National Nuclear Regulator

Outcome of the assessment of the Koeberg Long Term Operation Application

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Rev 1


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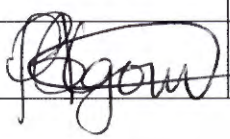

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	P Bester	Programme Manager: NPP		11 July 24
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EXECUTIVE SUMMARY

On 6 January 2021 Eskom Holdings (SOC) Limited (Eskom or the applicant) lodged an application to operate the Koeberg Nuclear Power Station beyond 21 July 2024 as specified in Nuclear Installation Licence No. NIL-01 (Variation 19), General Licensing Condition 1.6.

An application to operate a Nuclear Installation beyond a timeframe as specified in its licence must comply with regulatory requirements which are contained in (1) the National Nuclear Regulator Act (Act No. 47 of 1999), (2) Regulations on the Long-Term Operation of Nuclear Installations (R266) and (3) Regulations on Safety Standards and Regulatory Practices (R 388) and Regulations on the Format for the Application for a Nuclear Installation Licence or a Certificate of Registration or a Certificate of Exemption (R 1219).

Recommended guidelines on how to comply with the above regulatory requirements are contained in various NNR guidance documents, namely, Interim Regulatory Guidance on Ageing Management and Long-Term Operations Of Nuclear Power Plants (RG-0027), Interim Guidance on Periodic Safety Review of Nuclear Power Plants (RG-0028), and Quality and Safety Management Requirements for Nuclear Installations (RD-0034).

Demonstration of compliance with regulatory requirements is a pre-requisite for a variation to a licence to be issued by the NNR.

The NNR assessed the application in accordance with NNR procedures to verify compliance of the application with technical provisions contained in "*Regulations on the Long-Term Operation of Nuclear Installations (R.266)*" together with all the documents mentioned above. The NNR also considered comments raised during the public consultation process concerning health, safety, and the environment.

In its assessment, the NNR considered nineteen (19) technical provisions or safety evaluation areas as required in R266. The assessment identified regulatory concerns related to the validation of TLAA 301: Concrete Containment Tendon Pre-Stress relating extending the operational life of Unit 2 of KNPS beyond 48 years of operation.

Notwithstanding, the assessment found that the LTO application is compliant for both units with the LTO regulations with respect to the following:

1. Submission of safety case for LTO.
2. Factors related to:

2.1. Safety related programmes.

2.2. Effectiveness of the ageing management programmes.

2.3. Revalidation of time limiting ageing analyses, except for the validation of TLAA 301: Concrete Containment Tendon Pre-Stress that involves a time restriction of 8 years for Unit 2 of KNPS.

2.4. Utilisation of the periodic safety review.

2.5. Programme for LTO.

The assessment also identified conditions that must be implemented during the period of LTO within specified timelines.

The assessment furthermore considered the representations made by the public during the Board's public hearings. The analysis found that the issues related to health, safety and the environment are either addressed or dispositioned by the nuclear installations licence conditions, the current licensing basis of KNPS, the safety case or are subject to ongoing review by the NNR.

The Applicant has been informed of the regulatory concerns related to the validation of TLAA 301 on Unit 2. The resolution of the NNR concerns relating to Unit 2 of KNPS may require:

(1) Conduct of additional tests to determine the material characteristics of the concrete (particularly in the dome area) to demonstrate the existence of adequate safety margin for the period of LTO.

(2) Further analysis supported by results and calibration insights obtained from the cross-validation of the integrated leak rate tests (ILRTs) and the TLAA.

(3) Additional containment monitoring instrumentation data to confirm respective safety and design margins.

1 INTRODUCTION

On 6 January 2021 Eskom Holdings (SOC) Limited (Eskom or the applicant) lodged an application to operate the Koeberg Nuclear Power Station beyond 21 July 2024 as specified in Nuclear Installation Licence No. NIL-01 (Variation 19), General Licensing Condition 1.6. The application was subsequently revised on 10 May 2021 to align with the newly promulgated Regulations on LTO.

The application is for a variation to the Nuclear Installation Licence No. NIL-01 to operate the KNPS beyond the timeframe (21 July 2024) established in NIL-01 (Variation 19) for an additional 20 years to 21 July 2044 for Unit 1 and to 9 November 2045 for Unit 2.

The application contained the concept of decoupling or separation of the operational end dates of the units, also submitted separately under a Licence Change Request (LCR). The NNR approved the separation of the operational end dates on 26 January 2024 with the issuing of Nuclear Installation Licence No. NIL-01 (Variation 20).

The NNR assessed the application based on the "Regulations on the Long-Term Operation of Nuclear Installations (R266)".

The NNR communicated to stakeholders on 26 January 2024 that there would be 2 rounds of public hearings. The 1st during the month of February and the 2nd during the month of June 2024. Comments concerning health, safety, and the environment collected during the hearings are considered.

2 PURPOSE

The purpose of this document is to provide the outcomes of the assessment reached by the NNR after assessing the LTO application and its supporting information to extend the operational life of the Koeberg Nuclear Power Station beyond the current licence term of 40 years, as well as comments raised during the public hearing process concerning health, safety, and the environment.

3 SCOPE AND REVIEW METHODOLOGY

The application for LTO must comply with regulatory requirements which are contained in the following primary documents:

- National Nuclear Regulator Act (Act No. 47 of 1999);
- R266, Regulations on the Long-Term Operation of Nuclear Installations;
- R388, Regulations on Safety Standards and Regulatory Practices; and
- R1219, Regulations on the Format for the Application for a Nuclear Installation Licence or a Certificate of Registration or a Certificate of Exemption

Recommended guidelines on how to comply with the above regulatory requirements are contained in the following regulatory guidance documents:

- RG-0027, Interim Regulatory Guidance on Ageing Management and Long Term Operations Of Nuclear Power Plants;
- RG-0028, Interim Guidance on Periodic Safety Review of Nuclear Power Plants;
- RD-0034, Quality and Safety Management Requirements for Nuclear Installations.

Demonstration of compliance with regulatory requirements is a pre-requisite to the variation of a licence by the NNR; however, demonstration of compliance with recommended guidelines is not a pre-requisite.

4 DEFINITIONS AND ABBREVIATIONS

4.1 Definitions

Ageing management: The process whereby analyses, tests, and assessments are performed to determine whether the environment and service conditions can cause or have caused the ageing of SSCs.

Ageing management programme (AMP): A set of policies, processes, procedures, arrangements and activities for managing the ageing of SSCs for a nuclear power plant.

Commitment: These are actions that have been identified by the applicant to be resolved either before or after entry into LTO.

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

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

Pre-condition: These are NNR review comments that must be resolved to ensure compliance with the LTO regulations.

Safety aspects of long-term operation: The IAEA peer-reviewed safety assessment focused on the safety aspects of long-term operation for nuclear power plants planning on extending plant life into long-term operation.

4.2 Abbreviations

ANS:	American Nuclear Standard
AM:	Ageing Management
AMP:	Ageing Management Programme
ASME:	American Standard Mechanical Engineers
CAP:	Corrective Action Programme
CLB:	Current Licensing Basis
EPTB:	Emergency Plan Technical Basis
IAEA:	International Atomic Energy Association
IEEE:	Institute of Electrical and Electronic Engineers
IEC:	International Electrotechnical Commission
INPO:	Institute of Nuclear Power Operations
IGALL:	International Generic Ageing Lessons Learnt
LTO:	Long Term Operation
PID:	Public Information Document
PSR:	Periodic Safety Review
SANS:	South African National Standards
SSC:	System, Structures and Components
SSRP:	Safety Standards and Regulatory Practices

TLAA:	Time-limited ageing analysis
US-NRC:	United States Nuclear Regulatory Commission
WANO:	World Association of Nuclear Operators

5 ASSESSMENT OF COMPLIANCE OF LTO APPLICATION BASED ON R266

The legal basis for a LTO application is directly linked to the National Nuclear Regulator Act (Act. No. 47 of 1999). The following sections are especially relevant to LTO:

- Section 5(b) that grants the NNR the power to, amongst others, exercise regulatory control related to safety over the siting, design, construction, operation, manufacture of component parts, decontamination, decommissioning and closure of nuclear installations, through the issuing of nuclear authorisations.
- Section 20(1) that states that: "No person may site, construct, operate, decontaminate or decommission a nuclear installation, except under the authority of a nuclear installation licence."
- Section 21(1) that requires that any person wishing to site, construct, operate, decontaminate. or decommission a nuclear installation may apply in the prescribed format to the Chief Executive Officer of the NNR for a nuclear installation licence and must furnish such information as required by the NNR board of directors.
- Section 21(5) states that the Chief Executive Officer of the NNR may refuse or grant a nuclear authorisation subject to approval by the NNR board of directors.
- Section 23, whereby the Chief Executive Officer may impose (and amend) conditions of authorisation which are necessary to ensure the protection of persons, property, and the environment against nuclear damage, or to provide for rehabilitation of the site.

Detailed technical provisions promulgated to provide for the effective administration of the NNR Act with respect to LTO are detailed in the Regulations on the Long-Term Operation of Nuclear Installations (R266).

The next sub-sections present the NNR findings on the assessment of compliance of the LTO application submitted by Eskom for a variation to the Nuclear Installation Licence No. NIL-01 to operate the KNPS beyond the timeframe established in NIL-01 (Variation 19) for an additional 20 years to 21 July 2044 for Unit 1 and to 9 November 2045 for Unit 2, based on the technical provisions in R266. The subsequent issuing of Variation 20 of the licence by the NNR does not impact on this assessment of compliance. Each subsection concludes by presenting an assessment outcome against the relevant requirement.

5.1 Regulation 4 (a) Safety case for long term operation

- **Requirement**

The safety case for Long Term Operation shall demonstrate compliance with relevant regulatory safety criteria and requirements.

- **Assessment of Compliance**

The safety case demonstrated the extent of compliance with the NNR Dose Limits, Risk Limits, LTO regulations, conditions in NIL-01 and followed the guidance provided in RG-0027 and RG-0028.

The information is predominantly contained in Section 9.2 Compliance with Safety Criteria and Requirements and extracted information from the PSR where the verification of compliance with the safety criteria and requirements are concluded.

The compliance with radiological risks limits is confirmed with reference to the station risk profile, updated to reflect latest modifications, updated source terms methodology and with information from updated accident analyses.

- **Assessment Outcome 1**

The application was verified to be compliant with regulation 4(a) as it was demonstrated in the safety case that there is for the period of LTO compliance with relevant regulatory safety criteria and requirements.

5.2 Regulation 4 (b) Safety case for long term operation

- **Requirement**

The safety case for Long Term Operation shall be prepared using the results of safety analyses, with due consideration of the ageing of structures, systems and components and the periodic safety review.

- **Assessment of Compliance**

The structure and content of the safety case was accepted by the NNR prior to the drafting of the safety case by Eskom. The pre-approved structure contained as a minimum information related to safety analyses, ageing and periodic safety review. The submitted safety case

integrates information and results from the major areas depicted below that envelope the minimum information required:

Major Modifications	Ageing Management	Safety Assessments (SALTO)	Periodic Safety Review	Other Inputs
• PTR Tank • RPVH • SGR • Fukushima Mods • Containment • SFSP	• Scoping • AMR's • AMP's	• Revalidation of TLAA's • TLAA re-analyses • Programme and systems update	• Review of EPTB • SSHAC • 14 Safety Factors • Improvement Plans	• Review of Safety Related Programmes • Waste Management

- **Assessment Outcome 2**

The application was verified to be compliant with regulation 4(b) as it was prepared using the results of safety analyses with due consideration of the ageing of SSC's and 3rd PSR results.

5.3 Regulation 4 (c) Safety case for long term operation

- **Requirement**

The safety case for Long Term Operation shall provide an overall assessment of the safety of the nuclear installation and justification for continued safe operation for the intended period of Long-Term Operation

- **Assessment of Compliance**

The safety case information presented demonstrated that KNPS can continue to operate safely. This conclusion is based on the outcome of the PSR global assessment and suitability for continued operation. The information used to provide such demonstration is predominantly contained and summarised in Section 10.0 "Why it is Safe to Continue Operation (Overall Assessment for Additional 20 Years)".

The information credited to formulate the overall assessment is obtained from the 3rd PSR,

SALTO assessments, KNPS design, demonstrated management of ageing, adequacy of operational programmes, impact from external hazards, adequacy of emergency planning, availability of resources, knowledge management and mature integrated management system.

- **Assessment Outcome 3**

The application is compliant with regulation 4(c) as it was verified that the safety case provides an overall assessment of the safety of the nuclear installation and justification for continued safe operation for the intended period of Long-Term Operation.

5.4 Regulation 4 (d) Safety case for long term operation

- **Requirement**

The safety case for Long Term Operation shall demonstrate availability of financial and human resources as well as knowledge management for the period of Long-Term Operation, which knowledge management shall include an integrated, systematic approach to identifying, managing and sharing an organisation's knowledge and enabling groups of people to collectively create new knowledge to help achieve the organisation's objectives.

- **Assessment of Compliance**

The intention of the LTO safety case is to demonstrate that organisational provisions is adequate to support the extended period of LTO. These include aspects of policies, human resources, competency management, knowledge management and financial resources. New policies were drafted for the period of LTO, this ensures the correct placement and alignment of the organisation to support the management of ageing. It also lays the groundwork for the establishment of the resource needs for the period of LTO.

The availability of financial and human resources for the period of LTO is demonstrated through safety case information contained and referenced in the safety case sections related to Plant Life Extension Feasibility Study (7.1), Organisational Provisions for Long Term Operation (9.7.5) and Arrangements for Financial Resources (9.7.5.6).

The periodic safety review under SF-10 evaluated whether existing policies and business objectives are adequate and are implemented in a safe and effective manner. Whether the existing organisation, management system, and safety culture meet current requirements, and that they are adequate and effective for ensuring the safe operation of the KNPS. None of the

deviations identified were of such a nature that it dispositions the conclusions in the LTO safety case regarding the adequacy of the programme. The NNR review of the 3rd PSR results did not identify any other issues that changes these arguments presented in the safety case. The NNR consider the current organisational provisions adequate to support the period of LTO.

In addition, the SALTO peer review scrutinised human resources from the point of continued management of ageing for the period of LTO.

Knowledge management for the period of LTO is demonstrated through the information in safety case section related to Knowledge Management (9.7.5.5).

The SALTO peer review did identify a weakness in knowledge management. There have been various initiatives implemented to ensure the integrity of identifying, capturing, evaluating, retrieving, and sharing relevant Koeberg information assets (such as databases, documents, policies, procedures, and previously uncaptured expertise and experiences from individual workers). The implementation of the initiatives as committed to be completed by July 2024 has been verified as completed.

- **Assessment Outcome 4**

The application is compliant with regulation 4(d) as it was demonstrated that there is management of financial and human resources as well as knowledge management processes in place.

5.5 Regulation 4 (e) Safety case for long term operation

- **Requirement**

The safety case for Long Term Operation shall identify necessary safety improvements which may include, but are not limited to, refurbishment, provision of additional structures, systems and components and additional safety analyses and engineering justifications, to ensure that the licensing basis remains valid during the period of Long-Term Operation.

- **Assessment of Compliance**

The safety case identified safety improvements from the outcome of the 3rd PSR safety factor reviews and conclusion of the global assessment. The validity of the current licensing basis is confirmed and where gaps have been identified, actions to be taken is documented in the 3rd

PSR integrated implementation plan (IIP) and the LTO integrated implementation plan, documented and referenced in the safety case in the sections related to Summary of the 3rd PSR (9.1), 3rd PSR Safety Improvements (9.1.3) and Long-Term Operation Integrated Implementation Plan (14).

The 3rd PSR also provided information of operational experience feedback, research activities and KNPS improvements, documented and referenced in the sections related to Specific Site Characteristics (9.3), PWR Design Features (9.4.2), Incorporation of Operating Experience for Continuous Improvement of KNPS Safety (9.8) and Long-Term Operation Integrated Implementation Plan (14).

The resultant list of safety related modifications or improvements for LTO is included in the safety case. The applicant will be directed to implement all IIP commitments.

- **Assessment Outcome 5**

The application was verified to be compliant with regulation 4(e) as it was verified that the safety case identified safety improvements which may include, but are not limited to, refurbishment, provision of additional structures, systems and components and additional safety analyses and engineering justifications, to ensure that the licensing basis remains valid during the period of Long-Term Operation.

Eskom is required to implement the safety improvements if the LTO application is granted in accordance with an agreed timeframes commensurate with the importance to safety.

5.6 Regulation 5 (a) Factors related to safety related programmes.

- **Requirement**

Factors to be considered in evaluating an application for Long Term Operation will include the safety related programmes relevant for ensuring the safe Long Term Operation of the nuclear installation beyond the timeframe established by the current licensing basis or the nuclear installation licence.

- **Assessment of Compliance**

The safety case demonstrated that safety related programmes have been evaluated and it was found to be adequate. These safety related programmes include Maintenance,

Equipment Qualification, In Service Inspection, Surveillance, Chemistry, Compliance Assurance Programmes. This is demonstrated and referenced in the safety case in the sections related to Summary of the 3rd PSR (9.1), Ageing Management Risk Items (9.5.2), Ageing Management of SSCs Supporting Licence Binding Programmes (9.5.3) and Incorporation of Experience for Continuous Improvement of Plant Safety (9.8).

Other operational safety related programmes evaluated are covered in the safety case in the sections related to Impact of Long-Term Operation on Nuclear Security (9.7.1), Impact of Long-Term Operation on Emergency Planning (9.7.2), Impact of Long-Term Operation on Radioactive Waste Management (9.7.3), Impact of Long-Term Operation on the Environment (9.7.4) and Organisational Provisions for Long-Term Operation (9.7.5).

- **Assessment Outcome 6**

The application was verified to be compliant with regulation 5(a) as it includes and evaluates programmes relevant for ensuring the safe Long Term Operation of the nuclear installation beyond the timeframe established by the current licensing basis or the nuclear installation licence.

5.7 Regulation 5 (b) Factors related to effectiveness of the ageing management programme.

- **Requirement**

Factors to be considered in evaluating an application for Long Term Operation will include the effectiveness of the ageing management programme necessary for ensuring that required safety functions of structures, systems and components are fulfilled over the period of Long-Term Operation of the nuclear installation.

- **Assessment of Compliance**

The adequacy and effectiveness of the ageing management programme necessary stems predominantly from the established organisational structures, processes, standards and individual programmes targeting known degradation or ageing mechanisms. This includes components known with time limited restrictions.

The establishment, integrity of and maintaining of the ageing management programme is the major component of the IAEA SALTO methodology. Measuring effectiveness is based on

ensuring that the measures from the IAEA SALTO methodology are entrenched in the station processes, implemented in compliance with the standards adopted and that the results obtained provide credible indications. For LTO it is necessary to ensure that all aspects of the newly established ageing management programme are in place, and it can be demonstrated that the previous programmes were effective in managing KNPS ageing.

The safety case demonstrated that an adequate ageing management programme exists and are implemented in the safety case sections related to Summary of the 3rd PSR (9.1), Ageing Management for Long Term Operation (9.5), Ageing Management Programmes (9.8.3) and Long-Term Operation Integrated Implementation Plan (14).

The SALTO mission and the establishment of an ageing management programme in accordance with the IAEA and NNR guidance were systematically implemented. The results of the various evaluations successfully demonstrated that the safety functions of SSCs are ensured.

- **Assessment Outcome 7**

The application was verified to be compliant with regulation 5(b) related to demonstrating the effectiveness of the ageing management programme necessary for ensuring that required safety functions of structures, systems and components are fulfilled over the period of Long-Term Operation of the nuclear installation.

5.8 Regulation 5 (c) Factors related to revalidation of the time limited ageing analyses.

- **Requirement**

Factors to be considered in evaluating an application for Long Term Operation will include the revalidation of the time limited ageing analyses to ensure continued acceptability of the analysed structures, systems or components for the planned period of Long-Term Operation

- **Assessment of Compliance**

TLAAs are plant-specific safety analysis in the plant design basis that considers time and ageing of the SSCs within the scope of ageing management. These time limited assumptions are typically based on an initially assumed period of operation and/or anticipated operational transients, design considerations, or license terms.

The revalidation process of SSCs within the scope of ageing management for which the plant specific safety analyses consider time and ageing was performed as part of the SALTO process and where appropriate the SGR analyses were credited.

Where original analyses exist, these were studied and where possible, their TLAAs were re-validated and justified for 60 years. The TLAAs that were identified but not re-validated for 60 years were recommended for creation, analysis, or re-analysis. In some cases where revalidation was not possible the process of replacement was initiated.

The safety case demonstrated the acceptability of the analysed SSCs for the planned period of Long-Term Operation through information contained and referenced in the sections related to Outcomes of the Safety Factor Reviews (9.1.1), Ageing Analyses in Design (9.4.6.4), Ageing Management for Long-Term Operation (9.5), Time Limited Ageing Analyses (TLAAs) (9.5.1.4) and Long-Term Operation Integrated Implementation Plan (Section 14).

TLAA 301 related to the adequacy of the revalidation of containment tendon prestress on both units initiated multiple review comments. The majority related to the possible limitation and restrictions in the dome portion of containment. For the final review conclusion, Figure 1, depicting a summary of the results for TLAA-301 has reference:

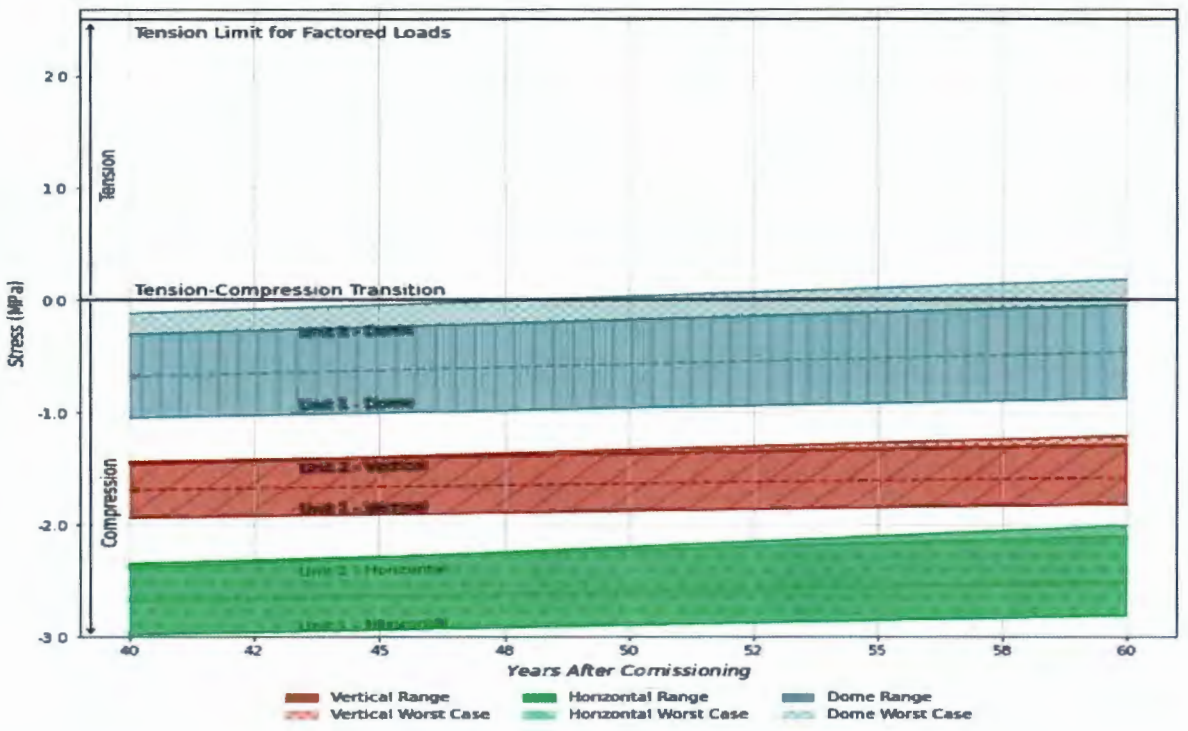


Figure 1: Summary of TLAA Results

As shown in the graph above, the results from the Eskom review identified that safety criteria are met for the different parts of containment and for the containment dome. Safety criteria are however marginally met with very little or no safety margin at 60 years for Unit 2. The calculations performed by Eskom relied on limited quality data as the data originated from the limitation of the monitoring technology available and applicable at the time of design and construction. The data limitations including inconsistencies and gaps prompted Eskom to rely on engineering judgement and data analysis to re-interpret the data. These methods introduced discretionary criteria that are not part of surveillance procedures.

The quality of the data used has a direct influence on the evaluation performed by the NNR and the determination of whether TLAA 301 is validated. Accordingly, this is considered when performing the safety evaluation. The quality of the data used as well as the fact that the structural safety margins for the dome have been eroded to the minimum leads the NNR to arrive at a review conclusion that the safety of the containment building is not fully demonstrated for Unit 2 for the period of LTO. The complete absence of dome data for Unit 2 and the use of dome data for Unit 1 introduced discretionary criteria and interpretation by Eskom. However, the NNR have concluded that from the margins shown in Figure 1 above, there is assurance that TLAA 301 was validated for the containment building of Unit 1, considering the uncertainties introduced through data analysis and use of engineering judgement.

For the containment building of Unit 2, the margins shown in Figure 1 above, does not provide assurance that TLAA 301 was validated for the complete period of LTO but only for a period of 8 years, considering worst case scenarios, assumptions, uncertainties introduced through data analysis and use of engineering judgement.

This leads to the overall NNR conclusion that TLAA 301 is fully validated for Unit 1 for the proposed 20 years and for Unit 2 for 8 years.

- **Assessment Outcome 8**

The application was verified to be compliant with regulation 5(c) related to the revalidation of time limited ageing analyses for the respective TLAAs for 20 years on Unit 1 and 8 years for Unit 2.

5.9 Regulation 5 (d) Factors related to utilisation of the results of the periodic safety review.

- **Requirement**

Factors to be considered in evaluating an application for Long Term Operation will include the utilisation of the results of the periodic safety review to justify Long Term Operation of the nuclear installation.

- **Assessment of Compliance**

The results of the 3rd PSR are contained in the PSR Global assessment report. Deviations have been appropriately graded and identified for resolution prior to the next PSR. The results are integrated throughout the safety case where individual SF review results as well as results from the global assessment were referenced or used to argue or justify LTO.

The 3rd PSR results presented in the global assessment report and the submitted integrated implementation plan were reviewed and there have been no comments generated that invalidate the deviations and conclusions from both the individual SF review reports and the global assessment report. The integrity of the results from the 3rd PSR may therefore be credited or used in the justifications presented in the LTO safety case.

- **Assessment Outcome 9**

The application was verified to be compliant with regulation 5(d) relayed to the utilisation of the results of the periodic safety review to justify Long Term Operation of the nuclear installation.

5.10 Regulation 6 (1) Programme for long term operation

- **Requirement**

The licensee shall ensure that an effective ageing management programme is developed, implemented and maintained to ensure that required safety functions of structures, systems and components are fulfilled over the entire operating lifetime of the nuclear installation.

- **Assessment of Compliance**

The ageing management review (AMR) for in-scope SSCs (commodity groups and stand-alone items) was performed by Eskom to demonstrate that ageing management at KNPS is

comprehensive and that ageing concerns are effectively managed so that the intended function(s) of the SSCs is maintained for the period of extended operation through LTO. The ageing management evaluation methodology used to perform the AMR was approved by the NNR and systematically assessed the ageing effects and their related degradation mechanisms that are experienced or are anticipated for specific commodity groups and SSCs.

The outcome of the reviews culminated into:

- Development of new AMP's and the identified outstanding ones are tracked in the SC commitments.
- Update of existing AMP's and the identified outstanding ones are tracked in the SC commitments.
- Performance of one-time inspections were identified, and the outstanding ones are tracked in the SC commitments

The ageing management evaluation reports for Mechanical, Electrical and Civil SSCs concluded that there are gaps in the current ageing management programmes at KNPS, however the assessment did not identify any ageing concerns that would prevent the plant from safely operating into LTO. The effectiveness of the existing plant programmes to manage the identified ageing degradations and their adequacy for LTO was confirmed.

This position was also reflected in the results of the IAEA SALTO peer review.

- **Assessment Outcome 10**

The application was verified to be compliant with regulation 6(1) related to the is development, implementation and maintenance of an effective ageing management programme to ensure that required safety functions of structures, systems and components are fulfilled over the entire operating lifetime of the nuclear installation.

5.11 Regulation 6 (2) Programme for long term operation

- **Requirement**

The licensee shall conduct systematic periodic safety reviews of the nuclear installation throughout its operational lifetime, taking into account the actual status of the facility, including the consequences of the cumulative effects of ageing and modifications to the facility, the operating experience and significant new safety information from relevant sources.

- **Assessment of Compliance**

Historically and prior to the establishment of the new regulatory framework for LTO Koeberg conducted safety re-assessments (SRA) under the umbrella of PSR. The first SRA was performed in 1998 and the second in 2011. The 3rd PSR coincided with the pursuit of LTO and the objectives were to demonstrate the extent to which the facility conforms to modern codes, standards, and practices, to ensure that the currently adopted codes, standards and practices, are not obsolete and do not pose nuclear safety risk to the facility for the period of LTO.

The 3rd PSR review was conducted against the national nuclear safety and radiation protection requirements, as stipulated in the relevant acts, associated nuclear regulations, NNR licensing and regulator directives, and Koeberg's Nuclear Installation License.

The review was used to identify any deviations to existing regulations and safety standards. The review was also used to identify changes in any high-level design codes and standards when KNPS was constructed (and/or modified), to the latest revision or equivalent nuclear design codes and standards and other international standards organisations including, but not limited to ANS, ASME, IEEE, IEC, WANO, US-NRC, and INPO on which the current KNPS design and/or operation is based. The review against local SANS standards and other standards was limited to those standards incorporated into the national regulations that are applicable to the nuclear safety at KNPS. An assessment of the Occupational Health and Safety Act regulations and the National Environmental Management Act regulations was conducted.

As per the guidance in RG-0028 the NNR accepted the PSR basis and methodology for the performance of the 3rd PSR. This included the list of standards and requirements applicable to the review. Any issues identified with regards the non-conformance to any of the standards is documented as a deviation and appropriately graded and evaluated during the Global Assessment review. The outcome forms part of the PSR final report that is an integral part of the Safety Case.

Following the Fukushima Daiichi accident Koeberg also performed a safety assessment with a scope limited to extreme external events.

- **Assessment Outcome 11**

The application has been verified to be compliant with regulation 6(2) as systematic periodic safety reviews of the nuclear installation were conducted throughout its operational lifetime, taking into account the actual status of the facility, including the consequences of the cumulative effects of ageing and modifications to the facility, the operating experience and significant new safety information from relevant sources.

5.12 Regulation 6 (3) Programme for long term operation

- **Requirement**

The licensee shall develop and implement a comprehensive programme for ensuring the safe Long-Term Operation of the nuclear installation beyond the timeframe established by the design limits in the current licensing basis or the nuclear installation licence.

- **Assessment of Compliance**

Eskom programme for LTO contains the elements of SALTO as provided for in RG-0027. The programme was supported by a LTO licensing framework and a subsequent Eskom LTO project plan, used to track and monitor implementation of the programme.

It must be noted that the LTO programme is essentially the IAEA SALTO process with an added full scope PSR. The programme was accepted by the NNR and includes the following elements:

(1) Pre-LTO feasibility study
(2) Evaluation of KNPS documentation and programmes relevant to LTO
(3) Scope setting for LTO
(4) Review of KNPS programmes for LTO
(5) Ageing Management review for LTO
(6) Revalidation of time limited ageing analyses
(7) LTO documentation, other regulatory requirements, i.e. PSR

- **Assessment Outcome 12**

The application is deemed compliant with regulation 6(3) as it was verified that a comprehensive programme for ensuring the safe Long-Term Operation of the nuclear installation beyond the time-frame established by the design limits in the current licensing basis or the nuclear installation licence was developed and implemented.

5.13 Regulation 6 (4)(a) Programme for long term operation

- **Requirement**

The comprehensive programme for Long Term Operation shall address relevant plant documentation and safety related programmes.

- **Assessment of Compliance**

The programme was accepted by the NNR and it was verified that it contains KNPS documentation and covers safety related programmes. Updating KNPS documentation is essential for the maintenance of KNPS configuration and to ensure that the design and licencing basis documents are kept current with necessary updates from the SALTO and/or 3rd PSR review. Where required KNPS documentation was updated, it includes the SAR, OTS, SRSM, Maintenance procedures, new AMP's, update AMP's, new standards, new programmes etc. Essentially all KNPS documents were affected.

The intent of the requirement was to ensure that ageing management is correctly incorporated into all KNPS documentation and that the effect on safety related programmes have been evaluated.

Both safety related programmes as well as operational safety related programmes are covered by the LTO programme.

- **Assessment Outcome 13**

The application has been verified to be compliant with regulation 6(4)a as it was verified that relevant plant documentation and safety related programmes are addressed.

5.14 Regulation 6 (4)(b) Programme for long term operation

- **Requirement**

The comprehensive programme for Long Term Operation shall consider the relevant scope of systems, structures and components important to Long Term Operation that must be agreed and approved by the Regulator.

- **Assessment of Compliance**

The SALTO scoping methodology documents the Eskom scope setting methodology required to meet the regulatory scope setting expectations. The methodology was initially developed based on the IAEA SALTO guidance and following the issuance of the interim guidance RG0027 the methodology was reviewed and updated to ensure alignment with the guidance in RG-0027.

The scoping methodology is the cornerstone of the ageing management process, and it was reviewed and accepted by the NNR.

- **Assessment Outcome 14**

The application has been verified to be compliant with regulation 6(4)b as the relevant scope of systems, structures and components important to Long Term Operation was agreed and approved by the NNR.

5.15 Regulation 6 (4)(c) Programme for long term operation

- **Requirement**

The comprehensive programme for Long Term Operation shall address the review of nuclear installation safety related programmes for Long Term Operation.

- **Assessment of Compliance**

The programme was accepted by the NNR and it was verified that it covers safety related programmes. The extent of the safety related programmes to be reviewed was documented in the structure and content of the safety case.

The structure and content for the safety case was accepted by the regulator.

- **Assessment Outcome 15**

The application has been verified to be compliant with regulation 6(4)c as it has a programme for Long Term Operation addressing the review of nuclear installation safety related programmes for Long Term Operation.

5.16 Regulation 6 (4)(d) Programme for long term operation

- **Requirement**

The comprehensive programme for Long Term Operation shall address ageing management review for Long Term Operation, including the review of existing ageing management programmes and development of new ageing management programmes as necessary.

- **Assessment of Compliance**

The programme was accepted by the NNR, and it was verified that it addresses ageing management review. The ageing management review process was documented under the SALTO project and included into the structure and content of the safety case.

The structure and content for the safety case as well as the ageing management review process was accepted by the regulator.

- **Assessment Outcome 16**

The application has been verified to be compliant with regulation 6(4)d as it was verified that the comprehensive programme for Long Term Operation addressed ageing management review for Long Term Operation, including the review of existing ageing management programmes and development of new ageing management programmes as necessary.

5.17 Regulation 6 (4)(e) Programme for long term operation

- **Requirement**

The comprehensive programme for Long Term Operation shall address revalidation of time limited ageing analysis.

- **Assessment of Compliance**

The programme was submitted to the NNR, and it was verified that it addresses revalidation of time limited ageing analyses. The time limited ageing analysis is integral and essential part of the SALTO methodology adopted and documented. It is also extensively referenced and documented into the structure and content of the safety case.

The structure and content for the safety case as well as the time limited ageing analysis as part of the SALTO process was accepted by the regulator.

- **Assessment Outcome 17**

The application has been verified to be compliant with regulation 6(4)e as the programme for Long Term Operation includes revalidation of time limited ageing analysis.

5.18 Regulation 6 (4)(f) Programme for long term operation

- **Requirement**

The comprehensive programme for Long Term Operation shall address long term operation documentation.

- **Assessment of Compliance**

The results of the LTO assessment were used to update the relevant LTO documentation and influence the plant changes in support of LTO.

Updated documents included as example, SALTO documentation, new process and standards for AM, new and updated AMP's etc. Where applicable some documents were submitted for Regulatory acceptance as dictated by existing licence basis requirements or specific documents required to be submitted related to AM and PSR in RG-0027 and RG-0028.

The accepted licensing framework for LTO complimented the requirements by providing clarity on which documents require Regulatory scrutiny.

Other documentation in support of LTO included the updated SAR, 3rd PSR report and Ageing Management report.

- **Assessment Outcome 18**

The application has been verified to be compliant with regulation 6(4)f as it was verified that the comprehensive programme for Long Term Operation addressed long term operation documentation.

5.19 Regulation 6 (4)(g) Programme for long term operation

- **Requirement**

The comprehensive programme for Long Term Operation shall address the implementation programme for Long Term Operation.

- **Assessment of Compliance**

The safety case documented in Section 14 the Long-Term Operation Integrated Implementation Plan (IIP), capturing all the committed actions required prior to and after LTO.

The LTO implementation programme was contained within the LTO Programme Management Manual, originally submitted as part of the LTO application, accepted by the NNR. It contained information on the Risk Management plan, Resource Plan, LTO programme schedule and LTO Programme organisation.

- **Assessment Outcome 19**

The application has been verified to be compliant with regulation 6(4)g as it was verified that the comprehensive programme for Long Term Operation addressed the implementation programme for Long Term Operation.

6 PUBLIC CONSULTATION

The NNR Board held public hearings to provide members of the public an opportunity to make representation to the NNR on health, safety and environmental issues connected with the LTO application.

During the public hearings, the NNR panel received oral representations from pre-registered interveners and other members of the public provided oral comments at the hearings. The representations received were from civil society organisations, public interest groups, concerned citizens, members of the public and industry bodies/associations. The NNR also received representations in the form of hand delivered and online written comments from members of the public.

The NNR, following receipt of the representations, performed an analysis of the submission. The analysis enabled the NNR to highlight topical issues that are driving the public comments

or concerns as well as assisting in determining the issues raised related to health, safety, and environment.

The NNR concluded that from the two rounds of public hearings that two themes related to Health, Safety and Environment are driving the public interests and concerns. These issues relate to concerns around Emergency Planning stemming from the exercise findings and the question around the integrity of the 3rd barrier, i.e. Containment with the evidence of cracks and overall status of its support instrumentation.

It is evident from the questions, presentations and request for information that accurate and clear understandable information must be shared with the public to enable an integrated understanding of overall nuclear safety. Nuclear hazards are real and therefore regulated and controlled. The type of control and regulations varies internationally but the principle that primary safety rest with the licensee is universally understood and endorsed.

It is evident from the public hearings conducted that the majority of comments originate from single source information, from media and from sources not independently or peer reviewed for accuracy and/or validity. It is shared between organisations and individuals to use in various representations.

The hearings also showed that there is difference in opinion between various sections of the public and communities:

a) Support for LTO - Some is in support of electricity generation from KNPS because the need for electricity and no-load shedding as they experience inconvenience and an increase in crime. They are concerned about the loss of jobs and impact on the economy. Support was also seen from unions and young participants. Especially those that understand the technology and wish for future opportunities to develop and be recognised as experts both locally and internationally.

b) Support with conditions - Some people have a caveat or view at the end of their presentation that if LTO is approved it must be done with respect to taking safety into considerations, ensure all open items are resolved, and compensation is considered for loss of land.

c) No support for LTO - The people oppose to KNPS continued operation commented from the point that nuclear is not welcomed or necessary because it is dangerous, pose a risk

to health and is not managed safely. The arguments presented in support of this narrative are not always correct or applicable. A number of times reference have been made to perceived or existing weaknesses with the current legislation, regulatory space, known technical issues, licensee operations and conduct.

The analysis found that the issues related to health, safety and the environment are either addressed or dispositioned by the nuclear installations licence conditions, the current licensing basis of the plant, the safety case or are subject to ongoing review by the NNR.

Nuclear operation as with any other activity do pose a risk to the public. This is however an integral part of the nuclear regulation in South Africa.

The peripheral issues and lessons learned from the hearings should be systematically addressed to close out any negativity or gaps in public knowledge and trust in the public consultation process.

7 OUTCOMES AND CONCLUSIONS

Pursuant to the provisions of the NNR Act, the Executive inform the outcome and status of the NNR review of the Koeberg LTO application and to make recommendation on the way forward.

The NNR review found that the LTO application is compliant with the NNR regulations on LTO with respect to:

1) Submission of Safety case for LTO.
2) Factors related to:
   a) Safety related programmes.
   b) Effectiveness of the ageing management programmes.
   c) Revalidation of time limiting ageing analyses, except for the validation of TLAA 301: Concrete Containment Tendon Pre-Stress that involves a time restriction of 8 years for Unit 2 of KNPS.
   d) Utilisation of the periodic safety review.
   e) Programme for LTO.

Considering the status of review and regulation 7(3) of the LTO regulations, the outcome of the assessment supports a variation as follows:

(1) Condition 1.6 of NIL-01, Variation 20, be varied as follows:

This variation of the licence authorises the operation of the Koeberg Nuclear Power Station as follows:

- Unit 1 until 21 July 2044
- Unit 2 until 9 November 2033

This variation of the licence will remain enforced unless:

a) amended for subsequent licensing stages including long term operation; or
b) varied, suspended or revoked.

2) The Executive issue a media statement on the outcome of the deliberations and the decision of the Board.

8 REFERENCES

[1] Regulations in terms of section 36, of the National Nuclear Regulator Act, 1999 (Act no. 47 of 1999), on Safety Standards and Regulatory Practices (GN R388).

[2] Regulations in terms of section 36, read with section 47 of the NNR Act on the Long-Term Operation of Nuclear Installations (R.266).

[3] NNR Interim Regulatory Guide RG-0027 Revision 1: Ageing Management and Long-Term Operations of Nuclear Power Plants.

[4] NNR Interim Regulatory Guide RG-0028 Revision 0: Periodic Safety Review of Nuclear Power Plants.

[5] Nuclear installation Licence no. NIL-01 (Var 19)

[6] Nuclear installation Licence no. NIL-01 (Var 20)

[7] 36-197, Koeberg Licensing Basis Manual, Rev 2

[8] Koeberg Nuclear Power Station Safety Analysis Report, Rev 5c.

[9] LTO Safety Case and PSR material

[10] IAEA, Specific Safety Guide, Ageing Management and Development of a Programme for Long-term Operation of Nuclear Power Plant, SSG-048

[11] RG-0011: Interim Guidance for the siting of Nuclear facilities

[12] Quality & Safety Management Requirements for Nuclear Installations (RD-0034)

ANNEXURE A: CONDITIONS TO ADRESS COMMENTS

No	Regulation in R266	Condition	Classification
1	4(a)	None	n/a
2	4(b)	None	n/a
3	4(c)	None	n/a
4	4(d)	None	n/a
5	4(e)	Implement safety improvements identified in review of SC and planned IIP commitments	Condition
6	5(a)	None	n/a
7	5(b)	None	n/a
8	5(c)	None	n/a
9	5(d)	None	n/a
10	6(1)	None	n/a
11	6(2)	None	n/a
12	6(3)	None	n/a
13	6(4)(a)	None	n/a
14	6(4)(b)	None	n/a
15	6(4)(c)	None	n/a
16	6(4)(d)	None	n/a
17	6(4)(e)	None	n/a
18	6(4)(f)	None	n/a
19	6(4)(g)	None	n/a