| Eskom | Guideline | Nuclear Engineering |
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| Compiled by | Functional Responsibility | Authorized by |
|---|---|---|
| **D Malale** | **B Mashele** | **S Touffie** |
| **Integration Engineering Manager (IPDK)** | **Senior Manager (NE)** | **Nuclear Engineering Manager** |
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## Content

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# 1. Executive Summary

The objective of this section is to provide an executive summary of the LTO Safety Case.

# 2. Introduction

This document outlines the structure and content of the safety case to be submitted to the NNR, to request for a variation to the Nuclear Installation Licence, in order to continue operating Koeberg Nuclear Power Station for a further 20 years. The safety case will be compiled by assembling inputs from various assessments, herein described. This document is complimented by Appendix A, which will be used to confirm that all the requirements for licence renewal are complete. This document starts by introducing the need for licence renewal, followed by the scope of the long-term operation safety case, justification for long-term operation, the changes made to the safety analysis report, the programme adopted for long- term operation, related documents, conclusions on why it is safe to continue operations, commitments and implementation plan for long-term operation.

The introduction will provide the following aspects:

- A brief description of the purpose of the safety case;
- A description of physical plant obsolescence and technological obsolescence, and organisational provisions;
- A discussion on the Long term operation programme;
- Applicable current licensing basis and licensing framework;
- An Introduction to the 20 years of operation and conclusion of the feasibility study.

# 3. Applicability

This document applies to Unit 1 and 2 of Koeberg Nuclear Power Station.

# 4. Supporting Clauses

## 4.1 Definitions

**Long-term operation**: Operation of the plant beyond an established time frame set forth by, for example, licence term, design, standards, licence and/or regulations, which has been justified by safety assessment, with consideration given to life limiting processes and features of SSCs.

**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. Items important to safety include:

- Those structures, systems and components whose malfunction or failure could lead to undue radiation exposure of site personnel or members of the public;
- Those structures, systems and components that prevent anticipated operational occurrences from leading to accident conditions;
- Safety features (for design extension conditions);

- Those features that are provided to mitigate the consequences of malfunction or failure of structures, systems and components.

### 4.2 Abbreviations

| Abbreviation | Explanation |
|---|---|
| ALARA | As Low As Reasonably Achievable |
| AM | Ageing Management |
| CLB | Current Licensing Basis |
| CSR | Critically Safety Related |
| DSSR | Duynefontein Site Safety Report |
| EERI | External Events Review Initiative |
| GOR | General Operating Rules |
| IAEA | International Atomic Energy Agency |
| IPDK | Integrated Plant Design Koeberg |
| LG | Licensing Guide |
| LTO | Long-term operation |
| NNR | National Nuclear Regulator |
| NTP | Nuclear Technical Plan |
| OSP | Other Safety-related Programmes |
| PLEX | Plant Life Extension |
| PSR | Periodic Safety Review |
| QA | Quality Assurance |
| QC | Quality Control |
| RG | Regulatory Guide |
| SALTO | Safety Aspects of Long-term Operation |
| SAR | Safety Analysis Report |
| SF | Safety Factor |
| SHA | Seismic Hazard Analysis Studies |
| SR | Safety Related |
| SRA | Safety Re-Assessment |
| SSC | Structures, Systems, and Components |
| SSHAC | Senior Seismic Hazard Analysis Committee |
| SSRP | Regulation on Safety Standards and Regulatory Practices |
| TLAA | Time Limited Ageing Analyses |

## 5. Scope of the Safety Case

### 5.1 Limitations with the Existing Design

The Koeberg site consists of two Pressurised Water Reactor units, constructed between 1976 and 1985. The first unit was commissioned for commercial operation in 1984 and the second unit in 1985. The safety analysis for both units assumed a design life 40 years.

The design codes and standards have improved over the years, since Koeberg's construction, over 40 years ago. The design of the Koeberg facility has not been comprehensively reviewed against the modern codes and standards, except during plant modifications, which are performed utilizing applicable modern codes and standards. The modernisation in codes and standards, may necessitate changes to the design and licensing basis of the plant for continued operation beyond the current validity of the licence to operate the plant.

Plant modifications have been performed throughout the life of the facility to ensure that plant design remains current in line with modern safety standards, and as part of Eskom's asset management strategy to maintain the life of the plant. Ten years into commercial operation, Eskom took a position to utilise Electricte De France similar plants, as a safety reference, to determine safety improvement initiatives for Koeberg. However, following the Fukushima Daiichi event, the position was revised to expand this reference and allow safety decision making to consider all relevant industry experience instead of just one utility's experience.

Furthermore, since the commissioning of the plant, ageing management philosophies to manage the ageing effects to ensure that the plant is fit for purpose have improved, based on industry lessons learned. Therefore, there is a need to assess current ageing management philosophies in line with international best practices, in order to determine the adequacy for long term operation.

To extend the life of the plant and to continue operation for an additional 20 years, the plant must be assessed utilizing the latest requirements for long-term operation (LTO), in order to justify continued operations. The justification should demonstrate that the design basis, the design of the plant and the ageing management philosophy are adequate for continued operation.

In addition, Eskom should demonstrate that adequate organisational provisions, skills and expertise and management systems to support LTO are in place to support the management of the ageing of the plant.

The Nuclear Installation Licence-01, Variation 19, stipulates conditions of operation for Koeberg Nuclear Power Station. It is valid until 21 July 2024 for unit1, unless amended for subsequent licensing stages, including LTO or varied, suspended or revoked. Therefore, Koeberg must obtain licence approval to continue operations for a further 20 years, from 21 July 2024 to 2044.

## 5.2 Basis for the scope of the Safety Case

Long term assessments were performed utilizing the current national regulatory requirements and international best practice approaches to LTO requirements. In accordance with NNR RG-0027, long term operation is defined as operation of the plant beyond an established time frame set forth by, for example, licence term, design, standards, licence and/or regulations, which has been justified by safety assessment, with consideration given to life limiting processes and features of SSCs.

RG-0027 describes the framework for LTO. The framework comprises the NNR Act, Regulation on Safety Standards and Regulatory Practices (SSRP) and nuclear authorisation in terms of the NNR Act. In addition, the current licensing basis is made up of all the applicable regulations, regulatory guidance, licensing directives and the licensing basis as defined in the Licensing Guide on Safety Assessments of Nuclear Power Reactors, RG-0019.

A feasibility study was performed in 2010. The study was aimed at identifying all the life-limiting features of the plant. A few major components were identified as life limiting requiring replacement and the work to replace these commenced in 2012.

The ageing management assessment commenced in 2015 in line with licensing requirements.

The programme for long term operation has been developed in accordance with the requirements of the regulatory guidance provided.

The scope of the organisational arrangements has been defined in accordance with the needs analysis and requirements to support the ageing management programme of the plant

### 5.3 Summary of the scope covered by the safety case.

An LTO programme was developed based on the licensing framework and the regulatory requirements. A summary of the LTO programme is depicted in Figure 1below. The integration of the scope of work is defined in §6 below.

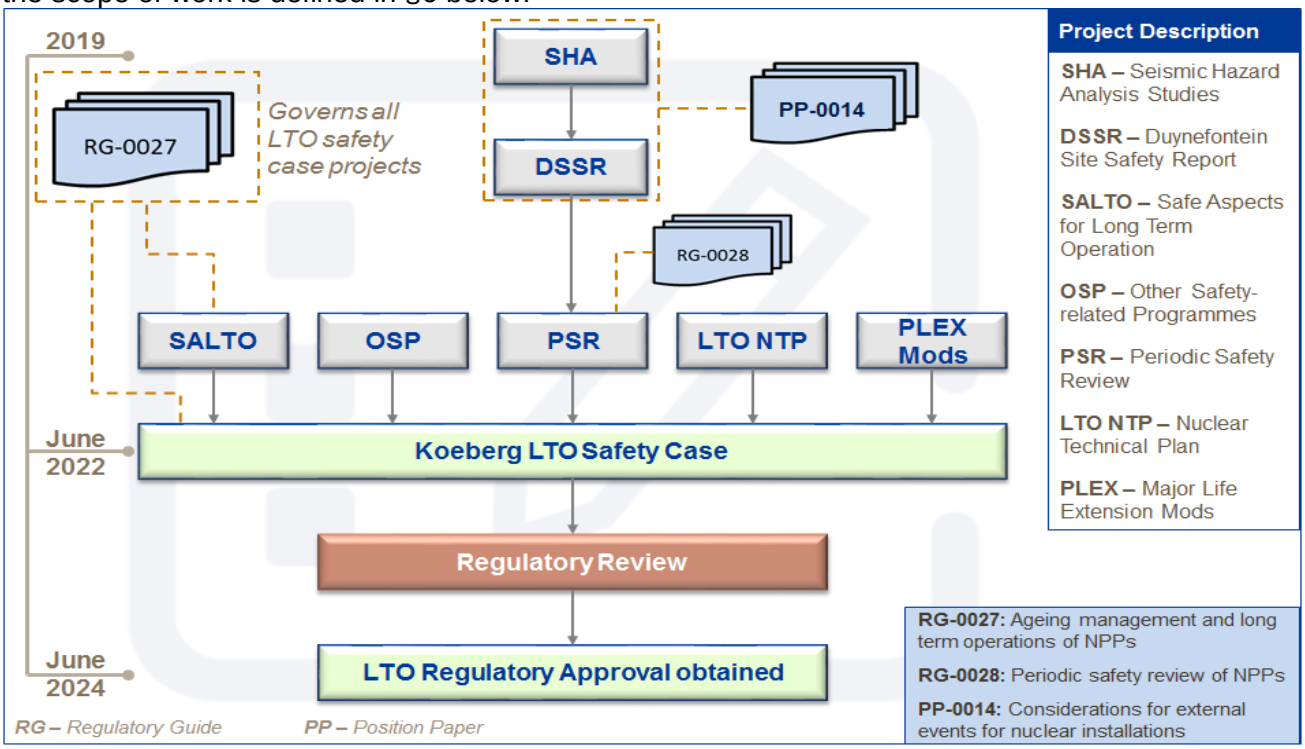


**Figure 1: LTO Programme**

## 6. Long Term Operation Scope Definition

Integration of the scope of the LTO preparation related activities is discussed in detail below.

### 6.1 Plant Life Extension Feasibility Studies

The feasibility study identified the following components as requiring replacements:

1. Steam generators due to Primary Water Stress Corrosion Cracking;
2. Refuelling water storage tanks due to Atmospheric Stress Corrosion;
3. Reactor vessel head due to Primary Water Stress Corrosion Cracking

4. Cables and switchboards, however, industry operating experience later revealed that sufficient ageing management philosophies and strategies exist to manage cables and switchgear without the need for replacement.

### 6.2 Periodic Safety Review

A comprehensive Periodic Safety Review (PSR) assessment is underway to support the additional 20 years of LTO. The review methodology of the PSR has taken into consideration aspects relating to LTO, described in RG-0027 and RG-0028. Particular attention was therefore paid to the following aspects, also called safety factors:

1. Plant Design;
2. Actual condition of SSCs important to safety;
3. Equipment qualification;
4. Ageing;
5. Deterministic analysis, specifically the safety analysis involving time-limiting assumptions relating to the proposed lifetime;
6. Programmes for promoting safety culture focused on the pursuit of excellence in all aspects of safety management and human factors;
7. Process to ensure key technical competencies are sufficient for future operation; and
8. The management system that addresses quality management and configuration management.

The safety factors include assessments of three key obsolescence areas that are affected by long term operation: namely technological obsolescence, codes and standard obsolescence, and knowledge obsolescence that are considered an essential part of justifying LTO. In addition, an assessment of the completeness and adequacy of the plant's documented design basis, and a comparison of the actual plant against the plant's documented design basis will be undertaken.
The graphic representation of safety review methodology is depicted in Figure 2 below.

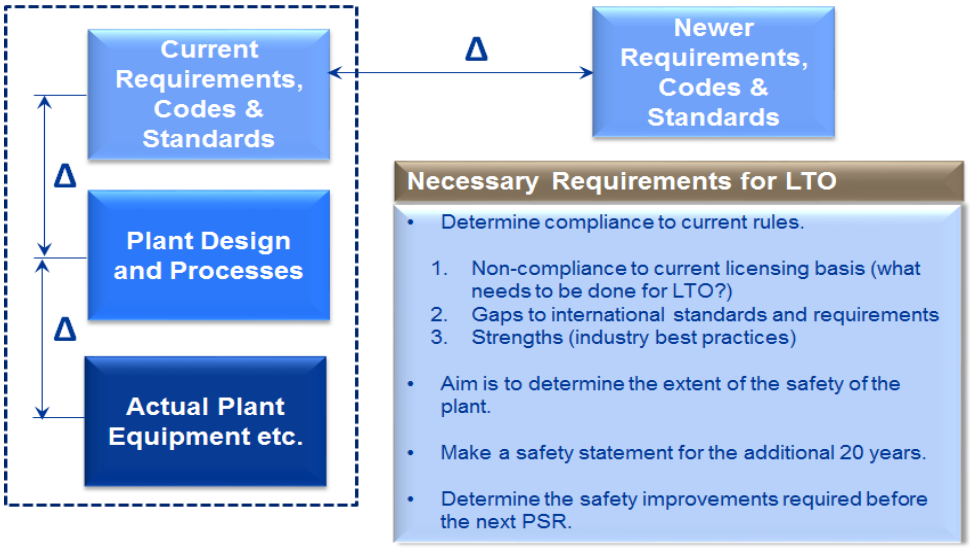


**Figure 2 : Periodic Safety Review Methodology**

## 6.3 Ageing Management Philosophy for Long Term Operations

The ageing management activities were performed in line with IAEA Safety Guide SSG-48 in order to meet the requirements of the regulatory guidance RG-0027. A summary of the process followed to perform these activities is shown in Figure 3 below. The detail of these activities is contained in the Ageing Management Assessment report.

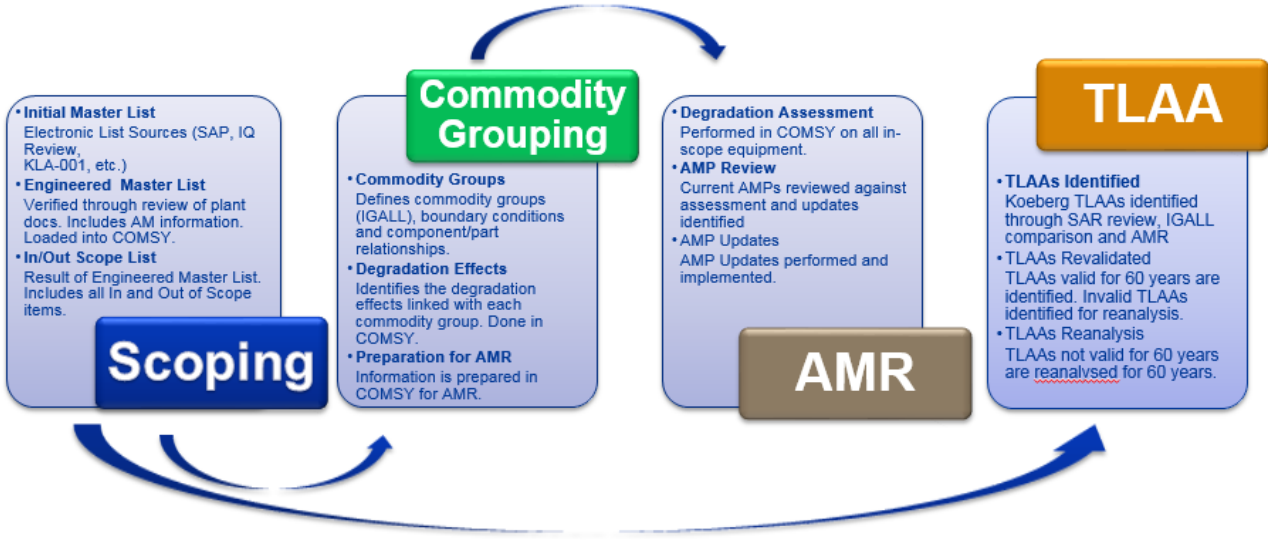


**Figure 3: Ageing Management Assessment Process,**

The scope of the ageing management evaluation includes all mechanical, civil, electrical, Instrumentation & control SSCs important to safety, including ageing affects and ageing

degradations relevant to the in-scope SSCs and their treatment. The scope encompasses the following:

- Design basis SSCs directly involved in nuclear safety;
- Safety related SSCs that support design basis SSCs;
- SSCs that affect safety classified design basis equipment;
- SSCs that are deemed risk significant with importance classification CSR and SR ;
- All design extension related SSCs

### 6.4 Operational Safety Related Programmes

RG-0027 requires that other programmes that affect nuclear safety be assessed for adequacy for long term operation. The maintenance, equipment qualification, in-service inspection, and surveillance programmes are assessed as part of the PSR. The additional programmes assessed in relation to long term operation includes the following:

- Security;
- Radioactive waste management;
- Environment;
- Water chemistry programme;
- Maintenance and surveillance programmes related to SSCs excluded from the SALTO in-scope SSCs that are required for other licence binding programmes (i.e. Radiation Protection, Emergency Planning, Environmental and Chemistry plant and laboratory analysis equipment, etc.).

### 6.5 Duynefontein Site Safety Report

During the second safety re-assessment (SRA-II), it was determined that the Koeberg Site Safety Report was outdated, specifically the seismic hazard assessment, as a result of the improvement in seismic assessment methodologies due to modernisation of seismic hazard analysis standards. Therefore, the specific site characterisation is not valid for the current licensing basis for the intended period of LTO. A reassessment of the design basis will be performed, as necessary.

### 6.6 Other Major replacements and safety improvements since the Commissioning of the Plant

Major replacements and safety improvements that have been performed since the commissioning of the plant, including the drivers for the changes are summarized below. In addition to information in Figure 4, is the CP1 modifications which resulted from the SRA-II assessment. Credit will be taken for the plant changes that have been implemented since commissioning.

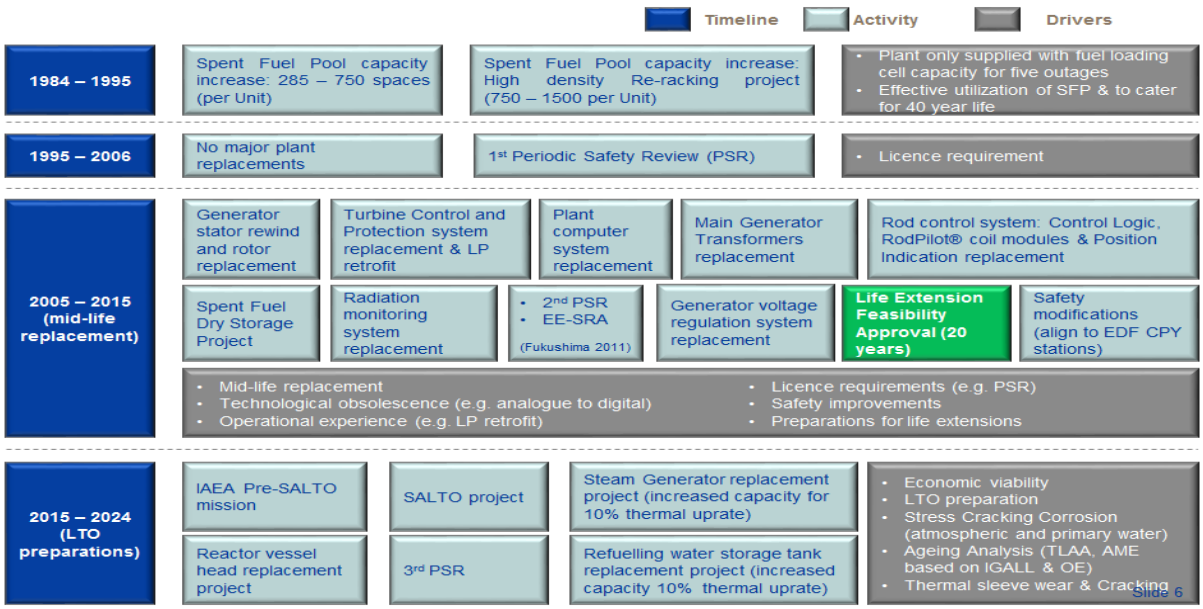


**Figure 4: Major improvements and replacements (more from Koeberg History)**

# 7. Long Term Operation Justification

## 7.1 LTO Requirements

The objective of this section is to:

- Define the current licensing basis (CLB as defined in RG-0019);
- Define the applicable national and international codes and standards;
- Demonstrate compliance to relevant regulatory safety criteria and requirements;
- Determine the extent to which the current licensing basis remains valid.

The inputs for this section include:

- National Nuclear Regulator Act, Act 47 of 1999 (NNRA);
- Occupational Health and Safety Act, Act No.85 of 1993 and Regulations (OSHAct);
- National Environmental Management Act, Act No. 107 of 1998;
- NNR, Regulations on Safety Standards and Regulatory Practices, No. R. 388, 28 April 2006 (SSRP 388);
- NNR, Interim Regulatory Guide: Periodic Safety Review of Nuclear Power Plants, RG-0028;
- NNR, Ageing Management and Long-Term Operations of Nuclear Power Plants, RG-0027;
- NNR, Nuclear Installation Licence No. NIL-01 Var. 19;
- IAEA, Specific Safety Guide, Relevant Guidance on the Management of Plant Ageing and Record Keeping, IAEA SSG-048.

### 7.1.1 Linking RG-0019 to LTO preparation activities

**Safety Analysis Report**

The SAR will be updated to reflect the following:

- Changes in the plant design based on the LTO modifications that are underway;
- Changes due to update in specific site characterisation;
- Ageing management time limited analyses;
- Ageing management programmes;
- Safety analysis as a result of the steam generator replacement project

**General Operating Rules**

**Table 1 : Assessments for various GOR**

| General Operating Rules | Assessment |
|---|---|
| Radiation protection provisions | PSR SF-8B |
| Operating Technical Specifications | PSR SF-11 |
| Operating / incident/accident procedure | PSR SF-11 |
| Severe Accident Management Guidelines | PSR SF-11 |
| Physical Security | PSR Security |
| Maintenance programme | PSR SF-4 |
| ISI/IST Programme | PSR SF-4 |
| Radiation protection programme | PSR SF-8B |
| Effluent and waste management programme | PSR SF-14 |
| Emergency planning | PSR SF-13 |

**Safety Analysis Report, General Operating Rules and other licence binding documents**

- Detailed plant descriptions used or implied in the safety analyses;
- Specifications of all systems, structures and components used or implied in the safety analyses;
- On-site/ off-site environmental factors components used or implied in the safety analyses;
- Design and manufacturing;
- Technical bases to general operating rules linked to the safety analyses
- Safety related plant management documentation;
- QA/QC document station and audit trail;
- Processes relating to maintaining the validity of the safety case.

## 7.2 Plant Design

The objective of this section is to describe aspects related to plant design listed below and to assess their validity and adequacy for long term operation:

- Applicable design basis changes since the commissioning of the plant;
- Plant design adopted to meet the design basis;
- Design documentation;
- Design safety margins;
- Plant equipment qualification;
- Plant modifications related to LTO;
- The extent to which the facility conforms to modern local and international standards;
- Configuration management process for modifications;
- Process for accessing design basis documentation in support of configuration management, modification management and to allow identification of safety analyses (e.g. TLAA).
    - Measures in place for compensation of lack of design basis documents;
    - Management of the overall plant design processes, including modifications and configuration control to ensure that knowledge of the design basis continues to be maintained;
- Summary of any safety analyses performed.

The inputs for this section include:

- PSR SF 1 and 3;
- PSR global assessment;
- Modification documentation (e.g. PLEX Modifications, SALTO Modifications, SRA-II Modifications, EERI Modifications, CSR and SR Minor Modifications, TAFs, Changes to fuel any other mods in the past 30 years);
- SSHAC (interim position / strategy).

### 7.3 Ageing Management for Long Term Operation

Ageing management for nuclear facilities is required in order to ensure asset integrity throughout the plant lifecycle as depicted in Figure 5 below.

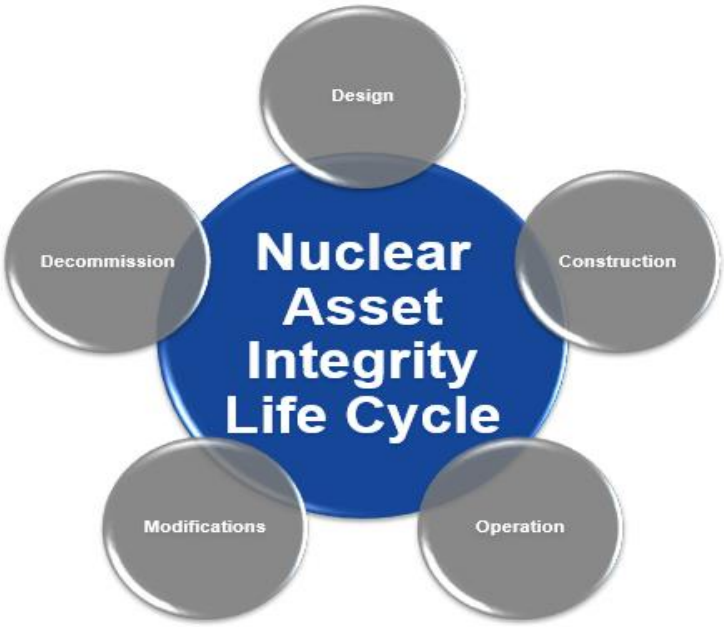


**Figure 5: Plant Lifecycle**

Nuclear plants are designed for a defined life, and the systems and equipment will degrade over time. Ageing equipment will result in degradation, which will result in loss of integrity and deterioration of functional performance. The nature and rate of degradation depends on factors such as the design, material condition, and construction, mode of operation and environment of operation. The primary objective of ageing management is to demonstrate that the effects of plant ageing will be adequately managed to ensure the asset is a fit-for-service condition (integrity, safety, reliability) while extending its remaining life in the most reliable, safe and cost effective manner.

Ageing management activities include ageing management reviews and validation of time-limited ageing analysis for the intended period of operation. The ageing management process that has been adopted for the LTO assessment is described in detail in the ageing management assessment report, and it includes obsolescence of technology and technical plant.

### 7.3.1 Current status of ageing management at Koeberg

The objective of this section is to summarise the ageing management assessment process and provide a position on the adequacy of the technological obsolescence management and the physical ageing management programmes. The ageing management assessment process, includes an assessment of the current physical condition of the plant, identification of ageing degradation mechanisms, assessment of the existing plant programmes, including a review and validation of the current programmes, processes and time limited ageing analyses for all in scope structures and components in order to demonstrate that the ageing effects will be adequately managed. The ageing management related activities consist of:

- Scope setting;
- Ageing management review ;
- Ageing management Programme;

- Ageing management analyses (TLAAs)
- Actual condition of SSC;
- Obsolescence management (tech and physical).

In order to justify continued operation, the results of the assessment of the above mentioned aspects will be utilised.
This section will also provide a summary all the verified TLAAs.

### 7.3.2 Programmatic aspects of ageing management

The following programmatic aspects will be addressed:

- Demonstration that sufficient consideration has been made in the design of Koeberg for adequate management of ageing SSCs throughout the life of Koeberg in accordance with national and international best practices, including ageing management considerations in the plant modification processes;
- A description of how ageing management is addressed in manufacturing and construction of SSCs;
- A description of how ageing and obsolescence of SSCs is managed adequately in a systematic manner to ensure that SSC's capability to perform design functions is maintained throughout operating life of Koeberg, by means of programmes and documentation relevant for management of ageing and technological obsolescence, such that the actual condition of SSC is known at all times;
- A description of how the specific operational procedures for the water chemistry programme or other environmental control programmes and other preventive or mitigatory actions with respect to ageing are followed;
- A description of how assumptions for evaluations for LTO are validated throughout the intended period of LTO or corrected and where the assumptions are documented (TLAA).
- A description of how ageing management will be addressed during all phases of plant lifecycle, including decommissioning, specifically during transitioning from operation to decommissioning and throughout decommissioning activities, thereby providing the assurance that the required SSCs will remain operational until completion of decommissioning, and to ensure that release of radioactive material to the environment does not occur.

The inputs for this section include:

- SALTO Areas B-E;
- PSR SF 2 and 4;
- Self-Assessment performed on gaps to meeting RG-0027 requirement;
- Ageing management evaluation process, 240-125122792;
- Ageing Management Review, 240-125146330;
- IGALL master table

- Updated Chapters of the SAR and CLB indicating results of ageing management review;
- Scoping document;
- Ageing management assessment report
- Decommissioning Plan, 240-149139316

## 7.4 Radiation Protection

Arrangements for the radiation protection programme and its effectiveness for LTO will be reviewed as part of the PSR. The review will focus on the specific aspects relating to plant design, actual condition of Radiation Protection (RP) related SSCs, safety performance, and RP procedures.

The objective of this section is to demonstrate how radiation protection has been ensured in the design of Koeberg Nuclear Power Plant, plant modifications process and in all the plant operational states, in order to minimise occupational and public radiation exposures, and the impact of radiation exposure to the environment. The aim will be to demonstrate that the principle of As Low As Reasonably Achievable (ALARA) will be maintained throughout the intended period of operation.

The inputs for this section include:

- PSR SF 8

## 7.5 Impact of LTO on Other Operational Safety Related Programmes

### 7.5.1 Impact of LTO on Nuclear Security

South Africa is a Member State, party to the Nuclear Non-Proliferation Treaty, and has subsequently also concluded a Comprehensive Safeguards Agreement (INFCIRC/394) with the International Atomic Energy Agency (IAEA). The provisions of this Agreement and South Africa's commitment thereto, has also been enshrined and legislated into the South African Nuclear Energy Act (Act 46 of 1999).

Koeberg, as a role player in the nuclear sector in South Africa, has an international obligation to comply with the provisions of the Act, and the requirements set forth in the IAEA Safeguards Agreement. These obligations require that IAEA Safeguards be implemented at Koeberg facilities, where Agency inspectors implement verification measures and/or regularly visit and inspect Koeberg to verify that nuclear material is not diverted, and that it is used exclusively for peaceful purposes.

Koeberg power station has developed Nuclear Safeguards and Nuclear Material Accounting structures, processes and procedures to ensure compliance to the Act and to meet its obligations in relation to nuclear non-proliferation. Since the life extension of Koeberg does not introduce any additional nuclear material types other than the current approved materials as regulated under the Koeberg licence. Koeberg intends to continue meeting these obligations and any future obligations relating to nuclear non-proliferation.

The objective of this section is to assess both physical and cyber nuclear security. The assessment will identify any security threats and their significance. Based on the significance of the gaps that are identified during the assessment, action plans will be developed to address the gaps in a graded approach. In the event that a gap is identified that has high risk to the safe operation of the plant, such gaps will be resolved prior to entering into LTO.
The following aspects will be assessed:

- The level of the cyber security assurance at the level of the design of the computer systems necessary to manage nuclear security, nuclear material recordings, physical and emergency radiation management in relation to current design requirements for such systems.

- Whether the security systems design meets the current requirements of the design security solution for nuclear installations and whether the design is capable of responding efficiently and reliably to protect Koeberg against design basis threats.

- And, whether these capabilities can be maintained throughout the lifecycle of the plant.

### 7.5.2 Impact of LTO on Emergency Planning

The implication of entering into LTO is that the Koeberg site and immediate surroundings will continue to constrain spatial development, therefore it will continue not to be available for all other uses, and the current restrictions on population growth around the site will remain. The regulatory requirements regarding nuclear emergency planning involves a periodic review of the emergency plan technical basis. In relation to LTO, this review will be performed as part of the periodic safety review of the nuclear facility. The result of the technical basis analysis will inform any changes to be made to the current nuclear emergency plan.

An effective emergency preparedness and response planning provide assurance that in the event of a nuclear accident, the organisation will effectively deal with the emergency while protecting personnel and the public.

In order to support the justification for long term operation, the objective of this section is to demonstrate that an adequate level of preparedness and response to a nuclear or radiological emergency exist, for the continued operation of Koeberg Nuclear Power Plant. Additionally, Koeberg must demonstrate that adequate mitigations exist and will exist during the long term operation period to mitigate the consequences of a nuclear or radiological emergency, in the event that such an emergency arises despite all efforts made to prevent it. In order to do this, Koeberg must demonstrate that there is adequate emergency personnel, adequate facilities and equipment to deal with any emergencies that might arise due to continued operations. Moreover, this section will demonstrate that as part of the emergency plan, Koeberg has an adequate stakeholder management plan that ensures effectively coordinated arrangements with local and national authorities, as well as international partners, that can be implemented in a timely manner, in case of a nuclear emergency.

The inputs for this section include:

- PSR SF 13

### 7.5.3 Impact of LTO on Radioactive Waste Management

The section will discuss the waste generation and management associated with the long-term operation. The objective of the section is to demonstrate that adequate programmes to manage the generation of waste and provisions to manage the disposal of radioactive waste exist in order to facilitate continued operation of the plant. There are two categories of waste generated at Koeberg, namely: low and intermediate level waste (LILW) and high level waste (HLW). Provisions for each of these streams of waste must be adequate to support long term operation.

The inputs for this section include:

- SF 8, GA

### 7.5.4 Impact of LTO on the Environment

The objective of this section is to demonstrate that Koeberg has an adequate and effective programme for monitoring of the impact of radiological effluents on the environment, due to plant operations. The programme should ensure that emissions and discharges are properly controlled and are as low as reasonably achievable.

The inputs for this section include:

- PSR SF 14,
- PSR global assessment

### 7.5.5 Organisational Provisions for LTO

The objective of this section is to describe organisational provisions made and management systems to support LTO, specifically in relation to ageing management.
In order to meet the objective, the following attributes will be considered:

- Outline of the organisational structure for management of ageing in support of LTO in a functional organisational structure, including the responsibilities of the ageing management entity and the means to ensure availability of resources to carry out the responsibilities;
- Description of the arrangements for experts (internal and external) to support the organisation on complex issues in relation to ageing management;
- Eskom's commitment to develop, implement and maintain an ageing management programme that comprises of the functions, duties and responsibilities for assuring the operability and technological conformance of SSCs important to nuclear safety throughout operating life of the facility;
- Description of the arrangements for Knowledge Management and the lessons learned programme in support of LTO, and the process of recruitment, training and management of skills and expertise.

The inputs for this section include:

- PSR SFs 10 and 12;
- SALTO Areas A and F;
- NE FOS;
- Nuclear Safety and Quality manual 238-8
- Nuclear Operating Unit Structure and Mandates 240-64602879;
- RD-0034 Quality and Safety Management Requirements for Nuclear Installations;
- The Operating Experience programme 238-131.

## 7.6 Incorporation of Operating Experience for Continuous Improvement of Plant Safety

The objective of this section is to describe the use of operating experience in improving the safety of the plant from for all the safety related programmes with specific focus on ageing management.

The inputs for this section include:

- PSR All Safety Factors, specifically SF9;
- PSR global assessment.

## 7.7 Nuclear Safety Culture

The objective of this section is to demonstrate the adequacy and effectiveness of the organisation's safety culture to ensure safe operation of Koeberg for LTO. The safety culture will be assessed as part of PSR, the conclusions of the review will be described in this section.

The inputs for this section include:

- PSR SF-10
- PSR global assessment

## 7.8 Why is it Safe to Continue Operation (Overall assessment for additional 20 years)

The objective of this section to provide the overall assessment of the safety of the nuclear facility and justification for continued safe operation for the intended period of LTO. This section will also highlight any nuclear safety risks identified during the LTO assessment and their mitigations. The justification will consider the adequacy of the plant design, adequacy and effectiveness of all the safety related programmes and organisational provisions made for LTO.

The inputs for this section include:

- PSR;
- SALTO;
- Modifications.

### 7.8.1 Adequacy of Plant Design and SSCs

This section will summarise discussions documented in §7.2.

### 7.8.2 Adequacy and Effectiveness of Safety Related Programmes

This section will summarise discussion documented in § 7.3, 7.4, 7.5, 7.6 and 7.7.

### 7.8.3 Adequacy of Organisational Provisions

This section will summarise discussion documented in §7.5.5.

## 8. Safety Analysis Report

The objective of this section is to discuss the changes to the current SAR and the justification for the changes, see §7.1 as directed by the Licensing Guide on Safety Assessments of Nuclear Power Reactors, RG-0019.

The inputs for this section include:

- SALTO;
- Modifications;
- DSSR

## 9. Adopted LTO Programme

The objective of this section is to describe the elements of the LTO programme to be adopted for future operations and how these will be maintained

The inputs for this section include:

- RG-0027;
- IAEA SSG 48.

## 10. LTO Related Documentation

- PSR report;
- Ageing management assessment report;
- SAR Update;
- Koeberg Licensing Basis Manual.

## 11. Conclusions

Describe the extent of the safety of the plant, fitness of plant to continue for additional 20 years.

## 12. LTO Commitments and Implementation Plan

Include the Project Manual, Licensing framework and LTO plan timelines

### 12.1 LTO Commitments

All the activities that need to be performed prior to entering LTO (in 2024) to support the conclusions of the safety case will be documented as part of the safety case submission.

### 12.2 LTO Implementation Plan

All activities to be performed during the implementation of LTO will be provided in the implementation plan.

## 13. Acceptance

This document has been seen and accepted by:

| Name | Designation |
|---|---|
| Nizaam Ryland | Middle Manager, Systems Engineering |
| Bravance Mashele | Koeberg Engineering Manager |
| Sadika Touffie | Nuclear Engineering General Manager |
| Isaac Malgas | Middle Manager, Nuclear Engineering |

## 14. Revisions

| Date | Rev. | Compiler | Remarks |
|---|---|---|---|
| March 2021 | 1 | D Malale | Initial compilation |

## 15. Development Team

The following people were involved in the development of this document:

- Bravance Mashele
- Ditsietsi Malale

## 16. Acknowledgements

IAEA Reviewers

US NRC Reviewer

## Appendix A - Checklist

| RG-0027 guidance | | Question | IAEA SSR-2/2 | IAEA GSR Part 2 | IAEA SSG-48 | IAEA SSG-25 (RG-0028) | Other IAEA sources |
|---|---|---|---|---|---|---|---|
| 5.3.1 | Safety case and submissions to NNR for Long Term Operation | What are the regulatory requirements, codes and standards related to AM and LTO, are they consistent with the IAEA Safety Standards, and are the gaps, if applicable, addressed by the plant in the LTO programme? | Req.16, 4.53 | | 1.10, 3.2, 7.2 | | |
| | | Are the AM and LTO activities overseen by the regulatory body throughout the lifetime of the nuclear power plant? | Req.16, 4.53 | | 3. 6, 3.18, 7.39, 7.40 | | |
| | | What are the interfaces between regulatory requirements, codes and standards for LTO and PSR? | Req.16, 4.53 | | 7.2 | | |
| | | Is there an adequate regulatory process to ensure safe LTO? | Req.16, 4.53 | | 7.8 | | |
| | | Does the PSR provide comprehensive information on AM, equipment qualification and LTO (e.g., assumptions, activities, evaluations, assessments and results of the plant programme for AM, equipment qualification and LTO)? | Req.12, 4.44, Req.14, 4.50, Req.16, 4.53 | | 4.3, 4.6-4.8, 5.73, 7.37 | 3.8, 5.29, 5.42-5.44, 5.49-5.51 | |
| | | Does the PSR consider the entire planned period of long term operation and not just the ten years until the next PSR? Is the policy, principles and concept for AM and LTO adequately documented in the PSR report? | Req.12, 4.44, Req.16, 4.53 | | 4.3, 5.74, 7.2, 7.7, 7.38 | 3.7 | |

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|---|---|---|---|---|---|---|---|
| | | Does the scope of PSR review identify life-limiting features of the plant in order to determine if there is a need to modify, refurbish or replace certain SSCs for the purpose of extending the operating lifetime of the nuclear power plant? | Req.12, 4.44, 4.47, Req.16, 4.53 | | 1.7, 7.15, 7.40 | 3.2, 3.5 | |
| | | Is the scope of national and international requirements, codes and standards, as well as practices used in the PSR appropriate and identified in the PSR basis document? | Req.12, 4.44 | | 4.6 | 4.6-4.9 | |
| | | Does the Periodic Safety Review, aimed at providing justification of the adequacy of AM for the planned period of long term operation, focus on safety factors 1 - 4 (plant design, actual condition of SSCs important to safety, equipment qualification, ageing) and considers also adequately safety factors 8, 9, and 10 (safety performance, use of experience from other plants and research findings, and management system that addresses quality management and configuration management)? | Req.12, 4.44, Req.14, 4.50, Req.16, 4.53 | | 4.6, 4.8 | 3.6, 3.8 | |
| | | Does PSR review identify trends of reported events and their possible connection with degradation of SSCs? | Req.12, 4.44 | | 2.7, 3.35, 4.8, 5.56, 7.40 | 2.5, 5.94, 5.95 | |
| | | Are the results of the previous PSR examined in order to detect any long term trends in deteriorating safety performance? | Req.12, 4.44, Req.16, 4.53 | | | 2.5, 5.94, 5.95 | |

| RG-0027 guidance | | Question | IAEA SSR-2/2 | IAEA GSR Part 2 | IAEA SSG-48 | IAEA SSG-25 (RG-0028) | Other IAEA sources |
|---|---|---|---|---|---|---|---|
| | | Is long term operation properly justified by safety assessment (that includes scope setting, AMR and revalidation of TLAAs), with consideration given to the life limiting processes and features of SSCs in scope of the evaluation? | Req.16, 4.53 | | 2.30, 2.31, 5.61 | 3.1, 3.2, 3.6 | |
| | | Does PSR global assessment provide safety justification for proposed long term operation by evaluating the cumulative effects of both ageing and obsolescence on the safety and reflecting the combined effects of all safety factors (findings and proposed improvements)? | Req.16, 4.53 | | 2.5, 2.30, 2.32 | 2.17, 4.21, 4.26-27, 6.6-6.9, 6.12, Appendix II.5 | |
| | | Is the PSR prepared (e.g. development of a "basis document") and conducted in co-operation with the regulatory body? Is the PSR report that demonstrates safety for long term operation provided to the regulatory body for review and approval at a level of detail, and in a manner adequate for this purpose? | Req.12, 4.45, Req.16, 4.54 | | 7.40 | 4.5, 4.6, 6.6-6.9 | |
| | | Does PSR review determine reasonable and practicable modifications to be made in order to ensure that a high level of safety is maintained during long term operation? Is justification for any improvements that cannot reasonably and practicably be made provided? | Req.12, 4.47, Req.16, 4.54 | | 1.7, 7.15, 7.40 | 3.5, 3.6, 3.10, 4.26-4.27, 5.12, 6.6-6.9, 8.14 | |
| | | Does the integrated implementation plan to be developed after the PSR contain the reasonable and practicable safety improvement? | Req.12, 4.47, Req.16, 4.54 | | 1.7, 7.15, 7.40 | 2.18, 4.25, 6.7, 8.23, 9.1 | |

| RG-0027 guidance | | Question | IAEA SSR-2/2 | IAEA GSR Part 2 | IAEA SSG-48 | IAEA SSG-25 (RG-0028) | Other IAEA sources |
|---|---|---|---|---|---|---|---|
| 6.1 | Ageing management, general considerations | Does the plant have a process to ensure competent human resources for LTO including external support? | Req.2, 3.4-3.7 | | | | NS-G-2.8: 2.18, 3.1, 3.2, Appendix I; GS-G-3.1: 4.18, 4.20, 4.21 |
| | | Does the plant have an adequate process for assessing and meeting the organizational competency requirements to support LTO? | | Req.9, 4.21, 4.23, 4.24, Req.10, 4.28, Req.13, 6.1-6.5 | | | NS-G-2.8: 2.2; 2.4; 2.12; 4.4; GS-G-3.1: 4.8; 4.9 |
| | | Have all key technical competences for LTO activities been identified and do all involved staff meet these requirements? | Req.3, 3.8-3.9, Req.4, 3.10-3.11 | | | | |
| | | Do personnel assigned to LTO duties that can affect safety have a sufficient understanding of the plant and its safety features? | | | | | NS-G-2.8: 3.2, 4.1 |
| | | Does plant management have the necessary management skills, experience and knowledge needed to manage safe LTO? | Req.5, 4.1-4.3 | | | | |
| | | Is the opportunity given to managers and plant personnel to learn from external peer organizations and their lessons learned? | Req.24, 5.27 | Req.13, 6.7 | | | SSG-50: 2.3, 2.7, 2.8; GS-G-3.1: 6.8, 6.16; GS-G-3.5: 3.30, 4.12, 6.23 |

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|---|---|---|---|---|---|---|---|
| | | Does the plant have an appropriate plant recruitment policy for LTO? | | | | | NS-G-2.4: 2.14, 2.15, 3.7; NS-G-2.8: 2.12 – 2.14; GS-G-3.1: 4.6, 4.7 |
| | | Does the policy and role of plant management support training needs and allocate sufficient resources? | | | | | NS-G-2.8: 4.10, 4.31, 6.5 |
| | | Is personnel involved in LTO activities well trained through on-job-training and other appropriate processes? | | | | | NS-G-2.8: 2.8, 4.15(b), 4.45, 5.6, 5.9, 5.24 |
| | | Does an appropriate Knowledge Management (KM) policy exist? | | Req.4, 4.3, Req.9, 4.27 | | | GS-G-3.1: 2.4, 2.5, 4.1, 4.2, 4.4, 5.6 |
| | | Are KM principles and practices embedded in the integrated management system? | | Req.9, 4.21-4.22, 4.26, 4.27 | | | GS-G-3.1: 2.4, 2.5, 3.1, 3.11, 4.1, 4.2, 5.6 |
| | | Is KM a part of the operating organization's long term strategy? | Req.4, 3.10, 3.11 | | | | |
| | | Is there clear ownership of KM processes and issues? | | Req.9, 4.23, 4.25-4.26 | | | GS-G-3.1: 5.14 |
| | | Are KM principles and practices embedded in the organization? | | Req.9, 4.22, 4.24 | | | |
| | | Has the plant embedded KM principles and practices in its process for collecting and using operating experience feedback? | Req.24, 5.28, 5.29, 5.30, 5.31, 5.32 | | 2.7, 2.21, 3.3, 3.30, 4.8, 5.8, 7.16, 7.18 | 5.7, 5.103-110, 8.13, 9.5 | |

| RG-0027 guidance | | Question | IAEA SSR-2/2 | IAEA GSR Part 2 | IAEA SSG-48 | IAEA SSG-25 (RG-0028) | Other IAEA sources |
|---|---|---|---|---|---|---|---|
| | | Has the plant implemented adequate processes for learning from the LTO experiences of other plants? | Req.24, 5.28, 5.29, 5.30, 5.31, 5.32 | | 2.31, 7.16, 7.18 | 5.103-110 | |
| | | Does the plant have a process for knowledge-loss risk assessment and mitigation for suppliers, TSOs and outside service providers? | | | 2.26, 2.29, 6.1-6.3 | | SSR-2/1: 2.17; NS-G-2.6: 3.10, 3.11, 3.12 |
| | | Does the plant have established adequate processes for transferring knowledge, information and data to/from the vendor, critical equipment/component suppliers, outsourced services and TSOs? | | | 3.4-3.5, 3.10, 3.13-3.14, 3.16-3.18 | | SSR-2/1: 2.17; NS-G-2.6: 2.16, 3.6, 3.10, 3.11, 3.12 |
| | | Do IT/IS processes support managing information and records and their availability? | Req.31, 8.4 | | | | NS-G-2.6: 6.1, 9.45, 10.45 |
| | | Does the plant retain records of traceability, rationale and assumptions of why and how operational, maintenance and design changes (corporate memory) have been made? | | Req.8, 4.16-4.17, 4.20 | 4.1-4.2, 4.9-4.10, 4.13-4.14 | | NS-G-2.3: 11.6 |
| 6.2.1 | Management of ageing throughout the lifetime of the facility, design | Does the plant have access to design basis documentation which contains design basis requirements and supporting design information? | | | 4.13 | 5.25 | SSR-2/1: Req.14, 5.3 |
| | | Is the design basis information and its changes included in the safety analysis report or in a separate design basis documentation? | | | 4.14 | | SSR-2/1: Req.14, 5.3 |

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| | | Are plant programmes and analyses relevant to AM and evaluation for long term operation properly documented in the safety analysis report (or in other current licensing basis documents)? Does the information clearly and adequately describe the current licensing basis and the design basis requirements for the plant? | Req.1, 3.2(e) | | 3.11, 4.1 - 4.2 | 3.9 | GS-G-4.1: 3.160-3.164, 3.166, 3.167, 3.173 - 3.175, 3.178 - 3.181, 4.3 - 4.4 |
| 6.3.1 | Safety analysis report and other current licensing basis documents | Is the justification for plant safety during the planned period of LTO properly documented in safety analysis report (both ageing aspects and safety upgrades)? | Req.1, 3.2(e) | | 4.3, 4.10 | 3.9 | GS-G-4.1: 3.160-3.164, 3.166, 3.167, 3.173 - 3.175, 3.178 - 3.181, 4.3 - 4.4 |
| | | Is the safety analysis report being updated to reflect the results of AM and LTO assessment activities (e.g., AMR, review of AMPs and plant programmes, revalidation of TLAAs)? | Req.1, 3.2(e) | | 4.4, 7.36 | 3.9 | GS-G-4.1: 3.160-3.164, 3.166, 3.167, 3.173 - 3.175, 3.178 - 3.181, 4.3 - 4.4 |
| | | Does the safety analysis report update include information describing the assumptions, activities and results of the plant programme for long term operation (including documentation of the revalidation of the TLAAs for the period of long term operation) | Req.1, 3.2(e) | | 4.5, 7.36 | 3.9 | GS-G-4.1: 3.160-3.164, 3.166, 3.167, 3.173 - 3.175, 3.178 - 3.181, 4.3 - 4.4 |
| 6.3.2 | Configuration and modification management programmes including | Does the management system contain processes and activities relating to the configuration management programme and the modification management programme? | Req.10, 4.38, Req.11, 4.39 - 4.43 | | 4.12 | | NS-G-2.3: 1.2, 2.4 |

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|---|---|---|---|---|---|---|---|
| | design basis documentation | Are all modifications to the plant (relating to the plant configuration: SSCs, process software, OLCs, operating procedures, as well as relating to management systems: organizational structures, operation, and safety assessment tools and processes) properly documented and retained in an auditable and retrievable form? Are all safety significant modifications addressed in the SAR? | Req.10, 4.38, Req.11, 4.39 - 4.43 | | 4.10 | | NS-G-2.3: 2.5 - 2.6, 11.1 - 11.6 |
| | | Is a design authority properly established including its role within configuration and modification management? | Req.1, 3.2(f) | | 4.11 | | NS-G-2.3: 3.1, 3.5 |
| | | Are alternative arrangements in place, which compensate for the lack of complete design basis documentation at the plant, e.g., a programme of reconstitution of design basis? | | | 4.15 | 5.25-5.25 | SSR-2/1: Req.14, 5.3 |
| 6.3.3-a) | Safety related programmes, Maintenance programmes | Is it clearly defined for each in-scope SC what maintenance programmes (e.g., preventive, predictive and corrective) are applied, which ageing effects they manage, what maintenance/inspection methods are used, maintenance frequency, tasks, documentation, records and their storage (e.g., a database)? | Req.31, 8.1, 8.4-8.5, Req.16, 4.54 | | 4.19, 4.20 | | NS-G-2.6: 2.5-2.6, 4.5, 4.21, 6.12, 8.1, 8.4 |
| | | Are the results of the scope setting, AMR, and TLAA revalidations adequately reflected in the existing preventive and predictive maintenance programmes? | Req.16, 4.54 | | 4.20-4.22 | | NS-G-2.6: 2.6-2.9, 7.6-7.8, 8.1, 8.4-8.5 |
| | | Are preventive and predictive maintenance programmes periodically evaluated based on new regulatory requirements, vendors' recommendations, past maintenance history | Req.31, 8.3-8.5, Req.16, 4.54 | | 3.3, 3.30, 3.33, 3.35, 4.21-4.22 | | NS-G-2.6: 2.7, 2.8, 2.10, 6.11-14 |

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| | | and feedback from related operational experience and research results and findings? | | | | | |
| | | Has the plant evaluated the existing preventive and predictive maintenance programmes used to manage ageing of in-scope SCs against the nine attributes of an effective AMP for the intended period of operation (i.e. including LTO)? | Req.31, 8.3-8.5, Req.16, 4.54 | | 4.17, 4.21, 4.22 | | |
| | | Are the measures taken to ensure that spare parts are stored in an appropriately controlled environment to avoid degradation mechanisms owing to their storage environment (e.g., high or low temperatures, moisture, chemical attack, dust accumulation; for mechanical, EI&C, and civil as applicable)? | Req.31, 8.15, 8,17 | | 3.28 | | NS-G-2.6: 8.32 |
| 6.3.3-b) | Safety related programmes, Equipment qualification programme | Has the plant developed, implemented, maintained and periodically reviewed comprehensive equipment qualification programme including its documentation and consistent with the IAEA safety standards? | Req.13, 4.48-49, Req.16, 4.54 | | 4.23-31 | | SSR-2/1: Req.30, 5.48-5.50 |
| | | Is there equipment qualification master list containing mechanical, electrical and I&C components in place? Does it include cables, connectors and penetrations? Is this list updated regularly? | Req.13, 4.48 | | 4.29-4.30 | | |
| | | Does the plant use appropriate seismic motions based on the latest knowledge, operational experience and research findings for seismic | Req.13, 4.48 | | 4.30 | | NS-G-2.13: 4.1-4.8 |

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|---|---|---|---|---|---|---|---|
| | | qualifications? Are possible ageing effects considered for seismic qualification? | | | | | |
| | | Are the results of the scope setting, ageing management review, and TLAA revalidations for LTO adequately used to update equipment qualification programmes? | Req.13, 4.48, Req.16, 4.54 | | 4.23, 4.28-4.30 | | |
| | | Is equipment qualification status preserved and updated through surveillance, maintenance, modifications and replacement, environment and equipment condition monitoring and configuration management? Are adequate interfaces with related programmes in place? | Req.13, 4.48 | | 3.35, 4.18, 4.27, 4.30, 4.31 | | |
| | | Has the plant evaluated the existing equipment qualification programmes for in-scope SCs against the nine attributes of an effective AMP for the intended period of operation (i.e. including LTO)? | Req.13, 4.48, Req.16, 4.54 | | 4.17 | | |
| | | If the equipment qualification programme was designed according to earlier standards, is the re-qualification programme for in-scope SCs in place, focused on ensuring that the equipment can perform its function under current design basis condition? | Req.13, 4.48, Req.16, 4.53 | | 4.28, 4.30 | | SSR-2/1: Req.30, 5.48, 5.50 |

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|---|---|---|---|---|---|---|---|
| | | Has it been demonstrated that environmental qualification will remain valid over the expected period of LTO? Does the demonstration support the technical justification that ageing effects will be managed effectively? Is timely replacement of equipment that cannot be qualified for the planned period of LTO adequately considered? Has a specific programme for replacement of mechanical, electrical and I&C equipment with qualified or stated lifetimes less than the planned LTO period been developed and implemented? | Req.13, 4.48, Req.16, 4.54 | | 4.25, 4.26, 4.28, 4.30, 5.25(6) | | |
| | | Do the qualification results on safety related mechanical, electric and I&C equipment located inside containment specify whether the equipment has been qualified to perform its safety functions in environmental conditions equivalent to design basis accident conditions for the planned period of LTO? | | | 4.25, 4.26, 4.28 | | SSR-2/1: Req.30, 5.48-5.50 |
| | | Is equipment qualification status documented and maintained throughout the life of the plant and consistent with the IAEA Safety Standards? | Req.13, 4.49 | | 4.31 | | |
| | | Were all identified TLAAs revalidated using methods and criteria consistent with the IAEA recommendations? | Req.16, 4.54 | | 5.66-5.68, 7.14(b), 7.17, 7.18(d), 7.28 | | |
| | | What corrective or compensatory measures are taken in case TLAAs cannot be revalidated? | Req.16, 4.54 | | 3.34, 5.68 | | |

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| | | Is the revalidation of TLAAs documented in an update to the Safety Analysis Report? | Req.16, 4.54 | | 5.70-5.72, 7.36 | | |
| 6.3.3-c) | Safety related programmes, In-service inspection programmes | Does the ISI programme for the in-scope SSCs clearly identify which ageing effects they manage, the inspection method, the links with AM programmes, the frequency, extent and tasks? | Req.31, 8.1, 8.4-8.5, Req.16, 4.54 | | 4.32-4.34, 4.36 | | NS-G-2.6: 2.13-2.15, 4.5, 4.21, 6.12, 10.1, 10.7-10.8, 10.11, 10.16, 10.45-10.47 |
| | | Are results of the scope setting, AMR, and TLAA revalidations for LTO adequately reflected in the existing ISI programmes? | Req.16, 4.54 | | 4.32, 4.35 | | NS-G-2.6: 2.13, 2.15, 7.6-7.8, 10.2-10.4, 10.7 |
| | | If ISI results indicate notable degradation, are similar locations appropriately determined? Are SSCs in redundant subsystems inspected independently to detect possible differences in their ageing behaviour? | Req.16, 4.54 | | 4.35 | | |
| | | Are ISI programmes periodically evaluated based on new regulatory requirements, vendors' recommendations, past ISI results, operating experience, new knowledge and research findings? | Req.31, 8.3-8.5, Req.16, 4.54 | | 3.3, 3.30, 3.33, 3.35, 4.33, 4.35 | | NS-G-2.6: 2.13-2.15, 6.11-14 |
| | | Has the plant evaluated the existing ISI programmes used to manage ageing of in-scope SCs against the nine attributes of an effective AMP for the intended period of operation (i.e., including LTO)? | Req.16, 4.54 | | 4.17 | | |
| | | Have the methodology, equipment, and personnel, which are part of the ISI process, been qualified according to regulatory requirements, codes and standards, and IAEA safety standards as applicable? | Req.16, 4.54 | | 4.33 | | NS-G-2.6: 10.24-34 |

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| | | Are ISI results documented in well-maintained database? | Req.16, 4.54, Req.31, 8.4 | | 4.34, 4.36 | | NS-G-2.6: 10.45-10.47 |
| 6.3.3-d) | Safety related programmes, Maintenance programmes | Does the surveillance programme for the in-scope SSCs clearly identify the surveillance measures, the links with AM programmes, the frequency, tasks, documentation, records and their storage (e.g., a database)? | Req.31, 8.1, 8.4-8.5, Req.16, 4.54 | | 4.37-4.38 | | NS-G-2.6: 2.11-2.12, 4.5, 4.21, 6.12, 9.1-9.3, 9.5, 9.19-9.22, 9.30, 9.45-9.46 |
| | | Are results of the scope setting, ageing management review, and TLAA revalidations for LTO adequately reflected in the existing surveillance programme? | Req.16, 4.54 | | 4.39-4.40 | | NS-G-2.6: 2.11-2.12,7.6-7.8, 9.1-9.9, 9.19-9.22, 9.30 |
| | | Is the surveillance programme periodically evaluated based on new regulatory requirements, vendors' recommendations, past surveillance results, operating experience, new knowledge and research findings? | Req.31, 8.3-8.5, Req.16, 4.54 | | 3.3, 3.30, 3.33, 3.35, 4.41-4.42, 5.8 | | NS-G-2.6: 2.11-2.12, 6.11-14, 9.30 |
| | | Has the plant evaluated the existing surveillance and monitoring used to manage ageing of in-scope SCs against the nine attributes of an effective AMP for the intended period of operation (i.e., including LTO)? | Req.16, 4.54 | | 4.17 | | |
| | | Has the plant implemented supplementary LTO related surveillance programmes, such as reactor pressure vessel supplementary surveillance programme, controlled ageing management programmes for cables, surveillance programme of concrete etc.? | Req.31, 8.1, Req.16, 4.54 | | 4.42-4.44 | | NS-G-2.6: 9.9, 9.30 |

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| 6.3.3-e) | Safety related programmes, Water chemistry programme | Are results of the scope setting, ageing management review, and TLAA revalidations for LTO adequately reflected in the existing chemistry programme? | Req.16, 4.54, Req.29, 7.13-7.16 | | 4.45, 4.48 | | SSG-13: 2.6, 3.1, 3.4, 4.1 |
| | | Has the plant chemistry programme been reviewed based on regulatory requirements, vendors' recommendations, chemistry related surveillance results, operating experience, new knowledge and research findings? | Req.16, 4.54, Req.29, 7.14 | | 3.3, 3.22-3.23, 3.30, 3.35, 4.46, 4.47, 5.8 | | SSG-13: 2.4, 2.9-2.10, 3.3, 7.6-7.9 |
| | | Has the plant evaluated the existing chemistry programme used to manage ageing of in-scope SCs against the nine attributes of an effective AMP for the intended period of operation (i.e. including LTO)? | Req.16, 4.54 | | 4.17 | | |
| | | Are chemistry staff aware of implications of chemistry parameters on known aspects which could adversely impact safety during LTO (such as corrosion, erosion, inter-granular stress corrosion cracking, primary water stress corrosion cracking, etc. of SCs within the scope of LTO)? | Req.16, 4.54, Req.29, 7.13 | | 4.48 | | SSG-13: 2.6, 3.4, 4.1, 4.4, 4.47 |
| | | Does the chemistry programme include diagnostic parameters that provide useful information for determining and preventing the cause of unexpected ageing? | Req.16, 4.54, Req.29, 7.15-7.16 | | 3.22, 4.45, 4.47 | | SSG-13: 6.7-6.23 |
| 6.3.4 | Corrective action programmes | Is there a corrective action programme in place to ensure that conditions adverse to quality, such as ageing related degradation, are identified and that corrective actions commensurate with the significance of the issue are specified and implemented? | Req.1, 3.2(e) | | 3.25, 4.49 | | |

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| | | Does the corrective action programme document occurrences of identified ageing related degradation (conditions adverse to quality) and the methods used to address the degradation, such as evaluation and acceptance, evaluation and monitoring, repair, or replacement? Is such information taken into account as plant specific operating experience? | Req.1, 3.2(f) | | 3.3, 3.25, 3.30, 4.50 | | |
| | | Does the corrective action programme document the modifications to AM programmes, system configuration or plant operations that are made to manage the occurrence or the severity of the ageing effect? | Req.1, 3.2(f) | | 4.51 | | |
| | | Is the corrective action programme and the associated plant specific operating experience routinely reviewed by individuals responsible for the relevant AM programme to determine whether AM programmes need to be enhanced? | Req.1, 3.2(f) | | 3.3, 3.30, 3.35, 4.52 | | |
| | | Are the modifications of the existing AM programmes specified and implemented, or new AM programmes developed, if it is determined as needed through the evaluation of the corrective action programme and the associated plant specific operating experience? | Req.1, 3.2(f) | | 3.25, 3.30, 4.53 | | |
| 6.4.1 | Management of Ageing, Organizational arrangements | Are the roles and responsibilities of all organization that participate in AM and LTO preparation properly defined and coordinated? | Req.3, 3.8-3.9 | Req.6, 4.11, Req.9, 4.23 | 3.5, 5.4, 5.6 | | |

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| | | Has the plant adopted a suitable organizational structure for preparation and implementation of the AM? | Req.14, 4.50 | | 5.1-5.3, 5.5 | | |
| | | Has the plant adopted a suitable organizational structure for preparation for LTO? | Req.16, 4.53 | | 3.31, 7.3, 7.4 | | |
| | | Are adequate resources (e.g. human resources, financial resources, tools and equipment, and external resources) allocated to support AM and LTO activities? | | Req.9, 4.21-4.22, 4.24 | 5.1, 7.4 | | GS-G-3.1: 4.1, 4.2 |
| | | Is personnel involved in AM and LTO activities properly qualified and trained? | | Req.9, 4.23, 4.26 | 5.7, 6.9 | | |
| | | Do staff involved in AM and LTO activities have specific job descriptions/task responsibilities? | | Req.9, 4.23, 4.24 | 5.4, 5.6, 7.4 | | GS-G-3.1: 2.61, 2.62, 3.5 |
| | | Do the plant human resources policy and strategy reflect LTO requirements? | | Req.8, 4.16 | | | NS-G-2.4: 5.10, 6.11; GS-G-3.1: 2.54 |
| | | Do management manuals and job descriptions determine roles, responsibilities and delegations of authority for all managers in key positions related to LTO? | | Req.8, 4.16 | | | NS-G-2.4: 2.11, 3.4; GS-G-3.1: 2.53; 2.54; |
| | | Is good coordination maintained among different plant groups, among the site organizations and contractors involved in LTO? | | Req.10, 4.29 | | | NS-G-2.4: 3.2(5) (9), 4.5-4.10; GS-G-3.1: 2.31, 6.3 |

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| | | Are staffing and resources sufficient to accomplish the tasks assigned? | Req.4, 3.10, 3.11 | Req.9, 4.21-4.27 | | | NS-G-2.4: 2.3, 3.1, 3.7, 3.15, 4.8, 5.10, 6.1, 6.2 6.11-6.15, 6.29, 6.30; GS-G-3.1: 2.23, 2.36, 3.2, 3.11-3.12, 4.1-4.12 |
| | | Is the staffing policy directed to retaining a pool of experienced and knowledgeable staff? | | Req.9, 4.21-4.27 | | | NS-G-2.4: 2.7; GS-G-3.1: 4.1; 4.2; 4.6; 4.7 5.60 |
| | | Are long term staffing policy objectives for human resources established and maintained? | | | | | NS-G-2.4: 6.11, 6.12, 6.14; NS-G-2.8: 2.2, 4.4; GS-G-3.1: 4.29, 5.11, 4.7 |
| | | Have specific competence requirements for LTO related positions been identified and are these used in the recruitment/selection process for these positions? | | | | | NS-G-2.4: 2.14, 2.15; NS-G-2.8: 2.12 – 2.14; GS-G-3.1: 4.6, 4.7 |
| | | Is long term succession planning established and implemented? | | | | | NS-G-2.8: 4.1, 4.11 |
| | | Do plant managers have the appropriate resources to carry out their assigned LTO responsibilities and accountabilities? | | Req.7, 4.15, Req.9, 4.21-4.25 | | | |
| 6.6 | Scope Setting for SSCs | Does the plant have a systematic scope setting process and methodology(ies), documented and applied to all plant SSCs? | Req.16, 4.54 | | 5.14, 5.15 | | |

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| | | Are the criteria for SSCs scope setting for AM and LTO consistent with IAEA Safety Standards? | Req.16, 4.54 | | 5.16, 5.17 | | |
| | | Were dedicated plant walk-downs used to check the completeness of the list of SSCs whose failure may prevent SSCs important to safety from performing their intended functions in addition to the analysis of plant documentation? | Req.16, 4.54 | | 5.19 | | |
| | | Are the results of the scope setting process clearly and well documented (such as list of SSCs in scope and out of scope, indicating e.g. information sources, intended function, safety class, other scoping criteria, etc.)? Are boundaries between SSC within the scope and SSC out of the scope clearly defined? | Req.16, 4.54 | | 5.18,5.20 - 5.21, 5.70, 7.18a), 7.29-7.30, 7.33 | | |
| | | Are the boundaries for SCs which include interfaces between different areas (mechanical, electrical, I&C and civil structures) like control valves clearly established? | Req.16, 4.54 | | 5.14, 5.18 | | |
| | | Have SCs commodities groups (group of components/ structures which have similar functions, similar materials or are in similar environment) been defined and if so, how? | Req.16, 4.54 | | 5.20 | | |
| | | Was a list or database of the plant SSCs (e.g., a master list) used as a basis for the scoping? Are the scoping process results provided in a list of SCs in the scope and a list of SCs out of the scope of AM/LTO? | Req.16, 4.54 | | 5.15, 5.17, 5.19, 5.21, 7.18(a), 7.20, 7.33 | | |

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| | | If scope setting data is distributed into more than one database, how is data consistency assured? | Req.16, 4.54 | | 5.14-5.15, 7.20, 7.29-7.30, 7.33 | | |
| | | Have SCs commodity groups (group of components/structures which have similar functions, similar materials and are in similar environment) been defined and if so, how? | Req.16, 4.54 | | 5.20, 7.20 | | |
| 6.7 | Ageing Management Review | Is there a systematic process in place to perform AMR that is consistent with the IAEA safety standards? | Req.14, 4.50, Req.16, 4.54 | | 5.22 - 5.26 | | |
| 6.7.1 | Ageing Management Review, Identification of relevant ageing effects and degradation mechanisms of structures or components | Does the AMR systematically identify and assess all ageing effects and degradation mechanisms that have been experienced or are anticipated based on understanding of ageing and to evaluate the impact of ageing on the in-scope SSCs' capability to perform their intended functions? | Req.14, 4.50, Req.16, 4.54 | | 3.24, 5.27, 7.21, 7.23-7.25 | | |
| | | Is the comprehensive understanding of ageing effects and degradation mechanisms for SCs based on design data, fabrication data, operation and maintenance histories, acting stressors (including environmental conditions), results of ISI and surveillance, operating experience and results of research and development, results of walkdowns and condition assessments, and results of evaluation of TLAAs? | Req.14, 4.50, Req.16, 4.54 | | 5.28, 5.69, 7.21, 7.28 | | |

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| | | Is knowledge of the characteristics of the ageing effect (e.g., necessary conditions under which the effect occurs and rates of degradation), the related degradation mechanisms and their impact on the structure or component's intended function(s) adequately considered in the identification process? | Req.14, 4.50, Req.16, 4.54 | | 5.29, 7.21 | | |
| 6.7.2 | Ageing Management Review, Identification of the appropriate programmes for ageing management | Were appropriate methods to detect, monitor, prevent and mitigate ageing effects and degradation mechanisms specified for each structure or component? | Req.14, 4.51 | | 5.30, 7.22, 7.24 | | |
| | | Are existing and proposed plant programmes that support LTO consistent with the IAEA recommendations including the nine attributes? | Req.14, 4.51 | | 3.33, 5.31-5.32, 5.38-5.41, 5.43-5.49, 7.18, 7.20, 7.24, 7.26-7.27 | | |
| | | Is there a process in place to ensure that programmes that are not effective are improved, modified, or new programmes are developed? | Req.14, 4.51 | | 5.32, 7.24 | | |
| 6.7.3 | Ageing Management Review, Reporting on the ageing management review | Is the approach to the AMR documented and justified in a way that logically demonstrates that the ageing effects will be adequately managed? | Req.14, 4.51, Req.16, 4.54 | | 5.33, 7.32 | | |
| | | Is all information and conclusions regarding the scope of the AMR documented and include the description and justification of the methods used (methodology), list of SCs subject to the | Req.14, 4.51, Req.16, 4.54 | | 5.33-5.34, 7.33 | | |

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| | | AMR and their intended functions, and the information sources to accomplish the above? | | | | | |
| | | Does the documentation of the AMR results provide the following information:<br>· Current performance and condition of individual SCs<br>· Identification of the ageing effects and degradation mechanisms requiring management;<br>· Understanding of ageing, monitoring of ageing, prevention and mitigation of ageing effects, as well as information on possible changes in the course of LTO;<br>· Identification of the specific programmes or activities that will manage the effects of ageing for each structure, component, or commodity grouping in scope of the AMR and the need for development of new AMPs;<br>· Description of how the programmes and activities will continue to identify and manage the effects of ageing such that the intended function of the SC will be maintained throughout the planned period of operation or LTO;<br>· List of substantiating references and source documents;<br>· All information and documentation necessary for an effective management of ageing effects is developed and retained in an auditable and retrievable form. | Req.14, 4.51, Req.16, 4.54 | | 5.33, 5.35-5.36, 5.70, 7.23, 7.29-7.31, 7.34-7.36 | | |

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| 6.8 | Ageing Management Programmes | Are AMPs and other plant programmes that are credited for managing ageing coordinated, implemented and periodically reviewed for improvements? Are they consistent with the nine attributes of an effective AMP? | Req.14, 4.50 | | 3.33, 5.37 - 5.38, 5.46, 7.26-7.27 | | |
| | | If the AMP involves inspection by sampling from a specific population of structures or components, does it describe and justify the methods used for selecting the samples to be inspected and the sample size (with respect to the performance of the SCs intended functions throughout its lifetime)? | Req.14, 4.50 | | 5.41 | | |
| 6.8.1 | Development of AMPs | Is the development of the AMPs based on the results of the AMR? Do the AMPs developed include provisions to prevent, detect, evaluate and mitigate the ageing effects of anticipated degradation mechanisms, based on the findings from the AMR? | Req.14, 4.50 | | 5.45, 5.48 | | |
| | | Are specific actions relating to the detection, monitoring and prevention or mitigation of ageing effects properly specified within each AMP (these may include maintenance, equipment qualification, in-service inspection, testing and surveillance, as well as for controlling operating conditions)? | Req.14, 4.50 | | 5.44 | | |
| | | Do all AMPs developed comply with relevant national regulatory requirements, codes and standards and the AM policy of the plant, and consistent with the nine attributes? Is justification provided if some of the attributes are not met? | Req.14, 4.50 | | 5.46 | | |

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| | | Are appropriate acceptance criteria for ageing effects, based on the design basis, technical requirements and applicable regulatory requirements, codes and standards established to facilitate timely corrective actions? | Req.14, 4.50 | | 5.47 | | |
| | | Is the information on the current status of in-scope SCs collected for subsequent review of the effectiveness of the AMPs? Are performance indicators representing the effectiveness of the AMPs developed along with the development of the AMPs? | Req.14, 4.50 | | 5.49, 5.56 | | |
| 6.8.2 | Implementation of AMPs | Are AMPs implemented in a timely manner to ensure that the intended functions of structures or components continue to be met? Are data required for decisions on AM actions collected as a part of the AMP implementation? | Req.14, 4.50 | | 5.51, 5.53 | | |
| | | Are detailed implementation procedures that describe preventive and mitigatory actions, monitoring or inspection and assessment actions, acceptance criteria and corrective actions established and shared among the different units of the nuclear power plant (e.g. the operations, maintenance and engineering units) that are responsible for implementing AM programmes? | Req.14, 4.50 | | 5.52 | | |
| 6.8.3 | Review and improvement of AMPs | Is the effectiveness of AMPs periodically evaluated in the light of current knowledge and feedback from the programme? Are performance indicators, such as material | Req.14, 4.50 | | 3.35, 5.54, 5.56 | | |

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| | | condition, failure and degradation trends, newly revealed ageing, etc. established and used? | | | | | |
| | | How are AMPs incorporated into the management system of the operating organization? | Req.14, 4.50 | | 5.55 | | |
| | | Are data and information newly acquired through the implementation of AMPs shared among responsible units and other internal or external organizations involved in AM? Are these data connected with the existing plant databases, such as the master equipment and component list? | Req.14, 4.50 | | 5.57 | | |
| | | Is an in-depth review of AM performed periodically (e.g. as part of PSR, of safety review for LTO, etc.) and does it demonstrate that ageing effects will continue to be identified and effectively managed? Are the results of the in-depth review documented and do they indicate findings and corrective actions as applicable (modifications of existing or development of new AMPs)? | Req.14, 4.50 | | 5.61 | | |
| | | Does the plant conclude, after reviewing the existing plant programmes and/or AMPs, that the management of ageing is not adequate in some cases? If so, does the plant modify the existing programme or develop a new programme for the purpose of LTO? | Req.16, 4.54 | | 3.33, 3.35, 5.37, 5.54, 5.58, 5.59, 5.60, 5.63 | | |

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| | | Provide selected examples of improved or new AMPs detailed documentation for review (examples to be selected by the reviewer). Does the plant reviewed AMPs for consistency with IGALL AMPs and are areas for improvement in AMPs identified and incorporated? | Req.16, 4.54 | | 5.55, 5.59-5.62 | | |
| 6.9 | Time Limited Ageing Analyses (TLAAs) | Has the plant identified all TLAAs? | Req.16, 4.54 | | 3.34, 5.64, 5.65, 7.14(b), 7.18(d) | | |
| | | Which methods and information sources were used to identify the TLAAs? Is the identification process (methods and information sources) documented? | Req.16, 4.54 | | 5.64, 5.65, 7.14(b), 7.18(d) | | |
| | | Were all identified TLAAs revalidated using methods and criteria consistent with the IAEA recommendations? | Req.16, 4.54 | | 5.66-5.68, 7.14(b), 7.17, 7.18(d), 7.28 | | |
| | | What corrective or compensatory measures are taken in case TLAAs cannot be revalidated? | Req.16, 4.54 | | 3.34, 5.68 | | |
| | | Is the revalidation of TLAAs documented in an update to the FSAR? | Req.16, 4.54 | | 5.70-5.72, 7.36 | | |
| 6.10 | Documentation of Ageing Management | Are the assumptions, activities, evaluations, assessments and results of the plant programme for AM and/or for LTO including the list of plant's commitments documented in accordance with national regulatory requirements and consistent with the IAEA Safety Standards in an auditable and | Req.16, 4.53 | | 5.70, 7.29-7.31, 7.33-7.35 | | |

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| | | retrievable form (see details of refs. provided next)? | | | | | |
| | | Does the documentation include respective methodologies (e.g. in the form of plant procedures, such as for scope setting, AMR, AMP review and improvement, TLAAs identification and revalidation, etc.)? | Req.16, 4.53 | | 7.29-7.30, 7.32, | | |
| | | Does the documentation also include demonstration that ageing effects will be managed during the planned operating period? | Req.16, 4.53 | | 7.35 | | |
| | | Does the documentation include an update of the safety analysis report reflecting the assumptions, activities and results of the plant programme for AM, and/or for LTO? | Req.16, 4.53 | | 5.71-5.72, 7.36 | | |
| | | Are the assumptions, activities, evaluations, assessments and results of the plant programme for AM and/or for LTO reflected in the PSR report? Is the entire planned period of LTO considered? | Req.16, 4.53 | | 5.73, 7.37-7.38 | | |
| 6.11 | Management of Technological Obsolescence | Has a dedicated plant programme to manage technological obsolescence consistent with the IAEA safety standards been developed and implemented? Does it address all SSCs important to safety and the spare parts required to maintain these SSCs? | Req.10, 4.38, Req.16, 4.54 | | 3.20, 3.27, 6.1, 6.2 | | |

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| | | Does the technological obsolescence programme involve the participation of the engineering, maintenance, operations and work planning units, plant senior management and supply chain organizations? | Req.16, 4.54 | | 6.3, 6.9 | | |
| | | Has the technological obsolescence programme been reviewed for consistency with the 9 attributes? Has it been made available to the regulatory body for review? | Req.16, 4.54 | | 4.17, 6.4, 6.5 | | |
| | | Are technological obsolescence programmes periodically reviewed based on new regulatory requirements, vendors' recommendations, operating experience, and new knowledge and research findings? | Req.16, 4.54, Req.24 | | 3.3, 3.30, 3.33, 3.35, 6.10, 6.11 | | |
| | | Does the technological obsolescence programme include the three basic steps (identify and prioritize issues, implement solutions) and activities consistent with the IAEA Safety Standards? | Req.16, 4.54 | | 6.6 | | |
| 6.12 | Reporting | Are efficient data collection and record-keeping systems in place so that trend analyses can readily be performed to predict SSC performance? | Req.15, 4.52 | | 3.23, 5.9-5.12 | | |
| | | Do the data collection and record-keeping systems provide all information for AMR? | Req.15, 4.52 | | 3.23, 5.9-5.12 | | |
| | | Is design documentation, including documentation from suppliers, available? | Req.15, 4.52 | | 3.13-3.19, 5.9-5.12 | | |

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| 7.3 | Principles of and Approach to Long Term Operation | Does a clear policy exist in the area of AM and LTO, consistent with related IAEA Safety Standards? | Req.16, 4.53, 4.54 | | 3.31, 5.1, 7.7, 7.9 | | GS-G-3.1: 3.10-3.12, 5.10 |
| | | Does the plant have plant level documentation covering principles and concept for AM and LTO? | Req.16, 4.53, 4.54 | | 5.1, 7.5, 7.6-7.8, 7.11-7.15 | | |
| | | Is PSR adequately used to support decision making for LTO? | Req.16, 4.53 | | 7.27 | 3.7, 3.10 | |
| | | Is the plant personnel familiar with the LTO, its principles and concept and is it understood? | | Req.9, 4.26 | 7.10 | | |
| 7.4 | Development of a Programme for Long Term Operation | Does the plant have an LTO programme, established in line with the plant's principles and strategy for LTO, and consistent with the IAEA Safety Standards? | Req.16, 4.54 | | 2.31, 3.31 - 3.32, 7.7 - 7.9, 7.16-7.19 | | |
| | | Is the LTO programme a set of activities, including evaluations, assessments, maintenance, inspections and testing, aimed at justifying and demonstrating plant safety for the planned period of long term operation? Does the LTO programme include scope setting, AMR, review of plant programmes and of AMPs, identification and revalidation of TLAAs, and the development of a implementation programme? Is the LTO programme based on national regulatory requirements and does it consider international best practices, operating experience and research findings? | Req.16, 4.54 | | 2.31, 3.3, 3.30, 4.8, 3.31 - 3.35, 7.7 - 7.9, 7.16-7.19 | | SSR-2/1: Req.6, 4.6 |

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| | | Is the LTO programme well documented (e.g., assumptions, activities, evaluations, assessments and results of the evaluation of AMPs and plant programmes) and retained in an auditable and retrievable form? | Req.16, 4.53-4.54 | | 5.70 7.29 | | |
| | | Does the LTO programme address the safety improvements (such as modifications, major reconstructions and scheduled replacements) required as well as the related plant commitments and implementation schedule? | Req.16, 4.53-4.54 | | 7.18e), 7.19, 7.41 | | |
| | | Does the plant have programme(s) or action plan for the resolution of issues identified during the review of AMPs, EQ and TLAAs? | Req.16, 4.53-4.54 | | 7.18 | | |
| | | Has an evaluation of the existing NPP programmes and documentation been performed? Are evaluation results used as a basis for developing the foundation for successful LTO and will they remain effective for the planned period of LTO? Will this evaluation determine if modifications and/or new programmes are necessary to ensure that SSCs are available and qualified to perform their intended function for the planned period of LTO? | Req.16, 4.53-4.54 | | 7.11-7.15, 7.16-7.18 | | |
| | | Are recommendations and other suggestions arising from different types of reviews incorporated into plant activities? | Req.12, 4.47, Req.16, 4.53-4.54 | | 2.21, 7.18-7.19, 7.31 | 9.1-9.5 | |