Supplementary Safety Evaluation Report

Koeberg Long Term Operation – Unit 2

TR-NPP-25-009

Rev 0

(Addendum to TR-NPP-24-001 Rev 1)

caring excellence integrity openness & transparency teamwork safety & security

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1 INTRODUCTION

Following the regulatory review in July 2024, the NNR granted approval for extending the operating timeframe on Unit 1 and issued Variation 21 of NIL-01 to reflect the new operating timeframe of Unit 1 of 60 years. Noting that the evaluating process for Unit 2 was still in progress, no decision was made on Unit 2.

The applicant was requested to conduct additional tests to determine the material characteristics of the concrete (particularly in the dome area) and to demonstrate the existence of adequate safety margin for the period of LTO on Unit 2.

2 PURPOSE

The purpose of the supplementary safety evaluation report is to document the outcome of:

1) the review of additional information submitted in support of the demonstrating of adequate safety margin on Unit 2.
2) the public consultation process related to the deferred Unit 2 decision.

Compliance with all other aspects related to the LTO regulations is dealt with in the LTO Safety Evaluation Report, TR-NPP-24-001 Rev 1.

3 SCOPE

Applicable to the review of additional information submitted in response to the 2024 Regulatory decision that the safety of the containment building was assessed not to be demonstrated for Unit 2 for the period of LTO.

4 ABBREVIATIONS

E_{mod}	Modulus of Elasticity
ILRT	Integrated Leak Rate Test
LOCA	Loss of Coolant Accident
LTO	Long Term Operation
TLAA	Time-limited ageing analysis

5 REVIEW OF ADDITIONAL INFORMATION

The applicant claimed in TLAA 301 in 2024 that safety criteria are met for the different parts of containment and for the containment dome. The NNR review found that the safety criteria were, however, marginally met with very little or no safety margin at 60 years for Unit 2. The calculations performed by the applicant relied on limited quality data as the data originated from the limitation of the monitoring available and applicable at the time of design and construction. The data limitations including inconsistencies and gaps prompted the applicant to rely on engineering judgement and data analysis to re-interpret the data. These evaluations introduced discretionary criteria that are not part of surveillance procedures.

The quality of the data used as well as the fact that the structural design margins for the dome have been eroded to the minimum led the NNR to arrive at a review conclusion that the safety of the containment building was not demonstrated for Unit 2 for the period of LTO.

The applicant was therefore required to conduct tests to determine the material characteristics of the concrete (particularly in the dome area), such that it can be used to validate the dome part of the containment building and to demonstrate the existence of adequate safety margin for LTO. Such an analysis would also be required to be supported by results and calibration insights obtained from data collected during previous ILRT's.

The applicant conducted the analyses, incorporating the:

1) measured (actual) strain collected during periodic testing (i.e. ILRT data); and
2) measured (actual) material properties of the concrete containment buildings obtained by conducting material tests on concrete core samples harvested from the containment buildings

to cross-validate the TLAA calculation, specifically considering the effect of the LOCA containment pressure.

For the applicants initial TLAA calculation, some of the material properties were based on conservative estimates. The average strains measured during the 3rd ILRTs were used to back-calculate the modulus of elasticity (E_{mod}) for each unit and each strain direction. This demonstrated the conservatism of the use of 40 GPa for the E_{mod} of the concrete used in the TLAA. Reperforming the TLAA using the modified E_{mod}, indicated an increased margin of safety for the period of LTO.

Concrete core sampling and laboratory testing were carried out by the applicant on both containment structures. The test program included measurements of key mechanical properties such as compressive strength, static and dynamic modulus of elasticity, Indirect tensile strength and Poisson's ratio. Consequently, the applicant used the results to reperform the TLAA calculations.

The analysis by the applicant was re-performed for both units of Koeberg and a range of strain data values were used to indicate the upper and lower limit range for the data used. The most conservative results for the E_{mod} values were used. A summary of the revised TLAA can be seen below in Figure 1:

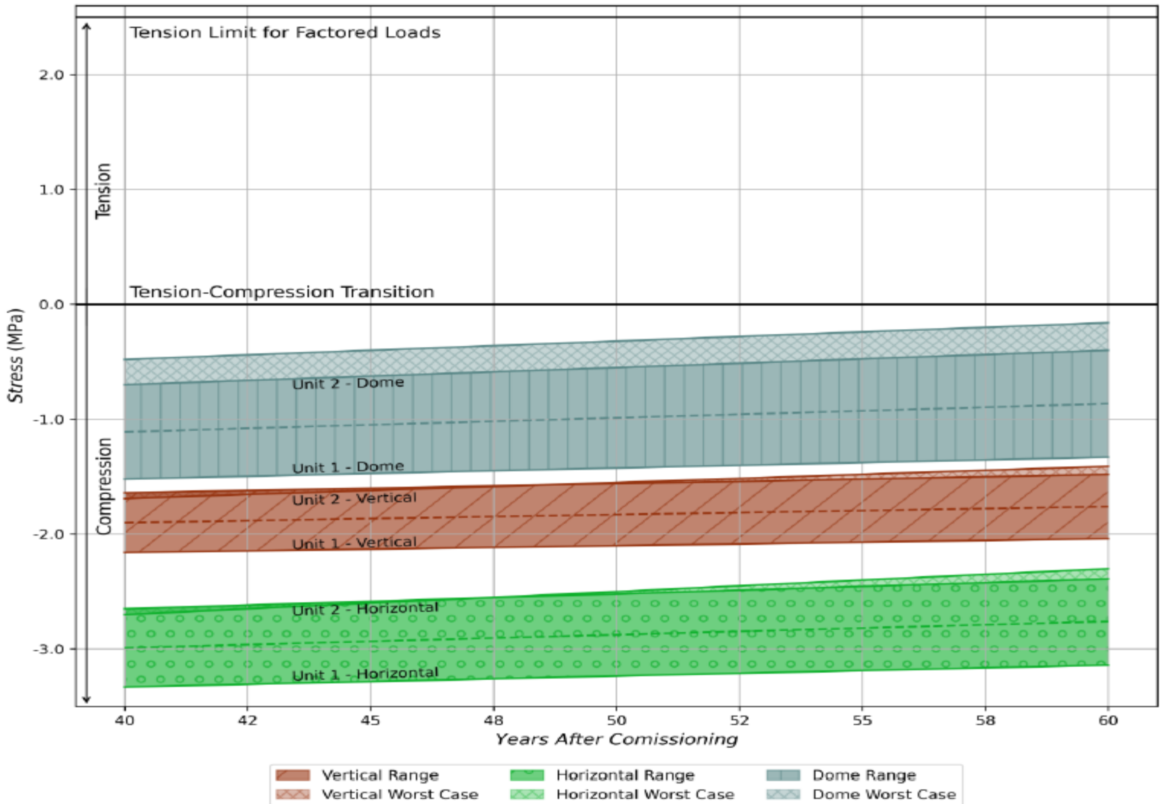

Figure 1: Graphical Summary of TLAA results with most conservative E_{mod}

The results of the applicant's re-analysis demonstrate the adequate safety margin for the intended period of LTO on Unit 2.

The applicants revised analyses benchmarked Koeberg's long-term strain development against the EDF containment structures' monitoring data. The comparison confirmed that the behavior of the Koeberg containments is consistent with that of the EDF fleet.

The applicant incorporated ILRT data from both units, in-situ material testing and benchmarking against the EDF containment fleet in order to validate the dome part of the Unit 2 containment building and demonstrate adequate safety margin for the period of 20 years of LTO.

The NNR independent structural response analyses verified the long-term performance models and the predicted deformations over a 60-year lifespan were confirmed as minimal, indicating the structural integrity is sufficiently demonstrated.

Based on regulatory review of the updated containment re-analysis, the NNR finds that the Koeberg containment structures meet the required design criteria for long-term operation.

6 PUBLIC CONSULTATION

Further to the public hearings held in 2024 and the deferred decision on Unit 2, the NNR received additional information from the applicant in connection with the LTO application. Upon receipt of the additional information, the NNR invited members of the public and interested and affected parties to submit written comments on health, safety and environmental issues pertaining to the additional information submitted by the applicant for Koeberg Unit 2.

The NNR held a third set of hearings comprising of 5 sessions which were held on 29 and 30 September 2025 in the Northern Cape province and on 2,3 and 4 October 2025 in the Western Cape province respectively.

The comments from the written submissions were collated, including the representations registered at the hearings. All comments have been allocated to common themes for ease of administration and for the purpose of providing responses where relevant and or appropriate. he comments. The top 5 themes identified related to health, safety and environment during the hearings relates to:

Table 1: Categorisation of comments according to various themes

Themes
Vaalputs
Emergency planning issues
Public consultation process
Technical documents and issues
Nuclear waste issues

The grouping approach serves to highlight the public's interest in specific safety issues connected with nuclear in general and Koeberg LTO. There was an increase in comments received, compared with the previous consultations. This is attributed to the extent of comments that was received from the communities around Vaalputs, contributing mostly to health, safety and environmental impact concerns.

The distribution of the type of comments received are reflected in Table 2 below:

Table 2: Categorisation of comments into Health, Safety and Environment

Categories	Received during 3rd phase (Public Consultation) in September and October 2025
Health	2.5%
Safety	31.3%
Environment	11.6%
General	54.6%

It is concluded that all the comments linked to the themes that directly relates to health, safety and environment can all be explained, and justification thereof is provided in the Safety Case and associated support documents provided or addressed in the current licensing bases of both KNPS and Vaalputs. All comments were accepted and considered, this despite the fact that some comments have already been addressed and explained with the Unit 1 decision.

7 ASSESSMENT OF COMPLIANCE OF LTO APPLICATION BASED ON R266

In July 2024 the NNR concluded that the LTO application is compliant with the LTO regulations for all factors except for the revalidation of the time limited ageing analyses on Unit 2 for the period applied for.

The assessment of the additional information submitted by the applicant related to the revalidation of the time-limiting ageing analyses on Unit 2 confirms the design margins and addresses the NNR concerns related to the analyses of TLAA 301 on Unit 2 for the 20 year period of LTO.

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

8 SUMMARY AND FINDINGS

The assessment by the NNR of the additional information submitted related to Unit 2 TLAA 301 dome data confirms the respective design margins and addresses the NNR concerns related to the validation of TLAA 301 on Unit 2 for the 20 year period of LTO.

All comments raised as part of representations made during the latest public consultation process have been registered, categorised and analysed.

The analysis of the issues related to health, safety and the environment are either addressed or dispositioned by the nuclear licence conditions, the current licensing basis of the plant, or the safety case.

9 REFERENCES

[1] Nuclear installation Licence, NIL-01 (Variation 21)
[2] TR-NPP-24-001 Rev 1, Safety Evaluation Report (July 2024)
[3] 331-691 Rev 4, Containment Reanalyses for Long Term Operation
[4] TR-NPP-25-008 Rev 0, Representations received during the NNR Public Consultation pertaining to additional information submitted by Eskom for Koeberg Unit 2