



United Arab Emirates

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## Regulation

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# Operational Safety including Commissioning (FANR-REG-16) Version 0

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## Definitions

### Article (1)

For purposes of this regulation, the following terms shall have the meanings set forth below. Other capitalised terms used but not defined herein shall have the meaning ascribed to them in Article 1 of the Federal Law by Decree No. 6 of 2009 Concerning the Peaceful Uses of Nuclear Energy (the Law):

**Accident Conditions** Deviations from Normal Operation more severe than Anticipated Operational Occurrences, including DBAs and Severe Accidents.

**Accident Management** The taking of a set of actions during the evolution of a beyond DBA:

- To prevent the escalation of the event into a Severe Accident;
- To mitigate the consequences of a Severe Accident; and
- To achieve a safe and stable state in the long term.

**Anticipated Operational Occurrences** An operational process deviating from Normal Operation which is expected to occur at least once during the operating lifetime of a Nuclear Facility but which, in view of appropriate Design provisions, does not cause any significant damage to Items Important to Safety or lead to Accident Conditions.

**Corrective Maintenance** Actions that restore, by repair, overhaul or replacement, the capability of a failed SSC to function within acceptance criteria.

**Design Basis Accident (DBA)** Accident Conditions against which a Nuclear Facility is designed according to established Design criteria, and for which the damage to the Nuclear Fuel and the release of Radioactive Material are kept within authorized limits.

**Defence-in-Depth** A hierarchical deployment of different levels of diverse equipment and procedures to prevent the escalation of Anticipated Operational Occurrences and to maintain the effectiveness of physical barriers placed between a Radiation Source or Radioactive Material and Operational States workers, members of the public or the environment, in and, for some barriers, in Accident Conditions.

**Equipment Operator (EO)** An Operator who works in a Nuclear Facility, normally outside the control room, under the direction of Reactor Operators and Senior Reactor Operators.

**Items Important to Safety**

An item that is part of a Safety Group and/or whose malfunction or failure could lead to radiation exposure of the site personnel or members of the public, including:

Those SSCs whose malfunction or failure could lead to undue radiation exposure of site personnel or members of the public;

Those SSCs that prevent Anticipated Operation Occurrences from leading to Accident Conditions; and

Those failures that are provided to mitigate the consequences of a malfunction or failure of SSCs.

**Normal Operation**

Operation within specified Operational Limits and Conditions. For a Nuclear Facility this includes start-up, power operation (including low power), shutting down and shutdown, Maintenance, testing and refuelling.

**Operating Personnel**

The Senior Reactor Operators, the Reactor Operators, or the Equipment Operators at a Nuclear Facility.

**Operational Limits and Conditions (OLC)**

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 authorized Facility.

**Operational States**

States defined under Normal Operation and Anticipated Operational Occurrences.

**Postulated Initiating Event (PIE)**

An event identified in Design as leading to Anticipated Operational Occurrences or Accident Conditions. This means that a PIE is not an accident itself; it is the event that initiates a sequence and that leads to an operational occurrence, a DBA or a Severe Accident depending on the additional failures that occur. Typical examples are equipment failures (including pipe breaks), human errors, human induced events and natural events.

**Probabilistic Risk Assessment (PRA)**

A comprehensive, structured approach to identifying failure scenarios constituting a conceptual and mathematical tool for deriving numerical estimates of risk.

Level 1 comprises the Assessment of failures leading to the determination of the frequency of core damage.

Level 2 constitutes the Assessment of containment response and leads to the determination of frequency of containment failure

resulting in release to the environment of a given percentage of the reactor core's inventory of radionuclides.

**Protection and Safety**

The protection of people against Ionizing Radiation or Radioactive Material and the Safety of Radiation Sources, including the means for achieving this, and the means for preventing Accidents and for mitigating the consequences of Accidents should they occur.

**Reactor Operator (RO)**

A control room operator who normally manipulates the Nuclear Facility controls, particularly the controls affecting reactor reactivity.

**Representative Simulator**

A full-scale replica training simulator whose behaviour corresponds well to the plant's behaviour under normal operational, transient, and accident conditions.

**Root Cause**

The fundamental cause of an initiating event, correction of which will prevent recurrence of the initiating event (i.e. the root cause is the failure to detect and correct the relevant latent weakness(es) and the reasons for that failure).

**Safety Analysis Report (SAR)**

The detailed demonstration of the Safety, security and safeguards of a Nuclear Facility presented in the form of an integrated report that presents the necessary and sufficient information in support of the licence application for authorization of the Regulated Activity requested.

**Safety Culture**

The assembly of characteristics and attitudes in organisations and individuals which establishes that, as an overriding priority, Protection and Safety issues receive the attention warranted by their significance.

**Safety Group**

The assembly of equipment designated to perform all actions required for a particular PIE to ensure that the limits specified in the design basis for Anticipated Operational Occurrences and DBAs are not exceeded.

**Safety System**

A system important to Safety, provided to ensure the safe shutdown of the reactor or the residual heat removal from the core, or to limit the consequences of Anticipated Operational Occurrences and DBAs.

**Senior Reactor Operator (SRO)**

A senior control room operator who oversees and directs the activities of Reactor Operators and Equipment Operators.



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**Severe Accidents**

Accident Conditions more severe than a DBA and involving significant core degradation.

**State System of Accounting for & Control of Nuclear Material (SSAC)**

A system of accounting for and control of all Nuclear Material subject to safeguards under the Safeguards Agreement, which is established and maintained by the Authority at the State level.

**Structures, Systems and Components (SSCs)**

A general term encompassing all the elements of a Facility or Activity which contributes to Protection and Safety, except human factors. Structures are the passive elements such as building vessels and shielding. Systems comprise several components assembled in such a way as to perform a specific active function. Components are discrete elements of systems.



## Objective and Scope

### Article (2)

1. The objective of this regulation is to establish the requirements that must be satisfied to ensure the safe Operation of a Nuclear Facility. The requirements of this regulation shall be considered in conjunction with the requirements from other related regulations issued by the Authority pursuant to the Law.
2. This regulation establishes requirements for the Commissioning and Operation of a Nuclear Facility. It covers Commissioning and Operation up to the removal of Nuclear Fuel from the Nuclear Facility, including testing, Inspection, Maintenance and modifications made throughout the lifetime of the Nuclear Facility. It covers also the preparation for Decommissioning.
3. This regulation applies to the holder of a License to operate a Nuclear Facility.

## Responsibility for Safety

### Article (3)

The prime responsibility for Safety is assigned to the Licensee of the Nuclear Facility. This prime responsibility shall cover all the activities related directly or indirectly to the Operation. It includes the responsibility for supervising the activities of all other related groups such as designers, suppliers, manufacturers and construction workers, employers and contractors as well as the responsibility for Operation of the Nuclear Facility.

## Management System

### Article (4)

The Licensee shall establish, implement, assess and continually improve an integrated Management System in accordance with the Authority's requirements.

## Structure and Functions of the Organisation

### Article (5)

1. Functional responsibilities, lines of authority and lines of internal and external communication for the safe Operation of a Nuclear Facility in all Operational States and in Accident Conditions shall be clearly documented in writing.
2. Documentation of the Nuclear Facility's organisational structure and of the arrangements for discharging responsibilities shall be made available to the Nuclear Facility's personnel. The organisational structure of the Licensee shall be specified so that all roles that are critical for the safe Operation of the Nuclear Facility are specified and described in writing. Proposed organisational

changes to the structure and associated arrangements that are of importance to Safety shall be analysed in advance by the Licensee and submitted to the Authority for approval.

## **Staffing and Resources of the Organisation**

### **Article (6)**

The Licensee shall be staffed with competent managers and sufficient qualified personnel for the safe Operation of the Nuclear Facility

1. The necessary knowledge, skills, attitudes and Safety expertise shall be sustained at the Nuclear Facility, and long-term objectives and policies for human resources shall be developed and met.
2. The organisation, qualifications and number of Nuclear Facility personnel shall be adequate for the safe and reliable Operation of the Nuclear Facility in all Operational States and in Accident Conditions. Succession planning shall be an established practice for the Nuclear Facility personnel. The recruitment and selection policy of the Licensee shall be directed at attracting and retaining competent personnel to cover all aspects of the safe Operation of the Nuclear Facility. A long-term staffing plan aligned to the long-term objectives of the Licensee shall be developed in anticipation of the future needs of the Licensee for personnel and skills.
3. There shall be sufficient Operating Personnel on shift to ensure that the Nuclear Facility is operated in accordance with the OLCs. Shift staffing patterns, shift cycles and controls on working hours shall provide sufficient time for the training of Operating Personnel. Distractions to control room Operators shall be minimised. In order to avoid burdening control room Operators and to allow them to focus on their responsibilities for Safety, activities shall be scheduled to reduce simultaneous activities as far as possible.
4. A staff health policy shall be instituted and maintained to ensure the fitness for duty of all Nuclear Facility personnel. Attention shall be paid to minimising conditions causing stress, and to setting restrictions on over-time and requirements for rest breaks. The health policy shall cover the prohibition of alcohol consumption and drug abuse.
5. Resources for support activities 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 shall be available to support the requirements of this regulation. For sites with shared important to Safety resources (such as sites with multiple units), the arrangements for the use of such shared resources shall be clearly defined.

## **Safety Policy**

### **Article (7)**

The Licensee shall establish and implement operational policies that give Safety the highest priority.

1. An operational policy implemented by the Licensee shall give Safety the utmost priority thereby overriding the demands of production and project schedules. The Safety policy shall promote a strong Safety Culture including a questioning attitude and a commitment to excellent performance in relation to all activities that are important to Safety. Managers shall promote an attitude of Safety consciousness amongst Nuclear Facility personnel.

2. The Safety policy shall stipulate clearly the leadership role of senior management in Safety matters. Senior management shall communicate the provisions of the Safety policy throughout the organisation. All personnel in the organisation shall be made aware of the Safety policy and of their responsibilities for ensuring Safety thereunder. Safety performance standards and the expectations of management for Safety performance shall be clearly communicated to site personnel.
3. Key aspects of the Safety policy shall be communicated to appropriate external support organisations including contractors so that the Licensee's requirements and expectations for those activities that are important to Safety are clearly understood and met.
4. The Safety policy of the Licensee shall include a commitment to achieving enhancements in operational Safety. The strategy of the Licensee for enhancing Safety and for finding more effective ways of applying and, where feasible, improving existing standards shall be continuously monitored and supported by means of a clearly specified programme with clear objectives and targets.

## **Operational Limits and Conditions**

### **Article (8)**

The Licensee shall ensure that the Nuclear Facility is operated in accordance with the set of OLCs.

1. The Nuclear Facility shall be operated within the 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.
2. The ROs and SROs shall remain cognisant of the condition of all Nuclear Facility systems that have a bearing on Safety and ensure that these conditions meet the requirements of the OLCs.
3. The OLCs shall be reviewed and revised as necessary in consideration of operating experience, developments in technology and approaches to Safety, and changes in the Nuclear Facility.
4. The OLCs shall include the following:
  - (a) Safety limits
  - (b) Limiting settings for Safety Systems
  - (c) Limits and conditions for Normal Operation
  - (d) Surveillance and testing requirements; and
  - (e) Action statements for deviations from Normal Operation.
5. Operating personnel who are directly responsible for the conduct of operations shall be trained and thoroughly familiar with the OLCs in order to comply with the provisions contained therein.
6. The Licensee shall ensure that an appropriate surveillance programme is implemented to ensure compliance with the OLCs, and that its results are evaluated, recorded, and retained.
7. The Nuclear Facility shall be returned to a safe Operational State when parameters deviate from the OLCs. These deviations shall be documented and appropriate remedial actions shall be taken. The Licensee shall undertake a review and evaluation of the circumstances that led to this condition. The Authority shall be notified in accordance with the Authority's requirements. Responsibilities and lines of communication for responding to such deviations shall be clearly specified in writing.

8. The Licensee shall not intentionally exceed the OLCs. A Licensee may take reasonable action that departs from the OLCs in an Emergency when this action is immediately needed to protect public health and Safety, and the environment and no action consistent with Licence conditions or the OLCs that can provide adequate or equivalent protection that is available. Any such situations shall be promptly reported to the Authority. Any other departures from the OLCs shall be approved in advance by the Authority and be conducted with clear formal instructions including instructions for returning the Nuclear Facility to Normal Operation.

## Qualification and Training of Personnel

### Article (9)

The Licensee shall ensure that all activities that may affect Safety are performed by suitably qualified and competent persons.

1. The Licensee shall clearly define the requirements for qualification and competence to ensure that personnel performing functions that are important to Safety are capable of safely performing their duties.
2. Suitably qualified personnel shall be selected and shall be given the necessary training and instruction to enable them to perform their duties correctly for different Operational States of the Nuclear Facility and in Accident Conditions in accordance with the appropriate procedures.
3. The management of the Licensee shall be responsible for the qualification and the competence of Nuclear Facility personnel. Managers shall participate in determining the needs for training and in ensuring that operating experience is taken into account in the training. Managers and supervisors shall ensure that production needs do not unduly interfere with the conduct of the training programme.
4. A suitable training programme shall be established and maintained for the training of personnel before their assignment to duties that are important to Safety. The training programme shall include provisions for periodic confirmation of the competence of personnel and for refresher training on a regular basis. The refresher training shall also include re-training provisions for personnel who have had extended absences from their authorised duties. The training shall emphasise the importance of Safety in all aspects of Nuclear Facility Operation and shall promote Safety Culture.
5. Performance-based programmes for initial and continuing training shall be developed and put in place for each major group of personnel (including, if necessary, external support organisations such as contractors). The content of each programme shall be based on a systematic approach. Training programmes shall promote attitudes that help to ensure Safety issues receive the attention that they warrant.
6. The training programmes shall be assessed and improved by means of periodic review. In addition, a system shall be put in place for the timely modification and updating of the training facilities, computer models, simulators and materials to ensure that they adequately reflect current Nuclear Facility conditions and operating policy, and that any differences are justified.
7. Operating experience at the Nuclear Facility, as well as relevant experience at other Facilities, shall be appropriately incorporated into the training programmes. The Licensee shall ensure that training is conducted on the Root Cause(s) of applicable operating experience events and the implementation of corrective actions to make their recurrence less likely.

8. Training instructors shall be technically competent in their assigned areas of responsibility, shall have the necessary instructional skills, and shall also be familiar with routines and work practices at the workplace. Qualification requirements shall be established for the training instructors.
9. Adequate training facilities, including a Representative Simulator, appropriate training materials, and technical and Maintenance training facilities shall be made available for the training of Operating Personnel. Simulator training shall incorporate training for Facility Operational States and for Accident Conditions.

### Performance of Important-to-Safety Activities

#### Article (10)

The Licensee shall ensure that Safety related activities are adequately analysed and controlled to ensure that the risks associated with harmful effects of Ionizing Radiation are kept as low as reasonably achievable.

1. Operational activities shall be assessed for the potential risks associated with harmful effects of Ionizing Radiation. The level of Assessment and control shall depend on the Safety significance of the task.
2. Acceptable margins shall be ensured between normal operating values and the established Safety System settings to avoid undesirably frequent actuation of Safety Systems.
3. No activities that are important to Safety shall be conducted without adequate justification. If there is a need to conduct a non-routine Operation or test that is not covered by existing procedures, a specific Safety review shall be performed and a special procedure shall be developed and approved.
4. Written communication shall be preferred to direct the performance of activities that are important to Safety, and spoken communication should be minimised. If spoken communication is used, attention shall be given to ensuring that spoken instructions are clearly understood.
5. Aspects of the working environment that influence human performance factors (such as work load or fatigue) and the effectiveness and fitness of personnel for duty shall be identified and controlled. Tools for enhancing human performance shall be used as appropriate to support the activities of the Nuclear Facility and its personnel.
6. The Licensee shall clearly communicate to its Nuclear Facility personnel the need to have both a questioning attitude and to make appropriate and conservative decisions, so as to minimise risk and to maintain the Nuclear Facility in a safe condition.
7. The responsibilities and authorities for re-starting a reactor after an event leading to an unplanned shutdown, scram or major transient, or to an extended period of Maintenance, shall be clearly established in writing. An investigation shall be carried out to determine the cause of the event and corrective actions shall be taken to make its recurrence less likely. Prior to the re-start or the resumption of full power of the affected reactor, the Licensee shall carry out necessary remedial actions including Inspection, testing and repair of damaged SSCs, and shall re-validate the Safety functions that might be challenged by the event. Re-start conditions and criteria shall be established and followed after the timely implementation of the necessary corrective actions.
8. If, in addition to the deterministic Safety Assessment, a PRA is to be used for decision-making purposes, the Licensee shall ensure that the risk analysis is of appropriate quality and scope for decision-making purposes. The risk analysis shall be performed by appropriately skilled analysts and

shall be used in a manner that complements the deterministic approach to decision-making in compliance with applicable regulations and Nuclear Facility Licence conditions.

## **Monitoring and Review of Safety Performance**

### **Article (11)**

The Licensee shall establish a system for continuous monitoring and periodic review of the Safety of the Nuclear Facility and of the performance of the Licensee.

1. An audit and review system shall be established by the Licensee to ensure that the Safety policy of the Licensee 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. Monitoring of Safety performance shall include the monitoring of personnel performance, attitudes toward Safety, response to infringements of Safety, and violations of OLCs, procedures, regulations and Licence conditions. The monitoring of Nuclear Facility conditions, activities and attitudes of personnel shall be supported by systematic walk-downs of the Nuclear Facility by the Nuclear Facility managers.
3. The persons and organisation performing Quality Assurance functions shall have sufficient authority and organisational independence to identify problems relating to quality and to initiate, to recommend and to verify the implementation of solutions. These persons and organisations shall 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 important to Safety matters.

## **Control of Nuclear Facility Configuration**

### **Article (12)**

1. The Licensee shall implement a system for Nuclear Facility configuration management to ensure consistency between Design requirements, physical configuration, and Nuclear Facility documentation.
2. Controls on Nuclear Facility configuration shall ensure that changes to the Nuclear Facility and its Safety related systems are properly identified, screened, designed, evaluated, implemented and recorded. Proper controls shall be implemented to handle changes in Nuclear Facility configuration that result from Maintenance, testing, and modifications.

## Management of Modifications

### Article (13)

The Licensee shall establish and implement a programme to manage modifications.

1. A modification programme shall be implemented to ensure that all modifications are properly identified, specified, screened, designed, evaluated, authorised, implemented, and recorded. Modification programmes shall cover SSCs, OLCs, procedures, documents, plans, computer programmes and the organisational structure of the Licensee. Modifications shall be characterised on the basis of their Safety significance. Modifications shall be subject to the approval of the Authority in accordance with their Safety significance.
2. Modification control shall ensure the proper Design, Safety Assessment and review, control, implementation, and testing of all permanent and temporary modifications. Consequences of the modification for human tasks and performance shall be systematically analysed. For all Nuclear Facility modifications, human and organisational factors shall be adequately considered.
3. Temporary modifications shall be limited in time and number to minimise the cumulative Safety significance. Temporary modifications shall be clearly identified at their location and at any relevant control position. The Licensee shall establish a formal system for informing relevant personnel of temporary modifications and of their consequences for the Operation and Safety of the Nuclear Facility.
4. Before commissioning a modification or putting the Nuclear Facility back into Operation after modifications, personnel shall be trained on the modification and its impact on Operations, as appropriate, and all relevant documents necessary for Nuclear Facility Operation shall be updated.

## Periodic Safety Review

### Article (14)

1. Periodic Safety Reviews of the Nuclear Facility shall be performed by the Licensee, starting from the start of plant Operation, every 10 years throughout the Nuclear Facility's operating lifetime with due account taken of operating experience and significant new important to Safety information from all relevant sources.
2. Periodic Safety Reviews shall address the consequences of the cumulative effects of Nuclear Facility ageing and Nuclear Facility modification, equipment qualification, operating experience, current standards, technical developments, and organisational and management issues, as well as site related aspects.
3. The scope of the Periodic Safety Reviews shall include all important to Safety aspects of the Nuclear Facility (including all Items Important to Safety) and shall be approved by the Authority. In order to complement a deterministic Safety Assessment, a PRA shall be used for input into the Safety review to provide insight into the contributions to Safety of different important to Safety functions of the Nuclear Facility (including all Items Important to Safety).
4. The Licensee shall submit a report of the results of the Periodic Safety Review to the Authority for review and acceptance. On the basis of these results, the Licensee shall implement any necessary corrective actions and modifications that comply with applicable standards aimed at enhancing the Safety of the Nuclear Facility and further reducing the likelihood and consequences of Severe Accidents.

## Equipment Qualification

### Article (15)

The Licensee shall ensure that a systematic Assessment is carried out to provide reliable confirmation that Safety related items are capable of the required performance for all Operational States and for Accident Conditions.

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

## Ageing Management

### Article (16)

1. The Licensee shall establish and implement a comprehensive programme for ensuring the long-term safe Operation of the Nuclear Facility consistent with the time frame established in the Licence conditions, Design limits, Safety standards and State regulations.
2. The Licensee shall ensure that an effective ageing management programme is implemented to ensure that required Safety functions of SSCs are fulfilled over the entire operating lifetime of the Nuclear Facility.
3. The Licensee shall implement an erosion and corrosion monitoring programme to assure the structural integrity of high-energy piping systems and associated components not covered in the scope of the in-service Inspection programme.
4. The Licensee shall implement a programme to account for cyclical and transient occurrences to ensure that components are maintained within their Design limits.

## Interfaces among Safety, Security and Safeguards

### Article (17)

1. Safety measures, Nuclear Security measures and arrangements for the SSAC of Nuclear Material shall be designed and implemented in an integrated manner so that they do not compromise one another. Safety, Nuclear Security and safeguards shall be viewed as complementary, as many of the measures designed to ensure one will also serve to ensure the other.
2. The Licensee shall ensure close cooperation between Safety, security, and safeguards managers and establish mechanisms to resolve potential conflicts and to manage their interfaces.



## Emergency Preparedness

### Article (18)

The Licensee shall prepare an Emergency Plan for preparedness for, and response to, a nuclear or radiological Emergency in accordance with the Authority's requirements.

## Accident Management Programme

### Article (19)

1. The Licensee shall establish an Accident Management programme for the Nuclear Facilities, that includes Spent Nuclear Fuel Storage and covers the preparatory measures and guidelines that are necessary for dealing with a DBA and beyond DBAs, including Severe Accidents. The Accident Management programme shall be documented and periodically reviewed and revised as necessary.
2. For a site where several units are co-located, the Accident Management programme shall consider concurrent Severe Accidents on multiple units due to, for example, external hazards. Resource in terms of trained and experienced personnel, equipment, supplies and external support shall be available to cope with such Severe Accidents.
3. The Accident Management programme shall include instructions for the use of the available equipment, both those that are important to Safety and conventional equipment, and the technical and administrative measures to mitigate the consequences of an Accident.
4. The Accident Management programme shall include contingency measures such as alternative supply of water, compressed air or other gasses and mobile electrical power sources to mitigate Severe Accidents, including any necessary equipment. This equipment shall be located and maintained so that it can withstand and will be readily accessible in postulated Emergency conditions.
5. The Accident Management programme shall also include organisational arrangements for Accident Management and communication networks.
6. The Accident Management programme shall include training necessary for the effective implementation of the programme for single and multiple unit events.
7. When developing the Accident Management programme and associated procedures, accessibility, adverse working conditions (e.g. elevated radiation levels, elevated temperatures, lack of lighting, access to plant from off-site) for operating staff, as well as degraded operating conditions for equipment shall be taken into account to ensure expected Accident Management actions will be feasible and reliable.
8. Arrangements for Accident Management shall provide the Nuclear Facility personnel with appropriate systems and technical support in relation to a DBA and a beyond DBA. These arrangements and guidance shall be available before the commencement of Nuclear Fuel loading, be validated and then periodically tested in exercises to ensure that they support the actions necessary following a DBA and a beyond DBA, including Severe Accidents. Furthermore, arrangements shall be made as part of the Emergency Plan to expand the Emergency response arrangements, where necessary, to include the responsibility for long-term actions including multiple unit events.

## **Radiation Protection**

### **Article (20)**

The Licensee shall establish and implement a Radiation Protection programme in accordance with the Authority's requirements.

## **Management of Radioactive Waste**

### **Article (21)**

The Licensee shall establish and implement a programme for the management of Radioactive Waste in accordance with the Authority's requirements.

## **Fire Safety**

### **Article (22)**

1. The Licensee shall implement a fire protection plan to minimise the potential for a fire that could create a radiological hazard or have an adverse effect on SSCs so that the capability to shut down the Nuclear Facility and maintain it safely in a shutdown condition is assured. The fire protection plan shall:
  - a) be based on a comprehensive fire hazard analysis for the Nuclear Facility that shall be periodically reviewed and, if necessary, updated;
  - b) describe the overall fire protection programme for the Nuclear Facility, including the administrative controls and personnel requirements to reasonably prevent fires from occurring and prevent the spread of those fires;
  - c) outline the plans for fire detection and suppression capability to rapidly detect, control, and extinguish those fires that may occur, including the capability for immediate response to fires by persons trained in fire-fighting;
  - d) include considerations of the following:
    - (1) application of the principle of Defence-in-Depth;
    - (2) control of combustible materials and ignition sources in particular during outages;
    - (3) Inspection, Maintenance and testing of fire protection measures;
    - (4) establishment of a manual fire-fighting capability;
    - (5) assignment of responsibilities, training and exercising of Nuclear Facility personnel;
    - (6) Assessment of the impact of Nuclear Facility modifications on fire Safety measures; and
    - (7) Assessment of the impact of spurious actuation of signals resulting from fire, including multiple simultaneous spurious actuations.
2. In the arrangements for fire-fighting, special attention shall be paid to cases for which there is a risk of release of Radioactive Material in a fire. Appropriate measures shall be established for the Radiation Protection of fire-fighting personnel and the management of releases to the public and into the environment.

3. The Licensee shall ensure that appropriate procedures and competent staffing are in place for effectively coordinating and cooperating with all fire-fighting and medical services involved. Periodic joint fire drills and exercises shall be conducted to assess the effectiveness of the fire response capability.

### **Feedback of Operating Experience**

#### **Article (23)**

The Licensee shall establish an operating experience programme to learn from events at the Nuclear Facility and events in the nuclear industry and other industries worldwide.

### **Commissioning Programme**

#### **Article (24)**

1. The Licensee shall implement a Commissioning programme for the Nuclear Facility that shall cover the full range of Nuclear Facility conditions required in the SAR. The results of the Commissioning programme shall be used to demonstrate that the behaviour of the Nuclear Facility, as built, is in compliance with the Design assumptions and the Licence conditions. Special attention shall be paid to ensuring that no Commissioning tests are performed that might place the Nuclear Facility in an unanalysed condition. Commissioning stages, test objectives and acceptance criteria shall be specified in such a way that the programme is capable of being evaluated and assessed.
2. The Licensee shall complete a review of the test results for each stage before Commissioning can continue to the next stage. Judgements shall be made on the basis of the review results on whether the succeeding stages will be modified as a consequence of the test results, or because some tests in the stage had not been undertaken, or some tests had been undertaken but had not been completed. The Licensee shall advise the Authority of the outcomes of its review before continuing to the next stage.
3. The Commissioning programme shall include all the tests necessary to demonstrate that the Nuclear Facility, as built, meets the requirements of the SAR and satisfies the Design intent and, consequently, that the Nuclear Facility can be safely operated in accordance with the OLCs.
4. Operating and Maintenance procedures shall be validated to the extent practicable as part of the Commissioning programme.
5. Suitably qualified Nuclear Facility personnel shall be directly involved in the Commissioning process. Operating Personnel and Nuclear Facility technical staff shall be involved in the Commissioning process to the extent necessary to ensure proper preparation for the operational phase.
6. The Commissioning programme shall be sufficiently comprehensive so as to provide initial system operating reference data to characterise SSCs. The Licensee shall retain such reference data for the lifetime of the Nuclear Facility as they are important for ensuring the Safety of the Nuclear Facility and for subsequent Safety reviews.
7. From the onset of Commissioning, reviewed and approved arrangements for work control, modification control, and Nuclear Facility configuration control shall be in place to meet the conditions of the Commissioning tests.

8. The Licensee shall ensure that interfaces and the communication lines between different groups (i.e. groups for Design, for Construction, for contractors, for Commissioning and for Operations) shall be clearly specified and controlled.
9. During Commissioning, the Nuclear Facility shall be monitored, preserved and maintained so as to protect Nuclear Facility equipment, to support the testing stage and to maintain consistency with the SAR.
10. During Commissioning, a comparison shall be carried out between the as-built Nuclear Facility and its Design parameters. A comprehensive process shall be implemented to address non-conformities in Design, manufacturing, Construction and Operation. The decisions made and implemented to correct differences between the initial Design and non-conformities shall be documented.

## Procedures

### Article (25)

1. All modes of Nuclear Facility Operation and all activities that are important-to-safety shall be controlled by validated and approved and appropriately detailed procedures, instructions and drawings to ensure that the Nuclear Facility is operated within the established OLCs.
2. The level of detail for a particular procedure shall be appropriate for the purpose of that procedure and the risk significance of the Activity. The guidance provided in the procedures shall be clear and concise and, to the extent possible, they shall be verified to ensure their technical accuracy and validated to ensure their usability with the installed equipment and systems of control. The procedures and reference material shall be clearly identified and shall be readily accessible in the control room and in other operating locations, if necessary. They shall be made available to the Authority, as requested. Procedures shall be issued under controlled conditions, and shall be subject to approval and periodically reviewed and revised as necessary to ensure their adequacy and effectiveness. Procedures shall be updated in a timely manner in the light of operating experience and the actual Nuclear Facility configuration. The related analysis and justifications shall be documented for procedures used for Emergency conditions.
3. Procedures shall be developed for use in the event of Anticipated Operational Occurrences and a DBA. Emergency operating procedures and guidance for managing beyond DBA shall also be developed. Both event-based approaches and symptom-based approaches shall be used, as appropriate.
4. Procedures and supporting documentation shall be issued under controlled conditions, and shall be subject to approval and periodically reviewed and revised as necessary to ensure their adequacy and effectiveness.
5. A system shall be implemented to administer and control an effective Operator aids programme. The system of control for Operator aids shall prevent the use of non-authorized Operator aids and any other non-authorized materials such as instructions or labels of any kind on the equipment, local panels, boards and measurement devices within the work areas. The system of control for Operator aids shall be used to ensure that Operator aids contain correct information and that they are updated, periodically reviewed, and approved.
6. A clear operating policy shall be maintained to minimise the use of and reliance upon temporary Operator aids. Where appropriate, temporary Operator aids shall be made into permanent Nuclear Facility features or shall be incorporated into operating procedures.

## **Control Rooms and Control Equipment**

### **Article (26)**

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

1. The habitability and condition of control rooms and control room equipment shall be maintained. Where the Design of the Nuclear Facility foresees additional or local control rooms that are dedicated to the control of processes that could affect Nuclear Facility conditions, clear communication lines shall be developed for ensuring an adequate transfer of information to the Operators in the main control room.
2. All important to Safety operational panels outside the control room, which includes the Emergency control room and/ or shut-down panel, shall be kept operable and free from obstructions as well as from non-essential material that would prevent their immediate Operation. The Licensee shall periodically confirm that these important-to-Safety operational panels are in the correct state of operational readiness including correct documentation, communications, alarm systems and habitability.
3. The Nuclear Facility information system shall be such that off-normal conditions are easily recognisable by the Operators. Control room alarms shall be clearly prioritised. The number of alarms, including alarm messages from process computers, shall be minimised for any analysed Operational State, outage or Accident condition of the Nuclear Facility.

## **Material Condition and House-Keeping**

### **Article (27)**

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

1. Administrative controls shall be implemented to ensure that operational areas of the Nuclear Facility and equipment are maintained, well-lit and accessible, and that temporary Storage is controlled and limited. Equipment that is degraded owing to leaks, corrosion spots, loose parts or damaged thermal insulation, for example, shall be identified, reported and repaired in a timely manner.
2. An exclusion programme for foreign objects shall be implemented and monitored, and suitable arrangements shall be made for locking, tagging or otherwise securing isolation points for systems or components to ensure Safety.
3. The Licensee shall ensure that the identification and labelling of Nuclear Facility equipment, rooms, piping and instruments are accurate, legible, well-maintained, and that they do not introduce any degradation.

## Chemistry Programme

### Article (28)

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

1. A chemistry programme shall be implemented prior to Normal Operation of the Nuclear Facility and shall be in place during the Commissioning programme. The chemistry programme shall provide the necessary information and assistance for chemistry and radiochemistry for ensuring safe Operation, long-term integrity of SSCs, and minimisation of radiation levels.
2. Chemistry surveillance shall be conducted at the Nuclear Facility to verify the effectiveness of chemistry control in Nuclear Facility systems and to verify that SSCs that are important to Safety are operated within the specified chemical limit values.
3. The chemistry programme shall include chemistry monitoring and data acquisition systems. These systems, together with laboratory analyses, shall provide accurate measuring and recording of chemistry data and shall provide alarms for relevant chemistry parameters. Records shall be kept available and shall be easily retrievable.
4. Laboratory monitoring shall involve the sampling and analysis of Nuclear Facility systems for specific chemical parameters, concentrations of dissolved and suspended impurities, and radionuclide concentrations.
5. The use of chemicals in the Nuclear Facility including chemicals brought in by contractors shall be kept under tight control. The appropriate control measures shall be put in place to ensure that the use of chemical substances does not adversely affect important to Safety equipment or lead to its degradation.

## Core Management and Nuclear Fuel Handling

### Article (29)

The Licensee shall be responsible and shall make arrangements for all activities associated with core management and with on-site Nuclear Fuel handling.

1. Provisions shall be made to ensure that only Nuclear Fuel that has been adequately manufactured is loaded into the core. Furthermore, the Nuclear Fuel Design criteria and Nuclear Fuel enrichment shall be in accordance with Design specifications and shall be subject to approval by the Authority.
2. The Licensee shall be responsible for the development of the specifications and procedures for the procurement, verification, receipt, accounting and control, loading, use, re-location, unloading and testing of Nuclear Fuel and core components. A fuelling programme shall be established in accordance with the Design assumptions and details shall be submitted to the Authority. Following re-fuelling, it shall be confirmed by means of calculations and measurements that the performance of the core meets the Safety criteria. It shall also be confirmed that all core alterations comply with approved configurations.
3. The Licensee shall implement a safe reactivity management programme under its Management System. Decisions on the planning, evaluation, conduct and control of Operations or modifications

involving the Nuclear Fuel that are likely to affect reactivity control shall be undertaken in accordance with approved procedures and adherence to pre-defined Operational limits for the core.

4. A comprehensive core monitoring programme shall be implemented to ensure that core parameters are monitored, and the trends are analysed and evaluated to detect abnormal behaviour to ensure that actual core performance is consistent with core Design requirements, and to ensure that the values of key operating parameters are recorded and retained in a logical, consistent and retrievable manner.
5. Reactivity manipulations shall be 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.
6. The operating procedures for reactor start-up, power Operation, shut-down and re-fuelling shall include the precautions and limitations necessary to maintain Nuclear Fuel integrity and to comply with the OLCs throughout the lifetime of the Nuclear Fuel.
7. Radiochemistry data that are indicative of Nuclear Fuel cladding integrity and/ or Nuclear Fuel defects shall be systematically monitored and the trends shall be analysed so as to be able to monitor whether Nuclear Fuel integrity is maintained under all operating conditions.
8. Appropriate methods shall be established to identify any anomalous changes in the activity of coolant and to perform data analysis for Nuclear Fuel defects to determine their nature and severity, their location, their probable Root Cause and the necessary corrective actions.
9. Before any Nuclear Fuel handling takes place, the Licensee shall ensure that an authorised, trained and qualified SRO is present, who shall be responsible for the control and handling of the Nuclear Fuel on the site in accordance with approved written procedures. Access to Nuclear Fuel Storage areas shall be limited to authorised personnel.

## Maintenance, Testing, Surveillance and Inspection Programmes

### Article (30)

The Licensee shall ensure that effective programmes for Maintenance, testing, surveillance and Inspection are established and implemented.

1. Maintenance, testing, surveillance and Inspection programmes shall be implemented that include predictive, preventive, and Corrective Maintenance activities. These Maintenance activities shall be conducted to maintain SSC availability and reliability during the service life of SSCs by controlling degradation and preventing failures. In the event that failures do occur, Maintenance activities shall be conducted to restore the capability of failed SSCs to function within acceptance criteria.
2. Data on Maintenance, testing, surveillance and Inspection shall be recorded, stored and analysed for confirming that the operating performance is in accordance with the Design intent and with requirements for the reliability and availability of equipment.
3. The frequency of Maintenance, testing, surveillance and Inspection of individual SSCs shall be determined on the basis of:
  - a) the importance-to-Safety of the SSCs with insight from a PRA shall be taken into account;
  - b) their reliability in, and availability for, Operation;
  - c) their assessed potential for degradation in Operation and their ageing characteristics;

- d) operating experience; and
  - e) recommendations of vendors.
4. A comprehensive and structured approach to identifying failure scenarios shall be taken to ensure the proper management of Maintenance activities are in line with the PRA as appropriate.
  5. New approaches that could result in significant changes to current strategies for Maintenance, testing, surveillance and Inspection shall be taken only after careful consideration of the implications for Safety and after appropriate authorisation, as required.
  6. A comprehensive work planning and system of control shall be implemented to ensure that work for purposes of Maintenance, testing, surveillance, and Inspection is properly authorised, is carried out safely, and is documented in accordance with approved written procedures.
  7. An adequate work and equipment control and tagging system of control shall be implemented for the Protection and Safety of personnel and for the protection of equipment during Maintenance, testing, surveillance, and Inspection. Pertinent information shall be transferred at shift turn-overs and at pre-job and post-job briefings on Maintenance, testing, surveillance and Inspection.
  8. The work system of control shall ensure that Nuclear Facility equipment is released from service for Maintenance, testing, surveillance or Inspection only with the authorisation of an SRO and in compliance with the OLCs. The work system of control shall also ensure that permission to return equipment to service following Maintenance, testing, surveillance and Inspection is given by a SRO. Such permission shall be given only after the completion of a documented check that the new Nuclear Facility configuration is within the established OLCs and, where appropriate, after functional tests have been carried out.
  9. Coordination shall be maintained between different Maintenance groups (e.g. Maintenance groups for mechanical, electrical, instrumentation and control, and civil equipment). Coordination shall also be maintained between Maintenance groups and Operations groups and support groups (e.g. groups for fire protection, Radiation Protection, Physical Protection and non-radiation-related Safety). The Licensee shall make arrangements with the external grid Operator to ensure that appropriate procedures are applied in maintaining the connections of the Nuclear Facility to the external grid.
  10. A Management System for managing and correcting weaknesses shall be implemented and shall be used to ensure that Nuclear Facility personnel are not overly burdened. This system shall also ensure that Safety at the Nuclear Facility is not compromised by the cumulative effects of these weaknesses.
  11. The Licensee shall ensure that Maintenance work during Operation is carried out with adequate Defence-in-Depth. A PRA shall be used, as appropriate, to demonstrate that the risks are not significantly increased prior to removal of SSCs from service for Maintenance.
  12. Corrective Maintenance of SSCs shall be performed as promptly as practicable and in compliance with the OLCs. Priorities for Corrective Maintenance shall be established with account taken first of the relative importance to Safety of the defective SSCs.
  13. A programme shall be established that ensures that tools or equipment that are used during Maintenance, Inspections and tests are uniquely identifiable and shall be calibrated with an adequate frequency and in accordance with approved written procedures. The tools shall be marked with the dates of the previous calibration and the next required calibration. Records shall be retained for equipment calibrations where such equipment is used on important to Safety SSCs.



## **Outage Management**

### **Article (31)**

1. The Licensee shall implement arrangements to ensure the effective performance, planning and control of work activities during outages.
2. In the processes for planning and performing outage activities, priority shall be given to important to Safety issues. Special attention shall be given to maintaining the Nuclear Facility configuration in accordance with the OLCs.
3. The interfaces between the group responsible for outages and other groups including groups on the site and off the site shall be clearly defined. Operating Personnel shall be kept informed of current activities for Maintenance, modification, and testing.
4. Optimisation of Radiation Protection and waste reduction shall be essential elements of outage programmes and planning, and this shall be clearly communicated to relevant Nuclear Facility personnel and contractors.
5. A comprehensive review shall be carried out after each outage to draw lessons to be learned.

## **Preparation for Decommissioning**

### **Article (32)**

The Licensee shall prepare a Decommissioning plan and shall maintain it throughout the lifetime of the Nuclear Facility in accordance with the Authority's requirements.