevant training programmes and used in reviewing procedures and instructions;
 - (d) plant event reports and non-radiation related accident reports identify tasks for which inadequate training may be contributing to
 - (i) equipment damage;
 - (ii) excessive unavailability of equipment;
 - (iii) the need for unscheduled maintenance work;
 - (iv) the need for repetition of work; and
 - (v) unsafe practices or lack of adherence to approved procedures.
- (3) The authorised person shall ensure that
- (a) the operating experience programme is carried out by designated staff with adequate training, resources, and support for collecting, screening, and analysing the events, for dissemination of findings important to safety, and for developing recommendations for corrective actions to be taken with significant findings and trends reported to the top management;
 - (b) operating experience is carefully examined by designated competent individuals for any precursors to, or trends in, adverse conditions for safety, so that necessary corrective actions can be taken before serious conditions arise;
 - (c) as a result of the investigation of events, clear recommendations are developed for the responsible managers, who are to take appropriate corrective action in due time to avoid any recurrence of the events;
 - (d) corrective actions are prioritized, scheduled, and effectively implemented and reviewed for their effectiveness; and
 - (e) operating personnel are briefed on events of relevance and shall take the necessary corrective actions to make their recurrence less likely.
- (4) The authorised person shall ensure that plant management
- (a) is responsible for instilling an attitude 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 and as such personnel are not exposed to risks of sanctions due to such reporting;
 - (b) maintain liaison, as appropriate, with the support organisations (manufacturer, research organisation, and designer) involved in the design, construction,

commissioning, and operation of the plant with the aim of sharing information on operating experience and obtaining advice, if necessary, in the event of equipment failures or other events;

- (c) collect and retain data on operating experience for use as input for the management of plant aging, for the evaluation of residual plant life, and for Probabilistic Safety Assessment (PSA) and Periodic Safety Review (PSR);
- (d) develop written procedures for the implementation of the operational experience feedback programme which includes:
 - (i) written procedures specifying appropriate investigation methods;
 - (ii) root cause analysis methods; and
 - (iii) the methods to analyse human performance and safety culture.

Other Operational Programmes

Operational Limits and Conditions (OLCs)

29.(1) The authorised person shall ensure that

- (a) the plant is operated in accordance with the set of OLCs;
- (b) the OLCs form an important part of the basis on which the plant is operated;
- (c) the plant is operated within OLCs 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;
- (d) the OLCs are developed to assure that the plant is being operated in accordance with the design assumptions and intent, as well as in accordance with its license conditions;
- (e) the OLCs reflect the provisions made in the design as described in the Safety Analysis Report (SAR); and
- (f) all OLCs are substantiated by stating the reason for their adoption.

(2) The authorised person shall ensure that

- (a) OLCs are reviewed and revised as necessary in consideration of experience, developments in technology and approaches to safety, changes in the plant and because of tests carried out during commissioning; and
- (b) if any modification is considered appropriate in the approved OLCs, the safety case is submitted to the Authority for approval before implementation.

(3) The authorised person shall ensure that

- (a) OLCs include requirements for normal operation, including shutdown and outage stages and cover actions to be taken and limitations to be observed by the operating personnel;
- (b) the OLCs are readily accessible for control room personnel;
- (c) operating personnel who are directly responsible for the conduct of operations are trained and thoroughly familiarised with the OLCs to comply with the provisions contained therein; and
- (d) an appropriate surveillance programme is established and implemented to ensure compliance with the OLCs, and that its results are evaluated, recorded, and retained.

(4) The authorised person shall ensure that

- (a) the plant is returned to a safe operational state when an event occurs in which parameters deviate from the limits and conditions for normal operation;
- (b) appropriate remedial actions are taken, undertaking review and evaluation of the event, and notify the Authority in accordance with the established event reporting system;
- (c) a process is established to document and report deviations from OLCs in an appropriate manner and that appropriate actions are taken in response;
- (d) responsibilities and lines of communication for responding to such deviations are clearly specified;
- (e) OLCs are not intentionally breached;
- (f) where circumstances necessitate plant operation outside the OLCs, clear formal instructions for such operations are developed, on the basis of safety analysis, if applicable with these instructions including
 - (i) instructions for returning the plant to normal operation within the OLCs; and
 - (ii) specification of the arrangements for approval by the Authority, of the changed OLCs, prior to operation under these changed OLCs.

Operating Instructions and Procedures.

30. (1) The authorised person shall ensure that

- (a) operating instructions and procedures are developed for normal operation, anticipated operational occurrences and accident conditions;

- (b) the level of detail for a particular procedure is appropriate for the purpose of that procedure;
- (c) the guidance provided in the procedures are clear, concise, and as far as possible verified and validated;
- (d) the procedures and reference material are clearly identified and readily accessible in the control room and other operating locations, if necessary, and is made available to the Authority, if required; and
- (e) strict adherence to the operating procedures is an essential element of safety policy at the plant.

(2) The authorised person shall ensure that

- (a) procedures developed for normal operation enable the plant to be operated within the OLCs.
- (b) procedures are developed and validated for use in the event of anticipated operational occurrences and design basis accidents;
- (c) guidelines or procedures are developed for the management of design extension accidents; and
- (d) both event-based approaches and symptom-based approaches are used, as appropriate and the related analysis and justifications documented.

(3) The authorised person shall ensure that

- (a) operating procedures and supporting documentations are issued under controlled conditions, and periodically reviewed and revised as necessary to ensure their adequacy and effectiveness;
- (b) procedures are updated in a timely manner in light of operating experience and the actual plant configuration;
- (c) any revision of these documents is known by the operating personnel and other holders of the documents; and
- (d) all instructions and procedures and their revisions are made available to the Authority, if required.

(4) The authorised person shall ensure that

- (a) responsibilities and lines of communication for operating instructions are clearly set out in writing for situations in which the operating personnel discover that the status or conditions of plant systems or equipment are not in accordance with operating procedures;

- (b) the control system for operating instructions prevents the use of unauthorised operating instructions and of any other unauthorised materials such as labels or instructions of any kind on the equipment, local panels, boards, and measurement devices within the work areas;
- (c) the control system for operating instructions is used to ensure that these contain correct information and that they are updated, periodically reviewed, and approved;
- (d) a clear operating policy is maintained to minimise the use of, and reliance on, temporary operating instructions; and
- (e) where appropriate, temporary operating instructions are made into permanent plant features or incorporated into plant procedures.

Operation Control Rooms and Control Equipment.

31.(1) The authorised person's plant management shall ensure that

- (a) the operation control rooms, and control equipment are maintained in suitable condition;
- (b) the habitability and ergonomic condition of control rooms are maintained; and
- (c) where the design of the plant foresees additional or local control rooms, which are dedicated to the control of processes that could affect plant conditions, clear communication lines are developed for ensuring an adequate transfer of information to the operators in the main control room.

(2) The authorised person shall ensure that

- (a) the emergency control room and the shutdown panel and all other safety related operational panels outside the control room are kept operable and free from obstructions as well as from nonessential material that would prevent their immediate operation; and
- (b) the plants management periodically confirm that the emergency control room or the shutdown panel and all other safety related operational panels are in the proper state of operational readiness, including proper documentation, communications, alarm systems and habitability.

(3) The authorised person shall ensure that

- (a) the alarms in the main control room are managed as an important feature in operating the plant safely;
- (b) the plant information system is such that off-normal conditions are easily recognisable by the operators;
- (c) control room alarms are clearly prioritised;
- (d) the number of alarms, including alarm messages from process computers, are minimised for any analysed operational state, outage, or accident condition of the plant; and
- (e) the plant management establish procedures for operators to manage the response to alarms.

Material Conditions and Housekeeping.

32.(1) The authorised person shall ensure that

- (a) the plant management develop and implement programmes to maintain high standard of material conditions, housekeeping, and cleanliness in all working areas;
- (b) administrative controls are established to ensure that operational premises and equipment are maintained, well-lit and accessible, and that temporary storage is controlled and limited; and
- (c) equipment that is degraded is identified, reported, and corrected in a timely manner.

(2) The authorised person shall ensure that

- (a) an exclusion programme for foreign objects is implemented and monitored, and suitable arrangements are made for locking, tagging or otherwise securing isolation points for systems or components to ensure safety; and
- (b) the plant management control the identification and labelling of safety equipment and safety related equipment, rooms, piping, and instruments in accurate, legible, and well maintained manner, and that they do not cause any degradation.

Chemistry Programme.

33.(1) The authorised person shall ensure that

- (a) the plant management establish and implement a chemistry programme to provide the necessary support for chemistry and radiochemistry control;
 - (b) the chemistry programme is developed prior to normal operation and in place during the commissioning phase; and
 - (c) the chemistry programme provides the necessary information and assistance for ensuring safe operation, long term integrity of structures, systems and components, and minimisation of radiation levels.
- (2) The authorised person shall ensure that
- (a) chemistry surveillance is 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;
 - (b) the chemistry programme includes chemistry monitoring and data acquisition systems which together with laboratory analyses, provides accurate measuring and recording of chemistry data as well as provide alarms for relevant chemistry parameters;
 - (c) records are kept available and easily retrievable; and
 - (d) laboratory monitoring involves the sampling and analysis of plant systems for specific chemical parameters, concentrations of dissolved and suspended impurities, and radionuclide concentrations.
- (3) The authorised person shall ensure that
- (a) the use of chemicals in the plant, including chemicals brought in by contractors, are kept under close control; and
 - (b) the appropriate control measures are 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.

34.(1) The authorised person shall

- (a) be responsible and plan for all activities associated with core management and with on-site fuel handling;
- (b) ensure that only fuel that has been appropriately manufactured is loaded into the core and that in each reactor only such fuel is loaded whose design and enrichment have been approved by the Authority for use with that reactor; and

- (c) ensure the same requirements are applied before the introduction of fuel of a new design or of a modified design into the core.

(2) The authorised person shall

- (a) 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;
- (b) ensure that a fuelling programme is established in accordance with the design assumptions;
- (c) confirm by means of calculations and measurements that the performance of the core meets the safety criteria after refuelling;
- (d) also confirm that all core alterations comply with approved configurations; and
- (e) ensure that after batch refuelling, tests are performed before and during startup to confirm that the core performance meets the design intent as given in Schedule I of these regulations.

(3) The authorised person shall

- (a) ensure a comprehensive core monitoring programme is established to direct that
 - (i) core parameters are monitored, analysed for trends and evaluated to detect abnormal behaviour;
 - (ii) actual core performance is consistent with core design requirements; and
 - (iii) the values of key operating parameters are recorded and retained in a logical, consistent, and retrievable manner;
- (b) establish a safe reactivity management programme under the management system;
- (c) ensure that decisions and planning on evaluation, conduct and control of all operations or modifications involving the fuel, that are liable to affect reactivity control, are undertaken by using approved procedures and respecting predefined operational limits for the core;
- (d) ensure that reactivity manipulations are made in a deliberate and carefully controlled manner to ensure that the reactor is maintained within prescribed OLCs, and that the desired response is achieved;
- (e) ensure the operating procedures for reactor startup, power operation, shut down and refuelling includes the precautions and limitations necessary to maintain fuel integrity and to comply with the OLCs throughout the lifetime of the fuel;

- (f) ensure that radiochemistry data that are indicative of fuel cladding integrity are systematically monitored and analysed for trends to be able to monitor whether fuel cladding integrity is maintained in all operating conditions;
- (g) ensure that appropriate methods are 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 locations, the probable root causes, and the necessary corrective actions;
- (h) ensure that for fuel and core components, handling procedures are developed to ensure the controlled movement of un-irradiated and irradiated fuel, proper storage on the site and preparation for transport from the site;
- (i) before any fuel handling takes place, ensure that an authorised, trained, and qualified person is present, who shall be responsible for control and handling of the fuel on the site in accordance with the approved procedures by the plant management;
- (j) ensure that access to fuel storage areas is limited to authorised personnel only;
- (k) ensure that detailed auditable accounts are maintained as required for the storage, irradiation and movement of all fissile material, including un-irradiated and irradiated fuel;
- (l) ensure that the packaging, carriage and transport of un-irradiated and irradiated fuel shall be carried out in accordance with the Regulations for Safe Transport of Radioactive Material; and
- (m) ensure that details of regulatory submissions regarding refuelling outage and long shutdown as provided in Schedule I and Schedule II respectively are submitted.

Maintenance, Testing, Surveillance and Inspection

Periodic Safety Reviews

35.(1) The authorised person shall ensure that

- (a) systematic safety assessments of the installation are performed by the installation management throughout its operational lifetime, with due account taken of
 - (i) overall impacts of ageing of the installation;
 - (ii) effects of modifications of the installation;
 - (iii) equipment requalification;

- (iv) operating experience;
- (v) current national and international standards;
- (vi) technical research and progress;
- (vii) changes at the site; and
- (viii) significant new safety information from all relevant sources.

(2) The authorised person shall ensure that

- (a) PSR is aimed at ensuring a high level of safety throughout the operating lifetime of the installation;
- (b) PSR is conducted in alignment with the PSR basis document, which shall be approved by the Authority;
- (c) the PSR basis document shall contain at least:
 - (i) the scope of the review;
 - (ii) major milestones, including cut-off dates beyond which changes to codes and standards and new information will not be considered;
 - (iii) methodology of the PSR;
 - (iv) the safety factors to be reviewed;
 - (v) the structure of the documentation;
 - (vi) the applicable national and international standards, codes, and practices; and
 - (vii) process for categorising, prioritising, and resolving findings agreed upon with the Authority;
- (d) PSR determines the compliance with current legislation, design bases based on which the operating licence was issued, with current international safety standards and international practice; and
- (e) the PSR, at the least, consider: the plant design, actual conditions of systems, structures and components important to safety, equipment qualification, ageing, deterministic safety analysis, PSA, hazard analysis, safety performance, use of experience from other plants and research findings, organisation, the management system and safety culture, procedures, human factors, on-site and off-site emergency planning, radiological impact on the environment, accident management, radiation protection aspects, any other aspect, and global assessment.

(3) The authorised person shall

- (a) ensure that a report on the review of each safety factor is prepared, which provide the description of applied review methods, the course of the review, all the findings of the review and the final assessment.
 - (b) ensure that report clearly state and explain detected deficiencies and propose modifications and improvements to remedy deficiencies and comply with criteria specified in the PSR basis document.
 - (c) prepare the final PSR report, which shall include at least
 - (i) a summary description of applied methods.
 - (ii) the overall safety assessment based on reports on each safety factor.
 - (iii) the implementation action plan of modifications and improvements in the facility with appropriate substantiations; and
 - (iv) as attachments, all the documents constituting parts of the PSR.
 - (d) ensure that the final PSR report with the implementation action plan is approved by the Authority.
- (4) The authorised person shall
- (a) ensure that to complement the deterministic assessment, use of PSA is made for input to the PSR to provide insight into the relative contributions to safety of different aspects of the plant.
 - (b) ensure that the plant management reports to the Authority in a timely manner, the confirmed findings of the safety review that have implications for safety.
 - (c) ensure that the implementation action plan includes necessary corrective actions to remedy detected deficiencies and comply with criteria specified in the PSR basis document, as well as reasonably practical modifications for compliance with the applicable standards with the aim of enhancing safety of the plant by further reducing the likelihood and potential consequences of accidents.
 - (d) implement all the modifications and improvements indicated in the approved PSR report within five years from the approval of the report with the deadline possibly extended, on an exceptional basis, to eight years from the approval of the report in cases of expensive and complex modifications; and
 - (e) ensure that deviations that could jeopardise nuclear safety of the installation, are resolved without delay.
- (5) The authorised person shall

- (a) submit progress report on status of implementation of corrective actions generated because of PSR according to the frequency mutually agreed with the Authority.
- (b) ensure that the report at least consists of the following information.
 - (i) total number of actions with titles.
 - (ii) completed actions.
 - (iii) progress on implementation on actions in comparison with target dates.
 - (iv) reason for delay in corrective actions (if any) and measures taken to address these reasons.
 - (v) implications of delayed actions on plant safe operation; and
 - (vi) alternative measures taken in connection with delayed corrective actions to ensure plant safety.

Maintenance, Testing, Surveillance and Inspection of Structures, Systems and Components.

36.(1) The authorised person shall ensure that

- (a) the plant management ensure that effective programs for maintenance, testing, surveillance and inspection of structures, systems and components are established and implemented.
- (b) these programs are in place prior to fuel loading and considers operating limits and conditions and re-evaluated at a frequency so specified.
- (c) the scope of the program includes safety and non-safety structures, systems, and components
 - (i) that are relied upon to mitigate accidents or transients or used in Emergency Operating Procedures (EOPs); or
 - (ii) whose failure could prevent safety structures, systems, and components from fulfilling their safety function; or
 - (iii) whose failure could cause a reactor scram or actuation of a safety system.

(2) The authorised person shall ensure that

- (a) the maintenance, testing, surveillance and inspection of all plant structures, systems, and components important to safety are performed to the program standard and at such a frequency as to ensure that their levels of reliability and effectiveness remain in accordance with the assumptions and intent of the design throughout commission, operation, and decommission of the installation.
 - (b) the program includes periodic inspections or tests of systems, structures, and components important to safety to demonstrate their reliability and to determine whether these are acceptable for continued safe operation of the plant or whether any remedial measures are necessary.
 - (c) in-service inspections (ISI) of nuclear power plants are carried out at chosen length intervals to ensure that any deterioration of the most exposed component is detected before it can lead to failure; and
 - (d) any ISI process is qualified, in terms of required inspection area(s), method(s) of non-destructive testing, defects being sought and required effectiveness of inspections.
- (3) The authorised person shall ensure that
- (a) the plant management develops procedures for all maintenance, testing, surveillance and inspection tasks.
 - (b) these procedures are prepared, reviewed, modified when required, validated, approved, and distributed in accordance with established administrative procedures; and
 - (c) the procedures include acceptance criteria for maintenance, testing, surveillance, and inspections, as well as actions to be taken when these criteria aren't met.
- (4) The authorised person shall ensure that
- (a) data on maintenance, testing, surveillance, and inspection are recorded, stored, and analysed to confirm that operating performance is in accordance with design intent and with requirements for equipment reliability and availability.
 - (b) data recording and analysis is used for identifying possible improvements in maintenance, testing, surveillance, and inspection activities to increase reliability and availability, as well as to recognise any increased degradation of SSCs in a timely manner; and
 - (c) results of the analyses form the bases for programme improvements.
- (5) The authorised person shall ensure that

- (a) the frequency of preventive and predictive maintenance, testing, surveillance and inspection of individual structures, systems and components are determined based on
 - (i) the importance to safety of the structures, systems, and components with insights from PSA considered.
 - (ii) their reliability and availability for operation.
 - (iii) their assessed potential for degradation in operation and their aging characteristics.
 - (iv) operational experience.
 - (v) vendors' recommendations.
 - (vi) requirements of OLCs.
 - (vii) frequency of operation and conditions in which an SSC operates; and
 - (viii) SSC condition as estimated based on previous testing, surveillance and inspections.
- (5) The authorised person shall ensure that
 - (a) a comprehensive and structured approach to identifying failure scenarios is taken to ensure proper management of maintenance activities using methods of PSA as appropriate.
 - (b) new approaches that could result in significant changes to current strategies for maintenance, testing, surveillance and inspection are taken only after careful consideration of the implications for safety and after approval by the Authority.
 - (c) a comprehensive work planning and control system is implemented to ensure that maintenance, testing, surveillance, and inspection work is properly authorised and is carried out in accordance with established procedures.
 - (d) any activity in the maintenance, testing or inspection of SSCs important for safety, in which external contractors participate in part or in full, is approved and supervised by the competent designated operating personnel of the installation.
 - (e) an adequate work control system is established for the protection and safety of personnel and for the protection of equipment during maintenance, testing, surveillance, and inspection.
 - (f) pertinent information is transferred at shift turnovers and at pre-job and post-job briefings on maintenance, testing, surveillance, and inspection.

- (g) the work control system ensures that plant equipment is only released from service for maintenance, testing, surveillance, or inspection with the authorisation of designated operating personnel and in compliance with the OLCs.
- (h) the work control system also ensures that permission to return equipment to service following maintenance, testing, surveillance, and inspection is given by the operating personnel.
- (i) permission is given only after the confirmation that the new plant configuration is within the established OLCs, and where appropriate, after functional tests have been successfully performed.
- (j) coordination is maintained between different maintenance groups (e.g., maintenance groups for mechanical, electrical, instrumentation & control, and civil). Coordination shall also be made among maintenance, operations, and support groups (e.g., groups for fire protection, radiation protection, physical protection and non-radiation related safety); and
- (k) the plant management plan with the external grid operators to ensure that appropriate procedures are applied in maintaining the connections of the plant to the external grid.

(6) The authorised person shall ensure that

- (a) a management system for managing and correcting deficiencies is established and used to ensure that operating personnel are not overburdened as well as ensure that safety at the plant is not compromised by the cumulative effects of these deficiencies.
- (b) all equipment used for SSC testing and inspection is qualified and calibrated before they are used and are properly identified in the calibration records; and
- (c) the validity of the calibration is regularly verified by the facility operator in accordance with the requirements of the management system.

(7) The authorised person shall ensure that

- (a) maintenance work during power operation is carried out with adequate defence in depth.
- (b) PSA is used, as appropriate, to demonstrate that the risks are not significantly increased.

- (c) the limit for cumulative increase of the core damage probability due to on-line maintenance is 5×10^{-7} per year, and 1×10^{-8} per year for the increase of the large early release probability.
 - (d) for the instantaneous risk, the core damage frequency does not exceed 1×10^{-4} per year for any SSC configuration with components inoperable due to maintenance or testing with the risk assessed before and after the activity.
 - (e) limits for SSC inoperability laid down in OLCs are observed regardless of PSA insights.
 - (f) the plant management establish maintenance programs for non-permanent equipment to be used for accidents more severe than design basis accidents, to maintain high reliability of this equipment; and
 - (g) The plant management carry out periodic training and exercises in handling the equipment and connecting it to the Nuclear Installation.
- (8) The authorised person shall ensure that
- (a) corrective maintenance of structures, systems and components shall be performed as promptly as practicable and in compliance with OLCs.
 - (b) priorities are established with account taken first of the relative importance to safety of the defective structure, system or component;
 - (c) when a detected flaw that exceeds the acceptance criteria is found in a sample, additional examinations are performed to investigate the specific problem area in the analysis of additional analogous components (or areas); and
 - (d) The extent of further examinations is decided with due regard for the nature of the flaw and degree to which it affects the nuclear safety assessments for the plant or component and the potential consequences.
- (9) The authorised person shall ensure that
- (a) arrangements are made to procure, receive, control, store and issue materials (including supplies), spare parts and components;
 - (b) the plant management is responsible to implement these arrangements and to ensure that the characteristics of such materials (including supplies), spare parts and components are consistent with the applicable safety standards and with the plant design; and
 - (c) the plant management ensure that storage conditions are adequate and that materials (including supplies), spare parts and components are available and are in proper condition for use.

- (10) The authorised person shall ensure that
- (a) the reactor coolant pressure boundary is subject to a system leakage test before resuming operation after a reactor outage in the course of which its leak tightness may been affected;
 - (b) the reactor coolant pressure boundary is subject to a system pressure test at or near the end of each major inspection interval;
 - (c) Surveillance measures to verify the containment integrity include
 - (i) leak rate tests;
 - (ii) tests of penetration seals and closure devices such as air locks and valves that are part of the boundaries, to demonstrate their leak-tightness and, where appropriate, their operability; and
 - (iii) inspections for structural integrity (such as those performed on liner and pre-stressing tendons)

Outage Management.

37.(1) The authorised person shall ensure that

- (a) the plant management shall establish and implement arrangements to ensure the effective performance, planning and control of work activities during outages;
- (b) outage planning is a continually improving process involving past, present, scheduled and future outages with reference points determined and used to track pre-outage work;
- (c) in the processes for planning and performing outage activities, priority is given to safety related considerations with special attention given to maintain the plant configuration in accordance with the OLCs;
- (d) the plant management is responsible for issuing programs and procedures for outage management, and for the provision of adequate resources for ensuring safety during shutdown operations;
- (e) the tasks, authorities and responsibilities of the groups and personnel involved in preparing, conducting or assessing outage schedules and activities are established and followed by all the plant personnel and contractors;
- (f) the interfaces among the group responsible for outages and other groups, including groups on the site and off the site, are clearly defined;

- (g) operating personnel are kept informed of current activities for maintenance, modification and testing;
- (h) optimisation of radiation protection and non-radiation related safety, waste reduction, and control of chemical hazards are essential elements of outage programs and planning, and are clearly communicated to relevant plant personnel and contractors; and
- (i) a comprehensive review is performed after each outage to determine lessons learnt.

Preparation For Decommissioning

Preparation for Decommissioning.

38.(1) The authorised person shall

- (a) prepare a decommissioning plan as per requirements of the Regulations on Decommissioning of Facilities and shall 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;
- (b) ensure that the decommissioning plan shall be updated in accordance with the regulatory requirements, modifications to the plant, advances in technology, changes in the need for decommissioning activities and changes in national policies;
- (c) ensure that a human resource programme is developed so 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;
- (d) ensure that in the preparatory period for decommissioning, the high level of operational safety is maintained until the nuclear fuel has been removed from the plant;
- (e) for a multiple unit plant, put appropriate measures in place to ensure that common systems and common equipment remained fully available to support the safe operation of all the generating units;
- (f) be aware, over the operating lifetime of the plant, of the needs in relation to future decommissioning;

- (g) ensure that experience and knowledge with regard to contaminated or irradiated structures, systems and components gained in modification and maintenance activities at the plant are recorded and retained to facilitate the planning of decommissioning;
- (h) ensure that completed and reviewed information is compiled to be transferred to the organisation responsible for managing the decommissioning phase; and
- (i) ensure that the implications for safety of the activities in the transitional phase prior to the commencement of decommissioning is assessed and managed so as to avoid undue hazards and to ensure safety.

Licensing of Operating Personnel

Criteria and Process for Licensing of Operating Personnel

39. The authorised person shall ensure that operating personnel of the said applicant or authorised person are licensed as specified in the *Licensing of Nuclear Installations regulations*.

Performance and Status of Licensed Personnel.

40.(1) An authorised person shall

- (a) file a report within twenty-one (21) days of the occurrence of certain situations or events, as the case may be, relating to the performance and status of personnel who have been licensed by NRA, in response to any of the following situations or events, as the case may be
 - (i) termination of the employment of a licensed person from the position for which the person is licensed by NRA.
 - (ii) failure, by a licensed person, to pass a re-qualification test referred to in the license or failure to take any re-qualification test referred to in the license; and
 - (iii) cancellation of operating license under the obligations of the provisions in the licensing regulatory requirement 21,22, and 23
- (b) ensure the report contain the following:
 - (i) full name and position of the licensed person.
 - (ii) date of termination of employment of a licensed person from a position for which the person was licensed.

- (iii) type and date of test that the person failed or did not appear in the test as per the provisions in the licensing regulatory requirement 24; and
- (iv) name and address of sender of the report, the date of completion of the report and the signature of the designated representative of the authorised person.

Reporting the Problems Identified through Research Findings or Revised Safety Analyses.

41. (1) The authorised person shall ensure that

- (a) the plant management report, within twenty-one (21) days of becoming aware, the outcome of research findings or new or revised safety analyses, of a problem or potential problem that represents a hazard or potential hazard to the health and safety of personnel or the environment, physical protection of the plant, or that is different in nature, greater in probability, or greater in magnitude than was previously analysed.
- (b) the problems or potential problems shall include the following occurrences:
 - (i) when an FSAR for an NPP contains an assumption, input, analytical method, or safety analysis result that is or may be invalid.
 - (ii) when a limit defined in the NPP licensing documents or in appendix to these documents is or may be inadequate to assure safety.
 - (iii) when an analysis, from which a limit in a licensing document was derived, may be invalid or uncertain such that the margin of safety may be less than predicted.
 - (iv) when the defined specifications of a safety system or of a safety related system of an NPP are or may be invalid.
 - (v) when an NPP licensing document contains an error that, if accepted, relied, or acted upon as being valid, could give rise to increased risks to the health and safety of personnel or the environment, physical protection of the plant; and
 - (vi) when the measures that are in place for the purpose of protecting the environment from the operating impacts of an NPP are, or may be, inadequate.

- (c) the report includes at least the following information:
- (i) identification of the plant (unit) that is or may be affected by the problem or potential problem.
 - (ii) identification of any structure, system, component, or function of the plant that is or may be affected by the problem or potential problem.
 - (iii) description of the problem or potential problem, and its actual or potential safety significance.
 - (iv) summary of the research or analysis that led to awareness of the problem or potential problem.
 - (v) evaluation of the degree of any impairment of a safety system or safety related system.
 - (vi) description of the corrective actions that have been taken, or that are proposed to be taken, to address the problem or potential problem; and
 - (vii) name and address of the sender of the report, the date of completion of the report and the signature of the designated representative of the authorised person.

Penalties

42. A person who contravenes any of the provisions of these Regulations commits an offence and is liable to penalty provision in Regulation 80 of the Basic Ionising Radiation Control Regulations.

Appeals

43. A person who is not satisfied with a decision taken by the Authority may appeal in accordance with sections 81, 82, 83, 84 and 85 of the Nuclear Regulatory Authority Act, 2015 (Act 895).

Interpretation

44. For the purposes of this regulation, the terms and definitions set out in Section 93 of the Nuclear Regulatory Authority Act (2015) apply, along with the additional terms and definitions given below:

“accident” means any unintended event, including operating errors, equipment failures and other mishaps, the consequences, or potential consequences of which are not negligible from the point of view of protection and safety.

“accident conditions” mean deviations from normal operation that are less frequent and more severe than anticipated operational occurrences, including design basis accidents and design extension conditions;

“ageing management ” means engineering, operations and maintenance actions to control, within acceptable limits, the ageing degradation of structures, systems and components;

“anticipated operational occurrences” mean operational processes deviating from normal operation which are expected to occur at least once during the operating lifetime of a facility but which, in view of appropriate design provisions, do not cause any significant damage to items important to safety or lead to accident conditions;

“commissioning” means the process during which systems structures and components of facility having been constructed, are made operational and verified to be in accordance with the design and to have met the required performance criteria;

“configuration management” means the process of identifying and documenting the characteristics of a facility’s structures, systems and components, including computer systems and software; and of ensuring that changes to these characteristics are properly developed, assessed, approved, issued, implemented, verified, recorded and incorporated into the facility documentation, and that both characteristic of SSCs as well as facility documentation are aligned with design requirements;

“controlled area” means a defined area in which specific protection measures and safety provisions are or could be required for controlling exposures or preventing the spread of contamination in normal working conditions, and preventing or limiting the extent of potential exposures;

“criticality” means the state of a nuclear chain reacting medium when the chain reaction is just self-sustaining (or critical), i.e., when the reactivity is zero;

“decommissioning” means administrative and technical actions taken to allow the removal of some or all of the regulatory controls from a facility;

“design basis accidents” mean a postulated accident leading to accident conditions for which a facility is designed in accordance with established design criteria and conservative methodology, and for which releases of radioactive material are kept within acceptable limits;

“design extension conditions” mean postulated accident conditions that are not considered for design basis accidents, but that are considered in the design process of the facility in accordance with best estimate methodology, and for which releases of radioactive material are kept within acceptable limits;

“facility” means nuclear installation such as a nuclear power plant, research reactor, and may also be called as plant;

“integrated management system” means a single coherent management system for facilities and activities in which all the component parts of an organization are integrated to enable the organization’s objectives to be achieved;

“limit” means the value of quantity used in certain specified activities or circumstances that must not be exceeded and is acceptable to and notified by the Authority;

“long shutdown” means a shutdown planned for a duration exceeding one (1) month for research reactors;

“management system” means a set of interrelated or interacting elements for establishing policies and objectives and enabling the objectives to be achieved in an efficient and effective manner;

“near miss” means a potentially significant event that could have occurred as the consequence of a sequence of actual occurrences but did not occur owing to the facility conditions prevailing at the time;

“normal operation” means operation within specified operational limits and

conditions;

“nuclear safety” means the achievement of proper operating conditions, prevention of accidents and mitigation of accident consequences, resulting in protection of workers, the public and the environment from undue radiation risks;

“operating personnel” mean individual workers engaged in the operation of the authorised facility;

“operation” means all activities performed to achieve the purpose for which an authorised facility was constructed;

“operational limits and conditions (OLCs)” mean 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. OLCs and operating policies and principles are also referred as OLCs;

“operational states” mean states defined under normal operation and anticipated operational occurrences;

“reactor operator (RO)” means licensed operator responsible for manipulating the controls of a nuclear reactor in the control room and in the field under the supervision of a licensed shift supervisor or shift engineer;

“safety” means the protection of people and the environment against radiation risks, and the safety of facilities and activities that give rise to radiation risks;

“safety function” means a specific purpose that must be accomplished for safety for a facility or activity to prevent or to mitigate radiological consequences of normal operation, anticipated operational occurrences and accident conditions;

“safety limits” mean limits on operational parameters within which an authorised facility has been shown to be safe;

“safety system settings” mean the settings for levels at which safety systems are automatically actuated in the event of anticipated operational occurrences or design basis accidents, 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 the residual heat removal from the reactor core, or to limit the consequences of anticipated operational occurrences and design basis accidents;

“site personnel” mean all persons working on the site of a facility either permanently or temporarily;

“shift engineer (SE)” means licensed engineer, second in command, assisting shift supervisor and responsible for manipulating the controls of a nuclear reactor and supervising the activities of licensed reactor operator in the control room and in the field;

“shift supervisor (SS)” means licensed engineer responsible for direct supervision of plant operation and in-charge of operation shift; and

“station health physicist (SHP)” means technical head of the health physics department.

“radiation protection officer (RPO)” a person technically competent in radiation protection matters relevant for a given type of practice who is designated by the authorised to oversee the application of regulatory requirement

“service life” is the period from commissioning to decommissioning of a structure, system, or component

SAR – Safety Analysis Report

Schedule I

Submission Requirements for Refuelling Outage

(1) The authorised person shall submit the following documents to the Authority at least one (1) month before the scheduled date of shutdown for refuelling outage, except outage job list, which shall be submitted two (2) months before the planned shutdown:

- (a) a refuelling safety analysis report which shall include prediction of core condition after completing refuelling and comparison of core prediction results with the OLCS of the plant.
- (b) administrative procedures on the following:
 - (i) overall organisational set-up for the refuelling outage including outside organisations.
 - (ii) responsibilities and authorities of various divisions/sections of the authorised person's organisation for the refuelling outage.
 - (iii) responsibilities and authorities of outside organisations involved in activities during refuelling outage.
 - (iv) interfaces and communication lines within the authorised person and with outside organisations; and
 - (v) control measures of the authorised person on the activities performed by outside organisations.
- (c) training program for personnel involved in activities during refuelling outage but are not part of plant organisation regarding access control, radiation protection, work control, reporting of event, and other relevant administrative requirements.
- (d) detailed refuelling plan and schedule for the activities to be conducted during refuelling outage including the following:
 - (i) handling and transportation of fuel and other core components and their inspections.
 - (ii) maintenance, modification and subsequent testing of structures, systems, and components important to safety.
 - (iii) in-Service Inspections of structures, systems, and components important to safety.
 - (iv) surveillance tests of structures, systems, and components important to safety.
 - (v) tests during fuel unloading and loading; and
 - (vi) criticality tests and subsequent tests at low power and power ascension.

- (e) dose estimation for the refuelling outage, bases for the estimation, and the methodology adopted, or procedure followed for dose estimation.
 - (f) estimation for radioactive waste generation during the refuelling outage including gaseous, liquid, and solid wastes, methodology adopted, or procedure followed for the estimation, capability and resources to handle, store and dispose-off the radioactive waste safely; and
 - (g) establishing personnel and process qualification requirements, for personnel engaged and processes involved in various activities, during the refuelling outage.
- (2) The authorised person shall submit any subsequent change in these documents also to NRA immediately.
- (3) The authorised person shall provide any other document and information, as required by NRA, to facilitate inspections and assessments.
- (4) After refuelling of the plant, the authorised person shall submit an application for making the reactor critical to NRA at one (1) week before the expected criticality date and the authorised person shall not make the reactor critical without approval of NRA and the application shall contain the following:
- (a) report on implementation of the refuelling plan;
 - (a) report on major problems encountered and events occurred during refuelling outage, their causes and the corrective action taken or planned;
 - (b) refuelling outage activities, which may affect safety, if any, that could not be completed along with the reason and any safety implication due to this; and
 - (c) assessment report on the doses received by the workers during refuelling outage and a comparison with the dose estimated for the outage.
- (5) The authorised person shall submit completion report on refuelling shutdown activities within four (4) months of making the reactor critical following refuelling outage and the reports shall include the following:
- (a) an overall summary of refuelling activities;
 - (b) details of implementation of the refuelling plan;
 - (c) results of criticality tests and subsequent tests at low power and power ascension;
 - (d) test and inspection reports of important activities;

- (e) details of doses received during the refuelling outage including overall dose, doses received by individuals, doses received in specific activities in high radiation areas, overexposure of individual, if any, and comparison with the estimated doses for the outage;
- (f) details of radioactive waste generated and released during the refuelling outage and comparison with the estimation made for the outage;
- (g) description of the activities that were not completed along with the reason and safety implications of such non-completed activities;
- (h) details of major problems encountered and events occurred during the outage, their root causes, and the corrective actions taken or planned to rectify the situation and avoid recurrence; and
- (i) conclusion.

Schedule II

Submission Requirements for Long Shutdown

- (1) The authorised person shall submit the following documents to NRA, at least one (1) month before the scheduled date of long shutdown except outage job list, which shall be submitted two (2) months before the planned shutdown:
 - (a) detailed long shutdown plan and schedule for the activities to be conducted during long shutdown including maintenance, modification and subsequent testing, in-service inspections and surveillance tests of structures, systems and components important to safety;
 - (b) dose estimation for the long shutdown period, bases for the estimation, and the methodology adopted or procedure followed for dose estimation;
 - (c) estimation for radioactive wastes generation during long shutdown including gaseous, liquid and solid wastes, methodology adopted or procedure followed for the estimation, capabilities and resources to handle, store and dispose-off the radioactive wastes safely; and
 - (d) establishing personnel and process qualification requirements, for personnel engaged and processes involved in various activities, during long shutdown.
- (2) After completion of long shutdown, authorised person shall submit an application for making the reactor critical to the Authority, one (1) week before the expected criticality date with the following documents and reports submitted along with the application for reactor criticality:

- (a) report on implementation of the long shutdown work plan;
 - (b) report on major problems encountered and events occurred during long shutdown, their causes and the corrective action taken or planned to rectify the situation and avoid recurrence;
 - (c) long shutdown activities, which may affect safety, if any, that could not be completed along with the reason and any safety implication due to this; and
 - (d) assessment report on the doses received by the workers during long shutdown and a comparison with the dose estimated for the outage.
- (3) The authorised person shall not make the reactor critical without approval of NRA.
- (4) The authorised person shall submit completion report on long shutdown activities within four (4) months of making the reactor critical following long shutdown and the report shall include the following:
- (a) an overall summary of long shutdown activities;
 - (b) details of implementation of long shutdown work plan;
 - (c) results of criticality tests and subsequent tests at low power and power ascension;
 - (d) test and inspection reports of important activities;
 - (e) details of doses received during long shutdown including overall dose, doses received by individuals, doses received in specific activities in high radiation areas, overexposure of individual, if any, and comparison with the estimated doses for the outage;
 - (f) details of radioactive wastes generated and released during long shutdown and comparison with the estimation made for the outage;
 - (g) description of all the activities that were not completed along with the reason and safety implications of such non-completed activities;
 - (h) details of major problems encountered and events occurred during long shutdown, their root causes, and the corrective actions taken or planned to rectify the situation and avoid recurrence; and
 - (i) conclusion