safcei SOUTHERN AFRICAN FAITH COMMUNITIES' ENVIRONMENT INSTITUTE

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

To: **THE NATIONAL NUCLEAR REGULATOR**

NNR Programme Manager:

Nuclear Power Plants

The National Nuclear Regulator

P.O. Box 46055

Kernkrag

7441

Per email: KoebergLTO@nnr.co.za

SUBMISSIONS BY THE SOUTHERN AFRICAN FAITH COMMUNITIES' ENVIRONMENT INSTITUTE (SAFCEI)

IN REGARD TO THE ESKOM APPLICATION TO OPERATE THE KOEBERG NUCLEAR POWER STATION (KNPS UNIT 2) BEYOND THE TIMEFRAME ESTABLISHED IN THE NUCLEAR INSTALLATION LICENCE NO. NIL-01 (VARIATION 21).

CONTENTS

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

EXECUTIVE SUMMARY

SAFCEI is a registered non-profit organisation that was established by multi-faith environmental and social justice advocates to confront, among other things, environmental and socio-economic injustices, and to support and encourage faith leaders and their communities in Southern Africa to take action on eco-justice, sustainable living and climate change issues. SAFCEI includes an Energy and Climate Justice Programme that focuses on climate change and energy.

This submission has been endorsed by Project90by2030 and The Green Connection.

ESKOM'S application for long-term operation (LTO) of Unit 2 of the Koeberg Nuclear Power Station (KNPS) must include a Safety Case to *"demonstrate that the regulatory requirements for LTO are met and that it is safe to continue operating the KNPS for an additional 20 years, from 2024 to 2045 for (Unit 2))."*[1] This applies especially to areas critical to defence-in-depth, namely integrity of the reactor containment structure, and the ability to monitor containment structural integrity, internal pressure and temperature. This submission will show that these requirements are not met and therefore the application should be refused, given the KNPS is a highly hazardous installation, and that the public could potentially be gravely at risk if the containment structure is not demonstrated to be safe for any period after the current 40-year licence expires.

We submit that the application

(i) does not comply with all the LTO regulations;

(ii) fails to enable the NNR to consider relevant considerations pertaining to safety and presents irrelevant considerations for consideration, including out of date information, and questionable assumptions and extrapolations; and

(iii) if granted will result in a decision that is irrational unconstitutional and non-compliant with the Promotion of Administrative Justice Act

The status of the containment structure

[1] Safety Case for Long-Term Operation of Koeberg Nuclear Power station page 7

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

The status of the containment dome is of critical importance in deciding whether to licence Unit 2 beyond its current licence. As matters stand, the application cannot provide the NNR with the necessary information to determine if it is safe for the long term for the following reasons:

Repairs to the containment structure regarded as urgent by ESKOM's expert panel ten years ago have still not been done. Safety issues that might arise from the Impressed current cathodic protection (ICCP) implementation and system are therefore not presented to the NNR and the public for consideration and input prior to the decision-making process.

Unit 2 does not have a fully functioning monitoring system and will not have one until 2028/2029. A nuclear power station requires a fully functional containment monitoring system to detect and correct any abnormal condition, before it can give rise to significant consequences for safety. The absence of it undermines defence-in-depth requirements, and consequences for safety could be severe, including a worst-case scenario release of radiation. This is aggravated by the fact that the licence variation application has proposed that this state of affairs continues until at least 2028 or 2029. The project to restore the containment monitoring system is currently only in the stage of a pre-feasibility study. At this time ESKOM does not know if it is even possible to restore Unit 2's monitoring system.

In the absence of data from a fully functioning monitoring system Unit 2 needs an integrated leak rate test (ILRT) to provide critical data to the NNR that it requires in order to make an informed decision on safety Unit 2 for the long term. The results of this test essentially demonstrate if the containment structure will hold in the case of a Loss of Coolant Accident (i.e. partial or full meltdown). It is one of the most important tests that can be done to demonstrate the continued safety function of the containment dome. However, ESKOM has not done an ILRT since 2015. ESKOM's engineers recommended in 2022 that this test be done before the application to extend the licence is considered by the NNR, in 2025, in order to attend to potential risks that are not evident currently. However in conflict with these safety recommendations the test is now planned for 2026, after the application is considered by the NNR.

Aside from the application for LTO, the KNPS is required to undertake an integrated leak rate test (ILRT) every ten years, and five yearly ILRT if there is a breakdown in containment monitoring capability, which is the case currently.

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

The KNPS 3rd periodic safety review (PSR) did not and could not represent the actual status of the plant because of a lack of monitoring data for Unit 2 and an out-of-date ILRT. Out-of-date information is irrelevant in a licensing process generally and especially in one of this magnitude.

Instead of completing the ILRT and the Impressed current cathodic protection (ICCP) project the application presents a new engineering report on the containment structure (hereafter referred to as the "the new containment TLAA" which uses assumptions and extrapolations of data from Unit 1 to Unit 2, and rests heavily upon Unit 2's out-of-date 2015 ILRT results, in order to come to the conclusions that the safety of the plant is assured for the period of long term operation. These assumptions and extrapolations are questionable since no two nuclear reactor units are identical and they give rise to a concern as to why an ILRT is not being undertaken for Unit 2 prior to deciding on the application for long term operation. Importantly the first (i.e. 2022) engineering report on containment (which the NNR said only validated Unit 2's containment structure for 8 years) strongly recommended an ILRT for Unit 2 in 2024 and at worst in 2025. However, this has not been done.

Non compliance with licence

As a result of the above failures the Safety Case cannot demonstrate that the KNPS is currently in compliance with its licence as required by LTO regulation 4(a), as well as justifying continued safe operation for the long term.

In addition, as a condition of the extended licence for Unit 1, the NNR gave deadlines for a range of activities that ESKOM must perform. Many of these activities affect both Unit 1 and Unit 2 and ESKOM has already missed one deadline (January 2025) for the Hardened Water Supply (Modification 12008), thus failing to comply with a condition of its licence. Another such deadline includes the testing of aseismic bearings to establish Koeberg's behaviour in an earthquake. ESKOM may not make the December 2025 deadline for testing of aseismic bearings, according to its own documentation. This information is also required in order to update the emergency plan.

Given the above delays and failures, the application does not present the NNR with the requisite information on safety of Unit 2 in order for it to properly understand the status and safety position of the facility. The result is the NNR is not in a position to make a decision that complies with National Nuclear Regular Act[2],

[2] Act 47 of 1999

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

the LTO regulations, and to justify the continued safe operation of the facility for the period beyond the current licence, and definitely not for 20 further years. It also cannot comply with section 6 of Promotion of Administrative Justice Act[3] (PAJA), which requires the decision maker to consider relevant considerations, and disregard irrelevant considerations. In several important instances pertaining to safety the public has been deprived of the opportunity to comment before the decision is taken.

Rationality and constitutionality

A decision by the NNR to authorize Unit 2 of the KNPS to operate for a further 20 years in the face of these significant safety concerns this will constitute administrative action that fails to be rationally connected to the power granted to the NNR, which is to provide for the protection of persons, property and the environment against nuclear damage through the establishment of safety standards and regulatory practices, and to exercise regulatory control related to safety through the granting of nuclear licences. It will accordingly be irrational and unlawful.

It will also be unconstitutional, for failing to be a reasonable measure as envisaged in section 24 of the Constitution. Authorisation on the basis of the application presented by ESKOM for 20 years of further operation of Unit 2 will be in disregard of applicable international law and will fail to meet international best practice. Under the circumstances it will be unreasonable and unconstitutional.

The long-term extension of the license for KNPS's Unit 2 should therefore not be granted.

1.

INTRODUCTION

The Eskom application is for a variation to the Nuclear Installation Licence No. NIL-01 to operate the Koeberg Nuclear Power Station (KNPS) beyond 21 July 2024 for an additional 20 years until 9 November 2045 for Unit 2. These submissions are made by SAFCEI in response to a notice published by ESKOM as required by the National Nuclear Regulator (NNR), indicating its application to operate KNPS beyond the timeframe established in NIL-01, specifically Unit 2.

[3] Act 3 of 2000

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

SAFCEI contends that this application to vary the licence and grant the authorisation for a further 20 year period of operation for Unit 2 fails to set out a basis for the NNR to make a lawful decision to operate beyond the end of the current licence. The granting of the authorisation applied for by ESKOM will result in an administrative decision that is fatally flawed and subject to being set aside on review in Court.

2.

SAFCEI is a non-profit company incorporated under the company law of South Africa and a registered Public Benefit and Non- Profit Organisation. It makes these submissions:

(i) in its own interests, as contemplated in section 38(b) of the Constitution. It is an organisation primarily concerned with environmental, social-economic, and social justice issues. A procedurally unfair, irrational, and unlawful decision by the NNR in authorising the continued operation of Unit 2 of the KNPS will adversely affect its very reason for existence;

(ii) in the public interest, as contemplated in section 38(d) of the Constitution: the fairness and lawfulness of the decision and the decision-making process to extend the licence for the Unit 2 of the KNPS for a further 20 years raises issues of the highest public and constitutional importance, including public safety, in which all South Africans have an interest.

3.

SAFCEI and its members would be adversely affected by a decision to authorise the operation of Unit 2 for a further 20 years, as such decision will violate the constitutional right to environment of SAFCEI members, as well as their right to fair administrative action. In addition, given that a decision to licence Unit 2 of the KNPS may compromise public safety, as set out in this submission, SAFCEI members may be directly harmed as a result of the release of radioactive material should an abnormal incident occur during the licence period and thereafter during decommissioning.

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

LEGAL FRAMEWORK

The decision sought by ESKOM to extend the life of Unit 2 must comply with the NNR Act and regulations for Long Term Operation (LTO), and must be rational, and a reasonable measure as envisaged by section 24 of the Constitution.[4]

.

For further details on applicable regulations see Annexure "A" to this submission.

Acronyms:

IAEA – International Atomic Energy Agency

ICCP - Impressed current cathodic protection

ILRT - Integrated Leak Rate Test

KNPS- Koeberg Nuclear Power Station

LTO – long term operation

NNR – National Nuclear Regulator

SALTO – Safety Aspects of Long Term Operations

TLAA – time limited aging analysis

3. INABILITY TO JUSTIFY CONTINUED SAFE OPERATION AND CURRENT COMPLIANCE - LTO REGULATION 4(a) AND 4(c)

ESKOM cannot demonstrate compliance with current regulatory requirements for the KNPS in at least the following respects. It also cannot provide *an overall assessment of safety and justification for the continued safe operation of the plant for the intended period of long-term operation* of Unit 2 as required by LTO regulations 4(a) and 4(c):

[4] Section 24 of the South African Constitution states that everyone has the right

a) To an environment that is not harmful to their health and well being; and

b) To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that

(i) Prevent pollution and ecological degradation.

(ii) Promote conservation; and

(iii) Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

3.1 monitoring of the containment structure;

3.2. five yearly integrated leak rate test;

3.3 completed ICCP;

3.4 compliant last periodic safety review;

3.5 aseismic bearings test;

3.6 up to date emergency plan.

3.1 Monitoring of the containment structure (dome)

The Safety Case cannot justify continued safe operation of Unit 2 for the intended period of long-term operation, without a fully functional monitoring system for the containment structure which is currently absent.

The IAEA safety standards, to which the NNR adheres, require a fully functional monitoring system for the containment structure of nuclear power stations, and for their long term operation, for defence in depth.[5] *Monitoring of the structures is part of the licence binding activities of the KNPS and shall be conducted in full compliance with the Nuclear Installation Licence granted by the NNR*. Accordingly, periodic monitoring by means of dynamometers, invar wires, pendulums, strain gauges and thermocouples is an essential part of the licensing basis of the KNPS.[6]

However, Unit 2 has not had fully functional monitoring of the containment structure for several years, and does not intend to implement such monitoring on Unit 2 until 2028 and 2029.

[5] https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1189_web.pdf IAEA Safety Standards: Design of Reactor Containment systems for Nuclear Power Plants states at INSTRUMENTATION AND CONTROL SYSTEMS 4.215. To provide defence in depth and to enhance the general reliability of the containment systems, instrumentation should be provided for the purposes of: (a) Detecting deviations from normal operation, (b) Monitoring the stability of the containment structure, (c) Leakage testing and integrity testing, (d) Monitoring the availability of the containment systems, (e) Providing actuation signals for containment systems, (f) Post-accident monitoring

[6] 331-691 Containment Re-Analysis for Long-Term Operation (hereafter simply called the new containment TLAA) at page 30

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

6.

The new Containment-Re-Analysis-for-Long-Term-Operation-Revision-4[7] of 2025 (new containment TLAA) lays bare the extent of the collapse of the monitoring system. Nothing quite highlights this as the dome structure. The report states:

> *6.3 Dome Strain*
> *The strain measurements for the domes exhibit some variability compared to the more consistent readings observed in the vertical and horizontal strain measurements on the walls. The data is sparse with numerous gaps and outliers. Therefore, the strain gauge results need to be closely considered and scrutinized.*
>
> *Unit 2 has no meaningful readings that can be compared with the Unit 1 strain. Note the figure below (Figure 32) for the 8 strain gauges on the domes (4 per Unit).* ***The Unit 2 data is limited and is disregarded for the remainder of the report.***

7.

Safety for the long term not demonstrated

For the long-term operation, a fully functional containment monitoring system is critical to the containment structure being able to perform its safety function. See SALTO report:

> *2.2 – SAFETY CONSEQUENCE: Without a fully functional containment monitoring system, not all necessary data for the containment structure will be available to demonstrate the intended safety function during LTO.*[8]

The lack of fully functional monitoring together with no Integrated Leak Rate Test (ILRT) since 2015 results in the Safety Case being unable to provide an overall assessment of the safety of the nuclear installation and justification for continued safe operation for the intended period of Long Term as required by LTO regulation 4(c).

7 Id page 54
8 Salto report page 61

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

During the 3rd Periodic Safety Review (PSR) ESKOM just did not take into account the actual status of Koeberg as it did not have dome data for Unit 2. This is further highlighted by the NNR's own statement in the licence decision:[9]

> *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.*

The new containment TLAA also states:[10]

> *The increasing number of non-functioning monitoring devices is a concern. It is clear from the strain data, for example, that the* ***Unit 2 Dome does not have sufficient monitoring equipment.***

8.

The application for LTO uses extrapolations of findings from Unit 1 to Unit 2 containment structures in order to address this deficiency. This is indicative of the fact that ESKOM does not know the actual state of Unit 2 and neither, therefore, can the NNR. An estimate, extrapolation or engineering judgement is not certain knowledge would only be useful if made between two identical entities, which unit 1 and unit 2 are not. The said extrapolations are therefore irrelevant considerations and the NNR may not take them into account when making its decision. Further discussion of this issue is contained in paragraph 6.1 below.

To project the status of Unit 2's containment structure, the TLAA relies heavily on the data from the 2015 ILRT. That data is out of date therefore irrelevant because Unit 2's containment structure cannot be described with certainty as being in precisely the same state as it was 10 years ago.

The NNR cannot make an informed decision about the status of the containment structure without hard data and that data set must run over time: in fact, from Unit 2's commissioning. To revalidate the TLAA, ESKOM requires data from an ILRT. This is quite apart from the fact that the facility requires an ILRT's at least every 10 years, and every 5 years where *containment monitoring instrumentation does not remain functional*. (see Annexure B for detailed regulations.) However, this has not taken place.

9 Filename: OCR TR-NPP-24-001-LTO-Safety-Evaluation-Report.pdf Page 67
10 Filename: NEW Containment-Re-Analysis-for-Long-Term-Operation-Revision-4_-Redacted.pdf See page 119

A company not for profit REG No 2006/014388/08 NPO 053498 PBO 930024255

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

9.

Feasibility of repairing the containment monitoring system

One very concerning aspect of the new containment TLAA relates to plans to restore the monitoring system to full functionality, slated for 2028 and 2029. This is a condition of licence for Unit 1 and will surely be so for Unit 2. However, the new containment TLAA states:[11]

> *As an interim bridging strategy, ESKOM is currently installing additional modern online monitoring equipment in the form of externally mounted Vibrating Wire Strain Gauges (VWSGs) and Optical Fibres on the domes and walls of the containment buildings prior to X27 ILRTs outages, in efforts to supplement the existing EAU system and to improve the quality of the monitoring data. The information obtained from the bridging strategy shall be used as an input data into* ***the feasibility studies****.*
>
> *Furthermore, the following requirements are prescribed to a modification* ***(which is currently in pre-feasibility stage)*** *by the Responsible Engineer…..*

10.

Given that even pre-feasibility of restoring the monitoring system to functionality is not yet established it is premature to authorise the extension of the licence for Unit 2.

11.

The TLAA of the containment structure cannot be validated without knowing whether the monitoring system on Unit 2 will become fully functional. (The assertion that the TLAA is not part of LTO is refuted in Section 5 at paragraph 63 below).[12] The fact that a pre-feasibility study is not complete, let alone a feasibility study, highlights a profound dereliction of duty on the part of ESKOM. Parts of the monitoring system

11 Filename: NEW Containment-Re-Analysis-for-Long-Term-Operation-Revision-4_-Redacted.pdf Page 120

[12] ICCP needs to be completed and then the TLAA for the containment structure validated which needs fully functional monitoring.

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

started failing in the mid 2000s: to take two decades to get to an incomplete pre-feasibility study indicates that ESKOM is not competent to operate Unit 2 for any period beyond its current licence.

Regulation 4(c) requires the Safety Case to *justify continued **safe operation** for the intended period of long-term operation,* which requires fully functional monitoring of the containment structure. This requirement is not possible to meet until a fully functional monitoring system is installed. The Safety Case therefore fails the requirement of 4(c) and the licence for LTO should not be granted.

3.2 Integrated Leak Rate Test (ILRT)

The absence of an ILRT prior to the NNR decision on the LTO application results in the Safety Case being unable to provide an overall assessment of the safety of the nuclear installation and justification for continued safe operation for the intended period of Long Term given the 9 year and ten month lapse of time since the last ILRT and the lack of functional containment monitoring.

Given the absence of a functioning containment monitoring system on Unit 2, ESKOM had no option but to undertake an ILRT in order to present the NNR with actual data on the structural integrity of the containment structures, and to enable the NNR to make a decision on whether the Safety Case can *justify continued safe operation for the intended period of long term operation.* It was also necessary in order to enable Eskom to mitigate risks that might become evident during the test and which might otherwise not be known.

An ILRT[13] is a vital test to demonstrate whether the containment structure will hold in the case of a Loss of Coolant Accident ("LOCA" i.e. partial or full meltdown) and is therefore one of the most important tests that can be done to demonstrate the continued safety function of the dome. In the absence of functional monitoring there is no substitute for an ILRT for determining structural integrity and *justification for continued safe operation* of the dome after 40 years. The assumptions, extrapolations and engineering judgments presented in the application by ESKOM cannot provide the level of confidence required by the

[13] This refers to a Type A leak test. F. "Type A Tests" means tests intended to measure the primary reactor containment overall integrated leakage rate (1) after the containment has been completed and is ready for operation, and (2) at periodic intervals thereafter. Type B and C are not relevant for this submission.

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

NNR and the public for determining safety of the facility, which is an inherently highly hazardous installation. Of concern is the fact that ESKOM is applying for a twenty-year extension of the licence for Unit 2 on the basis of an out-of-date ILRT – the last one having been done in 2015. And it also does not intend doing an ILRT on Unit 2 before the NNR considers the application for LTO.

13.

The ILRT is both a cyclical (10 year) requirement, as well as a five-year requirement where there is a failure in containment monitoring. (See regulatory provisions for leak testing discussed in Annexure B hereto).[14] ESKOM has not complied with the five-year test requirement and hence the Safety Case cannot meet the compliance requirement of LTO regulation 4(a).

14.

However aside from these regulatory requirements, an ILRT is critical to determining whether operation beyond the 40-year licence is justifiable, as was presented to ESKOM management during a senior review board meeting (see full quote in the next paragraph):[15]

> *"By the time that the LTO Safety Case is due in 2022 Koeberg will not meet all the NNR requirements for ageing management to provide confidence of the long-term integrity of the civil containment structures. It is likely that the situation will remain at 40 years of operation. Before the expiration of the current licence variation therefore Koeberg will have to provide a justification for continued operation to exceed 40 years. Successful ILRT results on the containment structures are required before 40 years (in x26 Outages) to provide confidence of containment integrity in the short term."*

15.

[14] See reference to regulatory standards applicable in Annexure B below
Key dates for ILRT at Unit 2
2015 ILRT test: conducted 28/10/25 to 01/11/25
2015 ILRT test results analysed and accepted within ESKOM: 26/01/2016 [14]
The Licence expiry date Unit 2, 9 November 2025

[15] 9_Engineering_Position_on_Containment_Structures_for_Long_Term_Operation_Redacted.pdf, document 331-623 at page 14

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

The importance of an ILRT is noted in the first (ie 2022) engineering report on containment structures, for other reasons as well. They include enabling ESKOM to mitigate LTO risks and solve issues that might exist, and to provide the KNPS with sufficient time to develop the Safety Case.

3.5.4 Tendon Condition

It is noted that the tendons form the core of the structural strength of the structures. As such the TLAA [1], previous numeric analysis [7] and Section 5.1 of this report carefully considers the tendons.

Furthermore, previous investigations conducted by Eskom and his appointed Inspector [8] indicated that, in general, the tendon ducts were in good condition at the time.

3.6 ILRT

An integrated leak rate test (ILRT) is a full-scale functional test to confirm the integrity of the containment structures by replicating the conditions of a loss-of coolant accident (LOCA). The test includes increasing the pressure inside the containment structures to 400 kPa.

The ILRT (and associated Structural Integrity Test (SIT)) is a method to determine the functional behaviour of the containment structures and can be used to provide confidence in the structural integrity of the structures, i.e., if any concerns exist, an ILRT shall confirm the behaviour of the structures under LOCA pressures and mitigates the risk of uncertainty that may exist for the short term from when the ILRT was performed.

The previous ILRTs (2015) confirmed elastic behaviour and structural integrity of both 1HRX and 2HRX.

ILRTs are performed 10-yearly in accordance with in-service inspection requirements and the next planned ILRTs was planned for outages X27. It was however decided that if the ILRTs were to be conducted in X26, it would give KNPS sufficient time to mitigate risks. It was subsequently decided that the ILRT may be moved to X26 to mitigate these risks, which include

1) LTO risks,
2) provide KNPS with time to solve issues that may exist, and to
3) provide KNPS with sufficient time to develop the safety case.

The following was presented to management during a senior review board meeting:

"By the time that the LTO Safety Case is due in 2022, Koeberg will not meet all the NNR requirements for ageing management to provide confidence of the long-term integrity of the containment civil structures. It is likely that this situation will remain at 40 years of operation. Before the expiration of the current license variation therefore, Koeberg will have to provide a Justification for Continued Operation to exceed 40 years. Successful ILRT results on the containment buildings are required before 40 years (in X26 Outages) to provide confidence of containment integrity in the short term."

"This strategy provides Koeberg with improved arguments for exceeding 40 years operation (in the short-term) while actions to achieve the remainder of the NNR ageing management requirements are due."

It is reiterated that the ILRTs will confirm structural integrity of containment structures, however there are no statutory requirements to perform the ILRTs during x26. Therefore the ILRT might be moved back to x27 to mitigate other organizational risks.

It is also worth noting that this report on containment was approved by Eskom in 2022, but three years later still no IRLT has been conducted on Unit 2.

A company not for profit REG No 2006/014388/08 NPO 053498 PBO 930024255

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

In the United States Nuclear Regulatory Commission's *Generic Aging Lessons Learned (GALL) Report* both the monitoring system and ILRT's feature substantially in the aging management programme for the containment structure.[16] Given the NNR's adherence to USA standards in this domain, such approaches should be applied to the KNPS application for long term operation.

17.

The new containment TLAA pushes the date for the ILRT to 2026. The TLAA states "*An Integrated Leak Rate Test (ILRT) is scheduled for the planned outages X27 for 2025 on Unit 1 and 2026 on Unit 2."*[17]
What the new containment TLAA represents is a step backwards. The first (2022) engineering report on containment states that the ILRT should happen **before** the licence decision so any necessary repairs (arising from results of the test) can be attended to prior to that decision. As the new containment TLAA puts the ILRT after the licence decision, any repairs would axiomatically come after the licence decision. In effect, the new containment TLAA is a weaker document from a safety governance perspective than the first one (TLAA 301), which the NNR said only validated the Unit 2 containment structure for 8 years.[18]

18.

Unit 2's containment structure has more problems than Unit 1, especially regarding the data available on the structure, something that an ILRT would partially (but only partially) resolve. About the lack of data, the NNR stated in its licence decision for Unit 1 and about Unit 2:

> *The quality of the data used as well as the fact that the structural safety margins for the dome [Unit 2] 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.*[19]

16 Filename: GALL ml103490041.pdf
17 Filename: NEW Containment-Re-Analysis-for-Long-Term-Operation-Revision-4_-Redacted.pdf See page 119
18 https://nnr.co.za/wp-content/uploads/2024/07/TR-NPP-24-001-LTO-Safety-Evaluation-Report.pdf at page 67
19 Filename: TR-NPP-24-003-Report-on-Koeberg-LTO-public-representations-receivedOCR.pdf See page 12

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

Therefore, it is critical that the NNR has all the possibly available hard data about Unit 2 that it can obtain. An ILRT, which even ESKOM said was best done in 2024, would provide some of that data. What the NNR has now is data from an ILRT that is 9 years and 10 months old. By the time the NNR makes a decision, the data from the 2015 ILRT will effectively have expired, so to speak.

19.

The Structural Integrity Test is a test associated with the ILRT which further enables the NNR to evaluate the structural integrity of the containment structures. The first (2022) engineering report on containment states:[20]

> *The ILRT (and associated Structural Integrity Test (SIT)) is a method to determine the functional behaviour of the containment structures and can be used to provide confidence in the structural integrity of the structures, i.e.,* ***if any concerns exist, an ILRT shall confirm the behaviour of the structures under LOCA pressures*** *and mitigates the risk of uncertainty that may exist for the short term from when the ILRT was performed*.

To say the least, concerns do exist. In fact, the new TLAA 301 tries to address the NNR significant concerns (i.e. lack of monitoring data) and the fact that the NNR only validated Unit 2 for 8 years. It follows that according to ESKOM, an ILRT needs to be done in order for the NNR to know the containment structure's behaviour under pressure.

20 OLD 9_Engineering_Position_on_Containment_Structures_for_Long_Term_Operation_Redacted.pdf, document 331-623 at page 14

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

The role of the ILRT in alerting the operator to previously unknown problems related to corrosion has been demonstrated with French plants like Koeberg and necessitated significant repairs:[21]

- FRANCE.

IRS-Nº 1288. GO (Ref.15) shows that some corrosion problems in the liner were found in some of the 900 MWe unit containments. In Bugey-4, these problems were found during the ILRT in 1990. Since that time, all EDF 900 MWe units have been scrutinized for this issue. The findings were some corroded parts and a few holes in the lower part of the liner (truncated region, beneath the dead concrete layer at the bottom of the reactor containment). According to an EDF safety study, the observed damage is not subject to aggravation under the mechanical stresses resulting from an accident, and in no case should yield an accidental radioactivity release into the environment. Nevertheless, all 900 MWe units are checked and fixed, when appropiate, to make them fully comply with the design requirements; methods include concrete injection, repair of holes and corroded parts, fixing and protection of the seals between the liner and the covering dead concrete layer. As of March 1995, nine units are fully repaired, and the works on the twenty-five remaining units are due to be completed by the end of 1997.

20.

Clearly an ILRT is required for the NNR to understand what the actual state of the KNPS is. There could be hitherto unknown problems, and it cannot be assumed that such problems do not exist. ESKOM is required to demonstrate the safety of the plant for the long-term operation and, given that ILRT's across the world have identified problems necessitating repairs, ESKOM cannot demonstrate the plant's safety in the absence of an ILRT. Neither can the NNR.

21.

The length of time that it should take to do an ILRT is demonstrated by the Korea Institute of Nuclear Safety to be two and half days:[22]

> *The ILRT is conducted as critical path work during the outage. During the test, the containment is isolated preventing any other maintenance work on the containment from being performed. A single test results in ~2.5 lost days of generating capacity.*

21 csni-r1995-25.pdf page 17

22 376 최종수.pdf page 1

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

Thus, and because Unit 2 has a lengthy outage coming, it is extremely difficult to believe that there is insufficient time for an ILRT to be conducted. When ESKOM conducted the 2015 ILRT, the test occurred from 28 October 2015 to 1 November 2015.[23]

22.

It is clear that in the absence of an ILRT prior to the NNR decision on the LTO application results in the Safety Case being unable to *provide an overall assessment of the safety of the nuclear installation and justification for continued safe operation for the intended period of Long Term* as required by LTO regulation 4(c), given the 9 year and ten month lapse of time since the last ILRT and the lack of functional containment monitoring. The true status of the containment structure is not fully known and confidence in the containment has not been established. The public and the NNR will also not be given an opportunity to consider and comment on the findings of an ILRT which may raise issues relating to safety of the facility. The extension of the licence should not be granted, especially given the critical importance to public safety of the containment dome

In addition, an IRLT is required where the PSR has insufficient data, and since the latest PSR (2022) did not have the benefit of fully functional containment monitoring and the last ILRT was in 2015, the PSR was not compliant, for want of being based on up-to-date information. [24]

23.

3.3. ICCP

As a result of the failure to timeously implement the ICCP safety of the dome cannot be assessed and continued safe operation after expiry of the licence cannot be justified. LTO regulation 4(c) is not complied with.

23 NEW Containment-Re-Analysis-for-Long-Term-Operation-Revision-4_-Redacted.pdf Page 82

24 240-134382460. Authorised 2021-01-22. See also paragraph 47 below.

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

The KNPS containment structures are in an advanced state of *chloride ingress and rebar corrosion* as was observed by the Eskom's expert panel in 2015.[25] The panel stated that as a result it was *unable to provide a reliable estimate as to the period that the containment buildings will still be able to meet their design basis.* And:

Unless prevented using a suitable repair strategy, corrosion damage to the post-tensioned (PT) ducts and subsequently, in the tendons can be expected in the future. [26]

24.

The state of the tendons is of crucial importance to safety of containment buildings:

> *The Expert Panel was informed by ESKOM that corrosion of the PT tendons would probably result in the end of the operational service life of the containment buildings at KNPS. The prevention of corrosion of the PT ducts and tendons is therefore of paramount importance for this project.*[27]

25.

The following is a summary of the Panel findings on containment corrosion:

> *Containment Unit 2 at KNPS is showing a progressed state of reinforcement corrosion damage. The following aspects summarize the Expert Panel's assessment of the degree of deterioration:*
> *• Significant rebar corrosion damage has developed since the condition assessment performed in 2002 [1]. This indicates that the structure is in an advanced state of corrosion propagation.*
> *• In reinforced concrete structures with such a high degree of corrosion damage future damage can be expected to develop exponentially with time.*
> *• Considerable additional rebar corrosion damage can be expected to develop in currently undamaged locations (in the near future). Substantial additional spalling may be observed in as little as 1-2 years from now.*
> ***• Unless prevented using a suitable repair strategy, corrosion damage to the post-***

25 Filename: f) JN465-NSE-ESKB-R-5704 Rev0 Expert Panel Main Report redacted.pdf See page 21
26 Filename: f) JN465-NSE-ESKB-R-5704 Rev0 Expert Panel Main Report redacted.pdf See page 21
27 Filename: f) JN465-NSE-ESKB-R-5704 Rev0 Expert Panel Main Report redacted.pdf See page 25

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

tensioned (PT) ducts and subsequently, in the tendons can be expected in the future.

• A long-term repair strategy should be implemented as soon as possible to ensure that the functionality and serviceability of the containment structures are not compromised. The expert panel is unable to provide a reliable estimate as to the period that the containment buildings will still be able to meet their design basis due to the advanced state of chloride ingress and rebar corrosion.[28]

26.

Several undertakings to implement ICCP have been made in the years since this report by ESKOM and this program has been included in the Unit 1 license for completion in 2025.[29] However ESKOM has indicated that this will not take place until 2026, ie it will only take place after the consideration of the LTO application for Unit 2. This has significant potential consequences for safety and the Unit 2 LTO application.

27.

The ICCP is considered mandatory by ESKOM's Life of Plant Plan approved by ESKOM in 2022:[30] The same document helpfully has a table[31] stating that ICCP should be done on both units between 2021 and 2024.

Currently, patch repairs have been completed on 1 and 2HRX. These maintenance works are conducted as part of a project under an Equivalency [19]. The work is not sustainable nor permanent, as the anode (part of the structure which corrodes) 'moves' next to where the anode used to be, i.e. the area which the patch repair is applied to. The repairs are non-structural and only about 11% of the structures' surfaces have been rehabilitated. The areas adjacent to the patched areas will now corrode at an accelerated rate.

---

28 Filename: f) JN465-NSE-ESKB-R-5704 Rev0 Expert Panel Main Report redacted.pdf See page 21

29 Filename: k10001925N-NIL-01-Condition-16.4-LTO-directive.pdf Pages 1-3
This directive addresses the conditions for Long Term Operation as covered by condition 16.4 of NIL-01, Variation 21. 1) The extended operation of KNPS Unit 1 is subject to the following conditions:
*a) I**mplementation of all commitments as listed with the timeframes specified** in Tables A.2-1, A.2-2, and A.2-3 of Appendix A of the Safety Case for Long-Term Operation of Koeberg Nuclear Power Station, 331-618, Rev 3.*
*b) I**mplementation of all planned safety improvements with the timeframes** as identified in Appendix I of the 3rd Periodic Safety Review Global Assessment and Integrated Implementation Plan Report, 331-608, Rev 2.*)

30 Filename: KBA0022NNEPOLOPP164_REV_3_Containment_PR.pdf See page 27

31 Filename: KBA0022NNEPOLOPP164_REV_3_Containment_PR.pdf Page 31

A company not for profit REG No 2006/014388/08 NPO 053498 PBO 930024255

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

An expert panel was appointed by ESKOM which looked at long-term permanent solutions. The panel [8] recommended that ICCP (Impressed current cathodic protection) be adopted as a long term solution.

Current plans are to install ICCP on both HRX structures under Mod 16002. A TRS has been compiled and approved [4] for the design of such a system. Once the design is approved by ESKOM and the NNR, the system will be installed. Hydrogen embrittlement is a degradation mechanism linked to ICCP system and as such, it was considered in the TRS [4] and to be taken into account as part of the design and subsequent installation, which will become available as the ICCP project progresses. Furthermore, CR 109937-008 GA has been raised to compile Ageing Management Programme for Containment ICCP which will be procured as part of TRS [4].

This will limit the need for patch repairs and is considered mandatory for the life extension of the containment structures to achieve a 60 year operating life.

28.

The following table from ESKOM's Life of Plant Plan states when ICCP should be done on both units and how much it will cost.

7 LIFE CYCLE PLAN AND EXPENDITURE

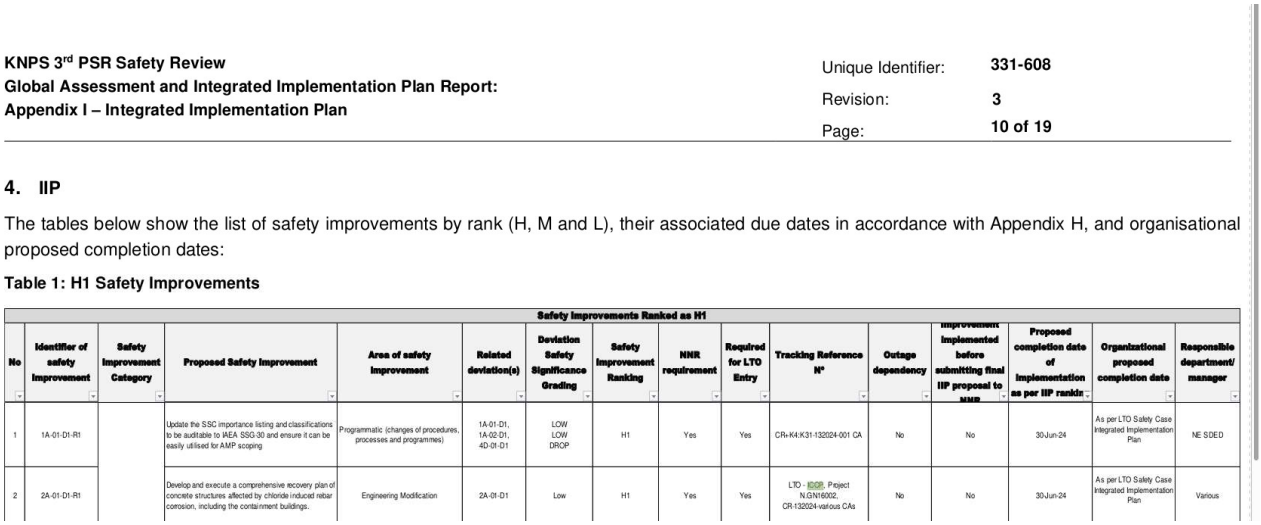
The life cycle plan and expenditure for planned and future modifications on the containment structures appear below. The objective is to plan for a 60-year plant life i.e. until 2045 plus 10 years decommissioning.

YEAR	COST (R)	CAPITAL/ R&E	REASON	IDENTIFICATION
2021	350K	R&E	Inspection as per KAU-030 (including online monitoring)	Monitoring
2021	40M	Capital	Concrete repairs/Waterproofing/ Coatings/Online monitoring equipment, maintenance replacement	Refurbishment
2021-2024	140M	Capital	ICCP on 1&2 HRX (Design/Mock-up/Implementation)	Mod:N.GN16002

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

29.

The Periodic Safety Review (PSR) is the basis of the Safety Case and, as such, it identifies key areas of concern. Regarding ICCP, the PSR's integrated implementation plan (necessary modifications, repairs, etc) states that ICCP is an NNR requirement, is necessary for LTO entry and gives a proposed date of completion of 30 June 2024. See image below, row 2.[32] The integrated implementation plan was approved by ESKOM on 12 January 2022.[33]



KNPS 3rd PSR Safety Review
Global Assessment and Integrated Implementation Plan Report:
Appendix I – Integrated Implementation Plan

Unique Identifier: 331-608
Revision: 3
Page: 10 of 19

4. IIP

The tables below show the list of safety improvements by rank (H, M and L), their associated due dates in accordance with Appendix H, and organisational proposed completion dates:

Table 1: H1 Safety Improvements

Safety Improvements Ranked as H1														
No	Identifier of safety improvement	Safety improvement Category	Proposed Safety Improvement	Area of safety improvement	Related deviation(s)	Deviation Safety Significance Grading	Safety improvement Ranking	NNR requirement	Required for LTO Entry	Tracking Reference N°	Outage dependency	Improvement implemented before submitting final IIP proposal to NNR	Proposed completion date of implementation as per IIP ranking	Organizational proposed completion date	Responsible department/ manager
1	1A-01-D1-R1		Update the SSC importance listing and classifications to be auditable to IAEA SSG-30 and ensure it can be easily utilised for AMP scoping	Programmatic (changes of procedures, processes and programmes)	1A-01-D1, 1A-02-D1, 4D-01-D1	LOW LOW DROP	H1	Yes	Yes	CR-K4-K31-132024-001 CA	No	No	30-Jun-24	As per LTO Safety Case Integrated Implementation Plan	NE SDED
2	2A-01-D1-R1		Develop and execute a comprehensive recovery plan of concrete structures affected by chloride induced rebar corrosion, including the containment buildings.	Engineering Modification	2A-01-D1	Low	H1	Yes	Yes	LTO - [redacted] Project N.GN16002, CR-132024-various CAs	No	No	30-Jun-24	As per LTO Safety Case Integrated Implementation Plan	Various

30.

ESKOM's safety documentation states that ICCP should be done prior to LTO entry

The Safety Case's implementation plan deadline for ICCP is 2024. The Safety Case was approved by ESKOM on 23 October 2023.[34]

32 Filename: 331-608-Rev-3-Appendix-I-Integrated-Implementation-Plan-IIP.pdf See page 10
33 See page 4, section 2.3 in 331-608-Rev-3-Appendix-I-Integrated-Implementation-Plan-IIP.pdf
34 Filename: 331-618-Safety_Case_for_Long-Term_Operation_of_Koeberg_Nuclear_Power_Station-Rev3.pdf See page 41

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

Table A.2-1: *Activities After LTO Implementation – Ageing Management*

Activity Title	Activity Description	Activity Progress	Safety Case Commitment Date	Activity Status	NNR Status
Civil – Containment Structure Testing					
Containment Integrated Leak Rate Testing (ILRT)	Perform containment ILRT test to confirm containment structural integrity.	Contract placed with EDF. Establishing the ILRT team. Finalisation of the strategy and test document in progress. There is no risk associated with this test as it is conducted in accordance with the ISI programme requirements.	Outage 127 and 227	On Track	
Civil – Modifications and Replacements					
Impressed Current Cathodic Protection (ICCP)	Implementation of the ICCP modification into the concrete of the containment buildings to neutralise the effects of chloride ingress.	Detailed design of mock-up is complete. Mock-up design awaiting approval. Eskom addressing NNR comments on detailed design, k29899N.	2025	On Track	

31.

Appendix A of the latest version of the Safety Case clearly says that ICCP needs to be installed in 2025:[35]

A.2 Activities After LTO Implementation

Table A.2-1: *Activities After LTO Implementation – Ageing Management*

Activity Title	Activity Description	Comment	Completion Date
Civil – Containment Structure			
Containment monitoring instrumentation (Linked to IAEA mission finding – Issue area E2)		Modification to be presented at MRC.	Outages 129 and 229
Containment Integrated Leak Rate Testing	Perform containment ILRT test to confirm containment structural integrity.	On track for the scheduled outages. Contract is in place.	Outages 127 and 227
Impressed Current Cathodic Protection (ICCP)		The mock-up for the modification is complete. Modification is on Track.	2025

National Nuclear Regulator commits to ICCP as part of CNS

35 Filename: ANNEXURE A Form 2 THE LATEST VERSION OF THE SAFETY CASE 26012023.pdf See page 211

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

The NNR's 9th report (2022) to the CNS directly mentions the need for a ICCP for an LTO and that there are significant issues with the containment structures. The report states in section *19.3.6.4 - Structural integrity and containment structures*:[36]

> *"Both Unit 1 and Unit 2 containment buildings show significant corrosion-related concrete damage, which has considerably increased over the last 10 to 15 years. For the most part, the damage is superficial. However,* ***to ensure that the building remains structurally sound, the installation of impressed current cathodic protection (ICCP) on both units is advised for the LTO of KNPS****. The solution of ICCP was derived through research conducted by the University of Cape Town and an international expert panel.* ***The purpose of the system is to protect the steel components (rebar and post-tensioned tendon tubes) from corrosion and ultimately ensure that the containment civil structures remain under post tensioning for the LTO of the KNPS.***
>
> *ESKOM has contracted the services of an international supplier who specialises in nuclear engineering to ensure a sound ICCP design that does not affect the integrity of the third barrier (containment). The supplier has partnered with a design firm with vast experience in the design of cathodic protection systems as well as computer modelling of impressed current.*
>
> ***The ICCP project budget was approved in 2019 and funding was obtained in March 2020 for the design and implementation of the ICCP. The project has progressed to the initial phases of ICCP design and will be completed prior to 2024."***

32.

From this undertaking it is clear that the NNR is aware of significant problems with the containment structure. Secondly, the solution to those problems is ICCP. Thirdly that ICCP is necessary for an LTO. Finally, the NNR has made a formal commitment under the CNS that ICCP would be done prior to 2024 and hence prior to any licence decision on the LTO for Unit 2. It is worth reiterating that the CNS has been ratified by parliament.

33.

36 Filename: report to iaea cns_national_report_2022_south_africa.pdf Page 167 & 168

A company not for profit REG No 2006/014388/08 NPO 053498 PBO 930024255

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

Yet, this will not happen as per these plans and undertakings. In an LTO update dated 8 April 2025, ESKOM states that:

> *The implementation of the ICCP modification is a first-of-a-kind initiative, requiring innovative solutions and rigorous validation. A number of delays have resulted in an adjustment of the detailed design that has now been submitted to the NNR for approval. Once approved, the installation can be contracted and only then will a credible schedule become clear.*[37]

34.

It is not known whether the NNR has approved the ICCP design. What is clear is that continual delays in the implementation of ICCP, and the advanced state of chloride ingress and rebar corrosion is creating a potential risk that the functionality and serviceability of the containment structures could be compromised, and by implication a safety risk could be created, as is clear from the expert panel report of 2015 regarding Unit 2.

35.

The new containment TLAA, approved by ESKOM on 9 July 2025, states that:

> *An Integrated Leak Rate Test (ILRT) is scheduled for the planned outages X27 for 2025 on Unit 1 and 2026 on Unit 2. This ILRT requires that the concrete surface be inspected during the pressurisation tests. Accordingly, the ICCP only be [sic] installed post the ILRT.*[38]

The fact that the ICCP will not be done in 2025, represents a failure of implementation at ESKOM, given the vital nature of it for an LTO (according to the NNR's own report). ESKOM will not be in a position to demonstrate compliance with its licence for Unit 1 as a consequence of the said delay.

37 Filename: ESKOM update ICCP Public-Information-Summary-as-shared-at-Public-Safety-Information-Forum-Mar-2025 (1).pdf See page 1.
38 Filename: NEW Containment-Re-Analysis-for-Long-Term-Operation-Revision-4_-Redacted.pdf See page 119

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

36.

However in order to attempt to address the challenges that these facts pose, the LTO application for Unit 2 has introduced certain assumptions regarding containment and chloride ingress. The new containment TLAA rests upon three section 3.3 at paragraph 36 above[39] that downplay the concerns over the delay of ICCP. We submit that these are unacceptable in the current licencing process.

37.

7.4 Assumptions

The following is assumed for the TLAA:

1. The post tensioning tendons are not affected by corrosion over the evaluated 20 years.
2. The full concrete section is assumed, and no delamination is considered during the analysis.
3. Assumptions with respect to the strain development predictions are discussed accordingly in the below sections.

Importantly, Point 1 above is checked for validity throughout the life of the structure through the approved ISI programme including the online monitoring and the 10-yearly performance of the ILRT test (see § 12.3).

Point 2 is validated as the assumption is conservative. A reduced concrete section, counterintuitively, distributes the compressive stress over a smaller section of the concrete, therefore increasing the axial compressive stress in the section.

Other mitigation efforts are not required to validate the TLAA, and if the assumptions are invalidated through the approved ISI programme, the re-analysis will require to be re-visited.

38.

The first assumption is of critical importance for if it does not hold, the entire new TLAA doesn't hold. The only way to prevent the post tensioning tendons from corroding is a successful ICCP. However, both ESKOM and the NNR are now not including ICCP as a specific part of the LTO licencing requirements, which is unacceptable (see further discussion in section 5 below) What the analysis states is *"Importantly, the ICCP and patch repairs do not influence the TLAA and does not change the conclusion of the re-analysis, if the assumptions listed in [section] 7.4 holds."*

39.

39 Filename: NEW Containment-Re-Analysis-for-Long-Term-Operation-Revision-4_-Redacted.pdf See page 68

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

The means by which Assumption 1 (no corrosion of the tendons) holds is by doing an ICCP. Therefore, a successful ICCP is a precondition for an LTO and it is not certain, ie it is not a forgone conclusion, that the ICCP will be successful. The new containment TLAA states:[40]

12.5 Potential Negative Consequences of ICCP

ICCP will not address the loss of pre-stress forces but will protect the embedded steel components from corrosion during the period of LTO. ICCP is not required as part of the containment re-analysis. The re-assessment is however based on the assumption that the cables do not degrade due to corrosion, and it is assumed that the cables will not corrode.

A potential negative consequence of ICCP is hydrogen embrittlement of the post-tensioning tendons. Hydrogen embrittlement will adequately be addressed through a competent design which considers the limits of voltage applied to the containment structures to ensure hydrogen embrittlement is not a possibility. This is addressed through the design of the ICCP. It therefore has no influence on the TLAA.

ICCP will only address the potential of corrosion of the tendons and act as corrosion protection, therefore preventing their potential degradation due to chloride induced corrosion.

40.

The above further makes the point that ICCP has to occur and be successful for the TLAA to be validated despite ESKOM's statement that ICCP has *"no influence on the TLAA."* It should be emphasised that that ICCP was supposed to have already happened. The need for it is so great and it has such a safety impact that the NNR formally reported on it to the CNS in 2022 and said it would be completed prior to 2024.

41.

What is also important to note is that Assumption 1 is tested via an ILRT and through a functioning containment structure monitoring system, neither of which currently exist, and it is not clear when they will exist. See: *"Point 1 above is checked for validated throughout the life of the structure through the approved ISI including the online monitoring and the ten yearly performance of the ILRT"*[41] Alternatively stated, the new containment TLAA was compiled three months before a new ILRT should be done and in an established context of no actual monitoring data. The confidence that Assumption 1 holds on the basis of a nearly expired ILRT, a broken monitoring system and a very delayed and still not implemented ICCP is rather low.

40 Filename: NEW Containment-Re-Analysis-for-Long-Term-Operation-Revision-4_-Redacted.pdf See page 119
41 Filename: NEW Containment-Re-Analysis-for-Long-Term-Operation-Revision-4_-Redacted.pdf See page 68, paragraph 7.4

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

42.

The questionable value of these assumptions is also clear from the fact that they are conditional on ISI validation. The report states that if the *"assumptions are invalidated through the ISI (in service inspection) program the re- analysis will require to be revisited."*[42] An invalidated Assumption 1 means that corrosion of the post tensioning cables **could** be affected by corrosion over the 20-year LTO. This is a very serious matter as it should be noted that the first (2022) engineering report on containment stated that "*corrosion of the PT tendons would probably result in the end of the operational service life of the containment buildings at KNPS. The prevention of corrosion of the PT ducts and tendons is therefore of paramount importance for this project.*[43]

43.

Assumption 1 should be rejected given the inherently hazardous nature of nuclear power plants, the age of the containment structure, the delays and consequent extent of the current chloride ingress and the regulatory and constitutional imperative to protect public safety.

44.

The absence of a completed ICCP means that the NNR cannot make an informed decision regarding the safety of Unit 2 over the period of the LTO. The justification of the continued safe operation of the containment structure for the intended LTO is not possible without it. Should the NNR fail to require completion of this program before making its decision it will be making an irregular decision-based failure of the safety report to comply with LTO regulations 4(a) and (c).

45.

The application for LTO for Unit 2 requires compliance in respect of the entire KNPS facility and since compliance with relevant regulatory safety criteria and requirements regarding the ICCP by Unit 1 will not

[42] NEW Containment-Re-Analysis-for-Long-Term-Operation-Revision-4_-Redacted.pdf, at paragraph 7.4
43 Filename: f) JN465-NSE-ESKB-R-5704 Rev0 Expert Panel Main Report redacted.pdf See page 25

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

be achieved before the NNR decision is taken the application cannot show that it meets the compliance requirements of LTO regulation 4(a) in this regard.

46.

3.4 Periodic safety review (PSR) is not compliant.

The most recent PSR was conducted in 2022 using the *"latest national and international standards.*[44] The review mentioned deficiencies in monitoring of the containment building.

47.

PSR Basis Document (3rd Periodic Safety Review for Koeberg Power Station)[45] indicates the tasks that must be carried out in the PSR.

The document states:

> *SF-2.1 Introduction*
>
> *A review of the actual condition of structures, systems and components (SSCs) important-to-safety will be conducted to assess the condition of plant equipment with the objective to identify equipment-related weaknesses and strengths in the design and operation of the plant. This safety factor will document the condition of the SSCs.*
>
> *SF 1.3 Scope and Tasks*
>
> *Verify that the design and other characteristics are appropriate to meet the requirements for plant safety and performance for all plant conditions and the applicable period of operation, including: • The prevention and mitigation of events (faults and hazards) that could jeopardise safety; • The application of defence-in-depth and engineered barriers for preventing the dispersion of radioactive material (integrity of fuel, cooling circuit, and containment building); • Safety requirements (for example, on the dependability, robustness, and capability of SSCs important to safety); • Design codes and standards;*
>
> *2.1 Review the plant programmes that ensure ongoing confidence in the condition of the SSC by reviewing all programmes related to the condition of plant equipment and structures.*

[44] https://nnr.co.za/wp-content/uploads/2024/03/7.-PSR-Summary-Report-Public-version-Rev-1_final.pdf
[45] 240-134382460. Authorised 2021-01-22

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

To confirm the containment integrity the results of a) leak rate tests; b) tests of penetration seals and closure devices such as air locks and valves that are part of the boundaries, to demonstrate their leak-tightness and, where appropriate, their operability; c) inspections for structural integrity (such as those performed on liner and prestressing tendons) shall also be assessed. Identify if there were any deviations noted for the condition of the selected SSCs and where there were deviations; verify that those were adequately resolved. Assessment will be performed in Safety Factor 4.

48.

It is clear that in the absence of containment monitoring and/or an up-to-date ILRT, the 2022 PSR could not comply with these requirements. Accordingly, the application for LTO cannot demonstrate that it meets the requirements of the regulatory scheme pertaining to a valid latest PSR and cannot thus satisfy LTO regulation 4(a). The authorisation should not be granted.

In addition, a PSR based on out-of-date information is an irrelevant consideration in the LTO application process as discussed in section 5 below and cannot be considered by the NNR when it makes its decision on the application.

49.

3.5 Lack of updated emergency plan and updated aseismic bearings study.

The condition of the aseismic bearings is crucial knowledge that the NNR needs in order to make an informed decision about the actual state or condition of the plant, the overall assessment of safety and whether the continued safe operation for the long term is justified as per LTO regulation 4(c). It is also required for the emergency plan to be updated and its effectiveness to be assured. These are serious safety concerns and until this information is available to the NNR the application should not be granted.

50.

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

ESKOM states in its update briefing (8 April 2025) that:[46]

> *In general, activities (as detailed above) are progressing well towards their target dates. There is a total of 139 activities, of which 46 have been closed.*

And:[47]

> *The assessment of the effectiveness of the Koeberg Nuclear Emergency Plan has a constrained schedule caused by the process of appointing an independent contractor to perform the evaluation. The procurement specification was updated to reflect the revised scope after input was obtained from the NNR. The contract placement is currently in progress.*
>
> *The update of the emergency plan technical basis (EPTB) requires input from the seismic probabilistic safety assessment (PSA).*
>
> *The contract for the seismic PSA has been placed, and work has commenced. However, in the unlikely event of delays with the seismic PSA, there is a potential impact on the schedule for updating the EPTB. T**he accelerated ageing (and testing) of representative samples of the aseismic bearings has a constrained schedule due to delays caused by the required motivation and approvals for a contract. The contract placement is currently in progress** and the project team remains committed to meeting the scheduled timeline.*

51.

As the actual status of the aseismic bearings is not known as yet. The aseismic bearings are critical for the entire nuclear island (Unit 1 & 2), and therefore this has a direct impact on Unit 2's licence. In a Safety Case supporting document (*Elastomeric Aseismic Bearings - Current Position and the Way Forward*), ESKOM states:[48]

> *The Aseismic Bearings play a crucial role in the seismic response of Koeberg Nuclear Power Station. The Aseismic Bearings dictate the seismic behaviour of the Nuclear Island and subsequently the*

46 Filename: ESKOM update ICCP Public-Information-Summary-as-shared-at-Public-Safety-Information-Forum-Mar-2025 (1).pdf Page 1
47 Filename: ESKOM update ICCP Public-Information-Summary-as-shared-at-Public-Safety-Information-Forum-Mar-2025 (1).pdf Page 1-2
48 Filename: 2_Elastomeric_aseismic_bearings_Current_position_and_the_way_forward_Rev_2.pdf Page 3

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

respective horizontal floor response spectra which are used in design for essential SSCs, especially with respect to the horizontal seismic response of the Nuclear Island.

A change in the mechanical properties of the Aseismic Bearings has a direct impact on the response of the Nuclear Island, especially with respect to the shear modulus and damping provided by the Aseismic Bearings. Changes in mechanical properties can occur due to aging and degradation.

52.

It follows that the condition of the aseismic bearings is crucial knowledge that the NNR needs in order to make an informed decision on the application. The Safety Case is not able to provide this knowledge in accordance with the requirements of LTO regulation 4(b) and (c). In the circumstances application should not be granted.

53.

4. FAILURE TO USE RESULTS OF SAFETY ANALYSES WITH DUE CONSIDERATION FOR AGING OF SSC AND THE PERIODIC SAFETY REVIEW – LTO REGULATION 4(b)

The Safety Case is required by regulation 4(b) to:

> (*b*) *be prepared using the results of safety analyses, with due consideration of the ageing of structures, systems and components and the periodic safety review;*

The application does not have at its disposal up to date safety analyses, given the absence of containment monitoring information and the lack of a recent ILRT. Analysis that could have been generated by the aseismic bearings analysis, and the ICCP, are absent. The recent Periodic Safety Review, the Safety Case and the critical new containment TLAA are not based upon the actual status of Unit 2's containment structure. Extrapolations and lack of data cannot represent the actual status of Unit 2's containment structure, as Unit 1 and Unit 2 are not identical. These reports are based on outdated information therefore are not able to present meaningful safety analyses. Legally, they are irrelevant considerations. This principle, (in the context of an environmental impact assessment under the National Environmental Management Act[49]) was

[49] 107 of 1998

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

recognised in the case of *Seafront for all and Another vs MEC, Environmental and Development Planning, Western Cape Provincial Government and Others* ("*Seafront*").[50]

54.

As previously stated, in the present circumstances the only way to know the actual status of Unit 2's containment structure in order to engage in a meaningful safety analysis thereof would be to undertake an ILRT. This is especially important as there is not consensus between the NNR and ESKOM as to the status of the containment structure, and secondly there is an absence of monitoring data. However, ESKOM does not intend to do such test before the NNR considers the application.

The application is therefore not compliant with LTO regulation 4(b). The NNR decision is currently not in a position to apply its mind to relevant safety analyses and cannot make a lawful decision in terms of the LTO regulations and section 6 of the PAJA. The authorisation for LTO should not be granted.

55.

5. FAILURE TO ENSURE REVALIDATION OF THE TLAA FOR CONTAINMENT STRUCTURE - LTO REGULATION 5(c)

Factors which must be considered by the NNR when deciding an application for LTO, and which are therefore mandatory relevant considerations for lawful administrative action as contemplated in section 6(2)(e)(iii) of PAJA are provided in regulation 5, and include but are not limited to the following:

5 *(a) 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:*

(b) 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;

[50] (2010) JOL 25602 (WCC).

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

(c) 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.

(d) utilisation of the results of the Periodic Safety Review to justify the continued long term operation of the nuclear installation.

56.

Of particular importance are the provisions relating to revalidation of the time limited ageing analysis. USA regulatory codes that are applied by the NNR suggest ICCP as part of TLAA 301, but ESKOM states that TLAA on containment is not part of LTO. The result is the NNR cannot consider 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 the LTO as required by regulation 5(a) and (b). The NNR also cannot apply its mind to the revalidation of the containment TLAA in conflict with the requirements of regulation 5(c). As set out above 5(d) cannot be complied with given the latest PSR is out of date and materially deficient

57.

As a result the NNR cannot comply with regulation 5 and in general cannot apply its mind to all relevant considerations relating to safety of the KNPS for the long term as required in terms of 6(2)(e)(iii) of PAJA.

58.

The authorisation should accordingly not be granted.

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

Detailed discussion of revalidation of the time limited aging analysis.

The IAEA has complied a variety of generic TLAA's that set down what is required in order to confirm that a TLAA has been validated.[51] The TLAA under contention for Koeberg is TLAA 301.[52]
It states, importantly:[53]

> *To ensure the integrity of the containment pressure boundary under design basis accident loads, tendon surveillances are performed in accordance with AMP 302 to compare the pre-stress force in the randomly selected tendons to predicted lower limit (PLL) force and minimum required design pre-stressing force (minimum required value: MRV).*
>
> *AMP 302: In-Service Inspection for Concrete Containment (Version 2023)* states that:
>
> *The monitoring of the structural behaviour of containment structures with grouted tendons can follow the requirements of [10]. The ageing management of these instruments is described in AMP311. Other approaches to ageing management of bonded prestressed concrete containments include containment pressure tests.*

AMP 311: Containment Monitoring System (Version 2018) describes how to manage the ageing of the containment monitoring system. In particular it states:[54]

> *6. Acceptance criteria:*
>
> *Acceptance Criteria for all devices: These criteria are metrological criterion based on the device type, or basic criteria already discussed in attribute 3. Acceptance Criterion for replacement in case of gauges failure: The acceptance criterion for replacement in case of gauge failure is to ensure the availability of minimum numbers of sensors as per requirement (e.g., OSS [3, 5]).*

[51] https://lto.epri.com/TLAA#Definition_of_a_TLAA
[52] TLAA301_Concrete_Containment_Tendon_Prestress_final_20181218.pdf
53 TLAA301_Concrete_Containment_Tendon_Prestress_final_20181218.pdf Page 1
54 AMP302_ISI_for_Concrete_Containment_final_20240131.pdf Page 4

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

Minimum numbers of sensors is defined in the plant programme documents, depending on containment type (with or without liner). For example, in France the basic principles of the definition of this "minimum operating monitoring" system are listed below:

• A minimum redundancy is ensured to be able to guarantee continuity of measurements in case of new failure (a sensor is considered as failed if the value of the measured strain is not valid as described in attribute 8);

• The locations of 'OSS' sensors are in standard areas in order to be able to interpret the results and to compare to theoretical values;

• Vertical wall, dome and gusset are monitored.

7. Corrective actions:

The corrective action is to install new monitoring system element when the current one is considered to be failed. *The new element is qualified taking into account the precision required and the operation condition. This replacement is mandatory when the available sensors are not adequate to meet the condition prescribed in dedicated document.*

60.

As stated previously, there is an absence of complete dome data for Unit 2 because the monitoring system on the dome has failed. The fact that ESKOM has had to use Unit 1 data for Unit 2 because of a lack of Unit 2 data clearly shows that the monitoring system had failed and was considered to have failed. The first major failing was when defective Invar wire stations were discovered in 2004.[55] Therefore, a new monitoring system (i.e. replacements and/or upgrades of the various failed elements) should already be in place. So, accordingly, there is no minimum operating monitoring. This means that AMP 311 has not been completed. Further, AMP 311 says that "*The corrective action is to install new monitoring system element when the current one is considered to be failed*."[56]

55 KBA0022NNEPOLOPP164_REV_3_Containment_PR.pdf Page 11
56 AMP302_ISI_for_Concrete_Containment_final_20240131.pdf Page 4

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

61.

Back in 2022, ESKOM published the following document informing the Safety Case. Note that main structural components were described as being in extreme condition, requiring ICCP to ensure continuous operation and in the case of ring beam, to protect embedded tendon heads (condition described as urgent):[57]

10.1 Maintenance Required and Notifications

	Component	Condition	Planned Rehabilitation	Notification/Project
Main Structural Components	Base Mat	None	-	
	Gusset	None	-	
	Cylindrical Wall	Extreme	ICCP Required to ensure continuous operation of KNPS	Mod 16002
	Ring Beam	Urgent	ICCP required to protect embedded tendon heads	Mod 16002
	Dome	Extreme	ICCP Required to ensure continuous operation of KNPS	Mod 16002
Internal Structures	Concrete Structures	None	-	
	Missile Shields	None	-	
	Steel Structures	None	-	
On-line Monitoring	Invar Wires	Long Term	Continuous monitoring of condition - no mitigation in-place and failure is anticipated	CE 17339
	Strain Gauges	None	Failure is occurring, however no rehabilitation or modification planned	CE 17339
	Thermocouples	Long Term	Failure is occurring, however a rehabilitation or modification is planned	CE 17339
	Dynamometers	Urgent	Calibration of the dynamometers-	CE 17339

Note: the dynamometers have been recalibrated.

62.

AMP 302 also states that:[58]

> *This AMP provides specific guidance for in service inspection (ISI) for managing ageing of containment reinforced concrete, and bonded and unbonded post-tensioning systems. The references [1–6] describe practices and techniques for the inspection, mitigation of ageing degradation, corrective action including repair methods, and operating experience for concrete*

57 KBA0022NNEPOLOPP164_REV_3_Containment_PR.pdf Page 38
58 AMP302_ISI_for_Concrete_Containment_final_20240131.pdf Page 1

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

containments. ***This AMP in conjunction with AMP318 provides general guidance for developing an effective AMP for concrete containments****.*

AMP 318 has this to say:[59]

5. Mitigation of ageing effects:

This AMP is a condition monitoring programme and no generic recommendations are included to mitigate ageing effects. However, if degradation of structures and components is detected that exceeds the acceptance criteria, plant specific actions can be identified based on detailed monitoring and trending, and structural evaluation to mitigate the root cause or source of degradation.

For instance, cathodic protection systems can be installed to help prevent or mitigate corrosion of concrete rebar, other concrete reinforcement, or concrete pipe. Systems can either use sacrificial anode cathodic protection (SACP), impressed current cathodic protection (ICCP), or both. (emphasis added)

AMP 318 goes on to provide three examples of three American nuclear plants where cathodic protection was used: Units 3 & 4 of Turkey Point NPP, Diablo Canyon 1/ 2 NPP and San Onofre 3 NPP.[60]

63.

This is important because ESKOM says that ICCP is not part of TLAA 301. **This is incorrect**. TLAA 301 is informed by AMP 302 which specifically states that AMP 302 has to be done in conjunction with AMP 318, which explicitly states that ICCP is an example of a solution to corrosion. The splitting of ICCP from TLAA 301 is contrary to the IAEA guides (which are the basis of the entire Safety Case).

Therefore, ICCP should be required to be part of ESKOM's TLAA 301 and, as such, the NNR cannot validate the TLAA until ICCP has been done. The NNR cannot comply with LTO regulation 5 (c) and make a lawful decision to authorise the LTO on the strength of the application as it currently stands.

59 AMP318_Concrete_Structures_Monitoring_final_20240131.pdf Page 4
60 AMP318_Concrete_Structures_Monitoring_final_20240131.pdf Page 5

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

.

64.

6 OTHER IRRELEVANT CONSIDERATIONS

The NNR is required in terms of section 6(2)(e)(ii) of the PAJA to make its decision after considering relevant considerations and may not take into account irrelevant considerations.[61]

The following is a summary of some of the considerations contained in the application which by their nature in this licensing process are irrelevant (some of which are discussed above) and which must be disregarded by the NNR when it considers the application, in order for the decision to be lawful.

65.

6.1 EXTRAPOLATIONS INSTEAD OF INTEGRATED LEAK RATE TEST

As stated in paragraph 13 above provision is made in the regulatory scheme, which applies the USA codes, for ILRT where containment monitoring is not fully functional. The need for this was highlighted in the first (2022) engineering report on containment. However instead of conducting an ILRT - which is the gold standard for determining the status containment buildings where monitoring has failed - ESKOM proceeds to use a questionable methodology, namely by extrapolating of Unit 1 data, to arrive at a description of Unit 2. Extrapolation, as a mathematical tool used to arrive at conclusions about an object from the characteristics of another object (here the characteristics are structural mechanics of the containment structure of nuclear power station) - **would only be credible if the two entities were identical at the time of the extrapolation**. But ESKOM does not have a current complete description of all the properties of Unit 2 given the lack of containment monitoring and up to date ILRT. In fact, this is the very thing that extrapolation seeks to determine.

[61] PAJA (Act 3 of 2000) section 6 – Judicial Review of Administrative Action
(1) Any person may institute proceedings in a court or a tribunal for the judicial review of an administrative action.
(2) A court or tribunal has the power to judicially review an administrative action if-
(e) the action was taken- (i) for a reason not authorised by the empowering provision; (ii) for an ulterior purpose or motive; (iii) because irrelevant considerations were taken into account or relevant considerations were not considered; (iv) because of the unauthorised or unwarranted dictates of another person or body; (v) in bad faith; or (vi) arbitrarily or capriciously;

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

Apart from this conundrum, no two nuclear containment structures could be identical after 40 years of operation, even if they were of the same original design.

66.

Differences between Unit 1 and Unit 2 and the use of extrapolation

While of the same design and construction, the two units are not the same. The chances that they have both aged in the same manner are zero. They do not have the same cracks, delamination, monitoring issues nor have had the exact same repairs. Moreover, they have not operated for the same number of hours. The very fact that the NNR only validated Unit 2 for 8 years shows that there is a difference between the two. There are different environmental conditions that impact both units and their structures are not exactly the same. From the new containment TLAA:

A company not for profit REG No 2006/014388/08 NPO 053498 PBO 930024255

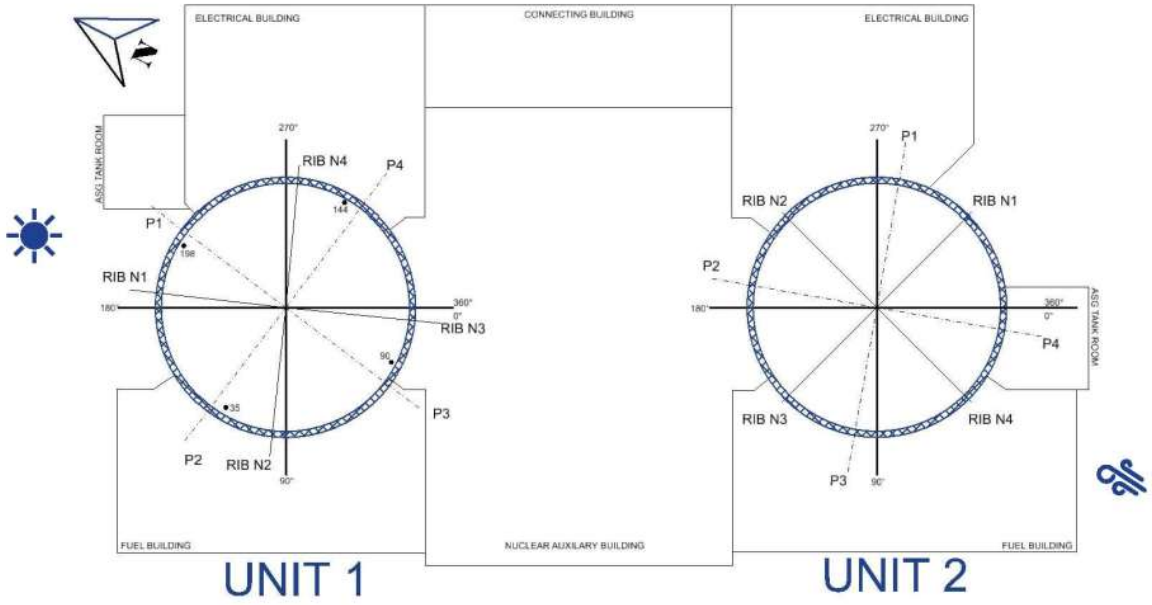


Figure 11: Layout and Orientation of Containment Structures

It is worth noting the local environmental conditions of the structures are different, as the Unit 1 structure is exposed to the sun more than the Unit 2 structure, and vice versa for the predominant wind.

67.

The application is for a licence decision for Unit 2, not Unit 1, and as such it is the state of Unit 2's containment structure that is under question, not Unit 1's. Therefore, what is required is not information on Unit 1 but knowledge of the status of Unit 2. There could be some unforeseen change in, for example, Unit 2's containment dome. Doing tests and monitoring on Unit 1 and then extrapolating that data will never discover that change. What is required is actual data from tests and monitoring on Unit 2.

68.

This is hardly an unreasonable request. All nuclear plants monitor and test each reactor unit separately, precisely because units can and do differ, they age at different rates and have different problems. Moreover, the containment structure is the last line of defence. What the public and the NNR need to know is whether the containment structure will retain its integrity in the case of a LOCA and that requires knowing the real status of Unit 2. ESKOM needs to make long overdue repairs (ICCP and concrete repairs), replace faulty components of the monitoring system, and do an ILRT. None of that is an imposition for ESKOM,

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

rather these are the basics of managing an ageing plant, which is what the entire Safety Case and all the TLAAs and AMPs are about: how to ensure that a plant designed to operate for 40 years can operate safely for 60 years.

69.

It follows that the extrapolations presented in the application are devoid of useful value, irregular in that they attempt to substitute the more accurate ILRT, and are therefore irrelevant considerations that should not be considered by the NNR when it decides the application.

.

70.

6.2 INVALID ASSUMPTIONS

As set out in section 3.3, paragraph 36 onwards above certain assumptions concerning the ICCP are questionable and should be discarded as irrelevant considerations when the NNR considers the application, in order for its decision on the application to be lawful.

71.

7. CONFORMITY WITH INTERNATIONAL STANDARDS

As per the NNR Regulatory Guide for Ageing Management and Long Term Operations of Nuclear Plants, the Safety Case should determine the:

> *ii) extent to which the nuclear facility conforms to modern current national and/or international safety standards and operating practices and considers operational experience.*[62]

As is clear from the above analysis the application falls far short of the applicable international standards, which have been set out in detail in this submission.

72.

[62] https://nnr.co.za/wp-content/uploads/2020/10/RG-0027-Interim-Guide-for-AM-and-LTO.pdf

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

8. THE GRANTING OF A 20 YEAR EXTENSION OF LIFE FOR THE KNPS UNIT 2 WILL BE UNCONSTITUTIONAL AND IRRATIONAL

Unlawfulness

As submitted above, an authorisation granted on the basis of the ESKOM application for Unit 2 of the KNPS to continue operating for a further 20 years will be unlawful, for failure to comply with the NNR Act and LTO regulations, and PAJA. It will also be irrational, unreasonable and unconstitutional.

73.

Constitutionality – unreasonableness

When considering whether a licensing decision complies with section 24 of the Constitution, the meaning of 'reasonable' in the particular context must be interpreted, with regard being had to international law.[63] This would include the safety standards of the IAEA given that South Africa is a member state of the International Atomic Energy Agency (IAEA) and has ratified the Convention on Nuclear Safety. This approach is accepted by the NNR which states on its website:

> *South Africa is a member state of the International Atomic Energy Agency (IAEA) and has ratified the Convention on Nuclear Safety. The conventions place certain obligations on member states to implement measures aimed at ensuring nuclear safety. The NNR Safety Standards are premised on international standards such as the IAEA Safety Standards, the UK NII Safety Principles and the WENRA Reference levels.*[64]

74.

[63] Constitution, section 39(1)
[64] NNR website: https://nnr.co.za/about/policy-and-legislation/

A company not for profit REG No 2006/014388/08 NPO 053498 PBO 930024255

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

The IAEA Safety Standards[65] provide a robust framework of fundamental principles, requirements, and guidance to ensure safety. They reflect an international consensus and serve as a global reference for protecting people and the environment from the harmful effects of ionizing radiation. A recommendation of the SALTO mission is in effect advice that the reactor does not comply with IAEA standards.[66]

75.

The 2022 SALTO mission reviewed the status of activities related to long term operation (LTO) of the both Unit 1 and Unit 2 plant against IAEA Safety Standards and international best practices.[67]
The status of the 2022 IAEA SALTO report was given as follows:

- *The IAEA SALTO peer review is a comprehensive safety review directly addressing strategy and key elements for the safe long-term operation of nuclear power plants. The evaluation of programmes and performance is made on the basis of the IAEA's Safety Standards and other guidance documents.*[68]

"The objective was to review the status and future plans for safe LTO programmes and activities performed at the plant with comparison to the relevant IAEA Safety Standards, guidance documents and internationally accepted practices and to provide recommendations and suggestions for improvement of the preparations for safe LTO.

The state of the KNPS was found by the 2022 SALTO mission to fall short of the IAEA standards, particularly as the containment structure monitoring system is not fully functional.[69] It commented that that many activities are still in progress to achieve full compliance.[70]

[65] https://www.iaea.org/resources/safety-standards
[66] SALTO report page 14, definitions: A recommendation is advice on what improvements in operational safety should be made in the activity or programme that has been evaluated. It is based on inadequate conformance with the IAEA Safety Requirements and addresses the general concern rather than the symptoms of the identified concern. Recommendations are specific, realistic and designed to result in tangible improvements
[67] SALTO report executive summary page 9
[68] https://www.iaea.org/services/review-missions/safety-aspects-of-long-term-operation-salto

[69] id
[70] SALTO report page 16

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

It stated: [71]

> *2.2 – SAFETY CONSEQUENCE: Without a fully functional containment monitoring system, not all necessary data for the containment structure will be available to demonstrate the intended safety function during LTO.*[72]

In 2024 updated report observed:

> *The team noted that the plant needs to continue its work to ensure that:*
>
> > *The plant programmes supporting LTO are fully implemented for the LTO period.*
> >
> > *The containment monitoring system is fully refurbished and remains fully functional during the LTO period.*[73]

76.

Without a fully functioning monitoring system (in this case for the next four years) means that the ability to take evasive action is compromised if abnormal conditions arise, as stated in the SALTO report: [74]

> *The operating organization shall establish surveillance programmes for ensuring compliance with established operational limits and conditions and for detecting and correcting any abnormal condition before it can give rise to significant consequences for safety.*

The regulatory purpose of the NNR in licensing the reactor for a further period is to protect the public, property and the environment.[75] A reasonable measure, in the context of the licensing of a nuclear power station to operate beyond the expiry date of the initial license must be formulated after considering international law.

[71] id
[72] SALTO report page 61
[73] https://www.iaea.org/newscenter/pressreleases/iaea-concludes-long-term-operation-safety-review-at-south-africas-koeberg-nuclear-power-plant

[74] International Atomic Energy Agency, SALTO, pg. 61

[75] NNR Act, preamble and Objects – section 5

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

77.

Notwithstanding the recommendation by SALTO should ensure full functionality of the containment structure monitoring system[76] ESKOM intends implementing this critical safety requirement after the granting of a 20 year extension of the license, during 2028 and 2029.[77] An authorization to continue operations in these circumstances would be unreasonable, and therefore unconstitutional, not only for failure to have proper regard to international standards but because it would fail to ensure the protection of public safety. The constitution says everyone has the right to an environment that is not detrimental to health and well-being. However such authorization would permit the plant to operate in circumstances and in a state where the IAEA has identified that this could have significant consequences for safety.

78.

Other failure to comply with international best practice.

In addition, an authorisation for Unit 2 to operate for a further 20 years would be excessive and unjustifiable when considered against international best practice and the considerable uncertainties regarding Unit 2.

79.

The NNR aspires to international best practice as is evident from its website and the Periodic Safety Assessment that takes place every 10 years in accordance with the KNPS Nuclear Installation Licence.[78] The latest PSA took place over the period 2019–2021 in fulfilment of this 10-yearly regulatory requirement.[79] The stated objectives of the PSA include:[80]

> *b) The extent to which KNPS conforms to modern codes, standards, and good practices, to ensure that the currently adopted codes, standards, and practices are not obsolete and do not pose a nuclear safety risk for KNPS;*

80.

[76] Id page 62
[77] NNR directive 19 July 2024
[78] (NIL-01 (Variation 19) [5]),
[79] https://www.ESKOM.co.za/wp-content/uploads/2024/05/331 607_KNPS_3rd_Periodic_Safety_Review_Final_Report.pdf
[80] PSR paragraph 4.1

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

International best practice for reactors of the type of the KNPS is applied in France, which does not provide for extension of licenses for periods of more than 10 years to any license.

Permits to operate nuclear facilities are issued by the French Government after consulting ASN[81](English=NSA). The facility undergoes an in-depth "periodic safety review" every ten years to assess the conditions for continued operation of the facility for the following ten years.[82] At the very least, the practice in South Africa should follow this approach after safety tests are completed satisfactorily, in order to be reasonable.

81.

.

The granting of a 20 year extension of life when there are as yet unresolved matters relating to safety, including those critical to defense-in-depth is unreasonable. The application to the NNR to vary the license so as to authorize 20 further years of operation for Unit 2 of the KNPS should be refused on the basis of failing to comply with the mandatory constitutional requirement of being a reasonable measure.[83]

82.

Irrationality

The purpose for which the power to authorize nuclear power stations is granted to the NNR is the protection of persons, property and the environment against nuclear damage when licensing an inherently highly hazardous industry.[84]

---

[81] The Autorité de sûreté nucléaire (English: Nuclear Safety Authority, ASN) is an independent French administrative authority set up by law 2006-686 of 13 June 2006 concerning nuclear transparency and security. It has replaced the General Direction for Nuclear Safety and Radioprotection. - Wikipaedia

[82] "ASN issues a position statement on the conditions for continued operation of the 900 Mwe reactors beyond 40 years." https://www.french-nuclear-safety.fr/asn-informs/news-releases/900-mwe-reactors-beyond-40-years

[83] Constitution section 24

[84] Act 47 of 1999

The preamble to the NNR Act states that the purpose of the NNR is

To provide for safety standards and regulatory practices for protection of persons, property and the environment against nuclear damage; and to provide for matters connected therewith.

The NNR Act states the objects of the regulator are to

(a) provide for the protection of persons, property and the environment against nuclear damage through the establishment of safety standards and regulatory practices;

(b) exercise regulatory control related to safety over-

(i) the siting. design. construction, operation. manufacture of component parts, and decontamination, decommissioning and closure of nuclear installations; ….

through the granting of nuclear authorisations;

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

Licensing decisions, made by applying safety standards and regulatory practices such as the LTO regulations and recommendations of the IAEA, are at the heart of protecting persons property and the environment from nuclear damage.

83.

The LTO application presents a Safety Case that cannot comply with LTO regulations 4, 5 and 6 largely due to ESKOM's failure to timeously effect repairs to the reactor containment and monitoring systems, and to conduct an ILRT on unit 2. **Instead, it relies for assurances of future safety on questionable assumptions and extrapolations when it could be conducting this test, which at the very least is due under a ten-year cycle.** ESKOM continues to delay the ICCP even though it is a license condition for Unit 1. It has failed to follow its own expert recommendations made ten years ago to attend to this program urgently.

The result is the NNR is expected to apply its mind to irrelevant considerations and out-of-date information and will not be in a position to ascertain whether the plant is safe to operate beyond the initial license period.

84.

In light of these fundamental deficiencies a decision of the NNR to license the LTO of Unit 2 of the KNPS on the basis of the application will be an exercise of power that will not be rationally connected to the purpose for which the power to license is granted to the NNR - which is to provide for the protection of persons, property and the environment against nuclear damage through the establishment of safety standards and regulatory practices such as would be exercised during licensing. It will therefore be irrational.

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

The NNR should not grant authorisation in the circumstances to Unit 2 to operate beyond its current licence.

DATED AT CAPE TOWN THIS DAY OF 2025

……

Southern African Faith Communities' Environment Institute (SAFCEI).

Per: F de Gasparis

Executive Director.

The Green Building

Bell Crescent,

Westlake Business Park,

Cape Town.

A company not for profit REG No 2006/014388/08 NPO 053498 PBO 930024255

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

86.

NNR Act and regulations

The NNR Act[85] states the objects[86] of the regulator are to:

> *(a) provide for the protection of persons, property and the environment against nuclear damage through the establishment of safety standards and regulatory practices;*
>
> *(b) exercise regulatory control related to safety over-*
>
> *(i) the siting. design. construction, operation. manufacture of component parts, and decontamination, decommissioning and closure of nuclear installations; …. through the granting of nuclear authorisations;*

The requirements for the long-term operation of the KNPS are contained in the regulations promulgated under the NNR Act for the Long-Term Operation of Nuclear Installations[87] (LTO regulations) and are required to be applied by the NNR to the application for long term operation.

87.

The following provisions of the LTO Regulations are relevant to the arguments made in this submission:

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

> *"Safety Case" means a logical and hierarchical set of documents that demonstrates compliance with the Regulatory requirements and criteria and describes the radiological hazards in terms of a nuclear*

[85] Act 47 of 1999
[86] Section 5
[87] National Nuclear Regulator Act, 1999 (Act No.47 Of 1999): Regulations On The Long Term Operation Of Nuclear Installations NO. R. 266 26 March 2021 published in No. 44394 GOVERNMENT GAZETTE, 26 March 2021

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

installation, site and the modes of operation, including potential undesired modes. It encompasses the authorisation basis, and safety related documentation applicable during different authorisation stages and will include the safety assessment, operational safety related programmes and supporting documentation; and "safety related programmes" collectively refers to all nuclear safety related activities conducted during the operational phase of the nuclear installation and may also be applicable during interim authorisation stages.

88.

In terms of regulation 3 of the LTO regulations:

3. (1) Any licensee wishing to operate a nuclear installation beyond an established timeframe defined in the respective nuclear installation licence shall lodge, in terms of section 21(1) of the Act, an application for the operation of the respective nuclear installation beyond an established timeframe with the Chief Executive Officer of the National Nuclear Regulator

(3) The application shall be supported by a Safety Case to demonstrate continued safe operation of the nuclear installation for the period of Long Term Operation and the Safety Case shall be submitted within the timelines specified by the Regulator.

89.

The requirements to be demonstrated by the Safety Case are set out as follows (underline added for emphasis):

4 (a) demonstrate compliance with relevant regulatory safety criteria and requirements;

(b) be prepared using the results of safety analyses, with due consideration of the ageing of structures, systems and components and the periodic safety review;

(c) 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;

(d) demonstrate availability of financial and human resources as well as knowledge management for the period of Long Term Operation, which knowledge management shall

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

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;

(e) 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 LTO.

90.

Factors which must be considered by the NNR when deciding an application for LTO, and which are therefore mandatory relevant considerations for lawful administrative action as contemplated in section 6(2)(e)(iii) of PAJA are provided in regulation 5, and include but are not limited to the following:

5 *(a) 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;*

(b) 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;

(c) 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; and

(d) utilisation of the results of the Periodic Safety Review to justify the continued long term operation of the nuclear installation.

91.

A company not for profit REG No 2006/014388/08 NPO 053498 PBO 930024255

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

The NNR LTO Guidelines[88] state that the Safety Case must *inter alia:*

> 5.3.1 3d) Determine the:
>
> i) extent to which the existing current licensing basis remains valid;
>
> ii) extent to which the nuclear facility conforms to modern current national and/or international safety standards and operating practices and considers operational experience;
>
> iii) adequacy and effectiveness of the safety related programmes and the SSCs in place to ensure plant safety until the end of commercial operation;
>
> iv) improvements to be implemented to resolve any gaps identified in the review and timelines for their implementation.

The LTO Guidelines describes the SALTO as follows:

> *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*[89]

92.

Constitutional Issues

Section 24 of the Constitution (the right to an environment that is not harmful to health and well-being), applies to the NNR decision to extend the life of Unit 2 of the KNPS, as this decision potentially significantly impacts on the environment and the health and well-being of significant numbers of people who live in the vicinity of the plant.

93.

Under section 39(1) of the Constitution, international law must be considered when the rights in the Bill of Rights are interpreted, in this case right to an environment that is not harmful to health and well-being. Section 39(2) of the Constitution of the Republic of South Africa, 1996 directs that when any legislation is

[88] RG-007 NNR INTERIM REGULATORY GUIDE for AGEING MANAGEMENT AND LONG TERM OPERATIONS OF NUCLEAR POWER PLANTS RG-0027 rev 0 March 2019 at page 12

[89] Id at page 8

A company not for profit REG No 2006/014388/08 NPO 053498 PBO 930024255

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

interpreted, the result must be a construction that promotes "the spirit, purport and objects of the Bill of Rights".

94.

Safety standards under the International Atomic Energy Agency

South Africa is a member state of the International Atomic Energy Agency (IAEA) and has ratified the Convention on Nuclear Safety. The Convention places certain obligations on member states to implement measures aimed at ensuring nuclear safety. The NNR Safety Standards are premised on international standards such as the IAEA Safety Standards, the UN Nll Safety Principles and the WENRA Reference levels.[90]

95.

The IAEA safety standards are therefore international law which must be considered when the NNR decision to extend the licence for Unit 2 of the KNPS is evaluated for reasonableness as envisaged in section 24 of the Constitution.

96.

The IAEA SALTO (Safety Aspects of Long-Term Operation) peer review is a comprehensive safety review directly addressing strategy and key elements for the safe long-term operation of nuclear power plants. The evaluation of programmes and performance is made on the basis of the IAEA's Safety Standards and other guidance documents.[91] The key objectives of the SALTO peer review include to provide the host organization with an objective assessment of the status of the preparedness for LTO with respect to international nuclear safety standards.[92] This is information that is clearly critical to the determination of whether the LTO Safety Case can demonstrate continued safe operation of the nuclear installation for the period of the LTO as envisaged by LTO regulation 3(3).

97.

Convention on Nuclear Safety (CNS)

[90] NNR website: https://nnr.co.za/about/policy-and-legislation/
[91] https://www.iaea.org/services/review-missions/safety-aspects-of-long-term-operation-salto
[92] https://www.iaea.org/sites/default/files/17/01/salto080615_how_to_prep_brochure.pdf

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

South Africa has signed the CNS on 20/09/1994 and ratified it on 24/12/1996.[93] The CNS, administered by the IAEA, binds states (the contracting parties) to adhere to a series of safety principles in the building, operation and decommissioning of nuclear power plants.

98.

USA Standards

ESKOM and the NNR rely upon the USA nuclear regulatory codes including. U.S. Regulatory Code 1.90 *In-service Inspection of Prestressed Concrete Containment Structures with Grouted Tendons.*[94]

99.

.ANNEXURE B

US Regulatory Codes

Detailed provisions relating to leak testing

ESKOM relies upon US nuclear regulatory codes in regard to in-service testing. In the NNR's response to public submissions on Unit 1, it stated:

> *At KNPS the code and rules applicable for in service inspections and testing is the American ASME code.*

Clearly these codes also therefore apply to Unit 2.

100.

Regulatory Guide 1.90 describes methods that the U.S. Nuclear Regulatory Commission (NRC) considers acceptable for use in developing an appropriate in-service inspection (ISI) program for prestressed concrete containment structures with grouted tendons. In particular, the guide states

93 https://www.iaea.org/resources/legal/country-factsheets

[94] Regulatory Guide 1.90 (Nov 2012) of the U.S. Nuclear Regulatory Commission https://www.nrc.gov/docs/ML1124/ML11249A008.pdf

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

> *if at any time the [containment monitoring equipment like strain gauges and thermocouples] instrumentation does not remain functional, then containment integrity must be monitored using the method in Alternative B, including the performance of pressure tests every 5 years.*[95]

And:

> *However, **if at any point during the life of the structure**, the installed instrumentation is not considered functional and effective at monitoring containment prestress level, the licensee should substitute Alternative B for Alternative A.*[96]

101.

ESKOM and the NNR rely upon the following US nuclear regulatory codes.

U.S. Regulatory Code 1.90 Inservice Inspection Of Prestressed Concrete Containment Structures With Grouted Tendons[97] states):

> *Regulatory requirements for ISI of Class CC and Class MC containment structures are provided in 10 CFR 50.55a "Codes and Standards." Paragraph (g)(4) "Inservice Inspection Requirements" of 10 CFR 50.55a requires, in part, that: "Components which are classified as Class MC pressure retaining components and their integral attachments, and components which are classified as Class CC pressure retaining components and their integral attachments must meet the requirements, except design and access provisions and preservice examination requirements, set forth in Section XI of the ASME B&PV Code and addenda that are incorporated by reference in paragraph (b) of this section, subject to the conditions listed in paragraph (b)(2)(vi) of this section and the conditions listed in paragraphs (b)(2)(viii) and (b)(2)(ix) of this section, to the extent practical within the limitation of design, geometry and materials of construction of the components." Essentially, 10 CFR 50.55a(g)(4) requires that the ISI program for Class CC and Class MC containment structures meets the requirements set forth in the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," (Ref. 2) Subsection IWL, "Requirements for Class CC Concrete Components of Light-Water-Cooled*

95 Regulatory guide NRC code.pdf, Page 6
96 ASME XI ML003744922.pdf Page 2
97 Regulatory Guide 1.90 (Nov 2012) of the U.S. Nuclear Regulatory Commission https://www.nrc.gov/docs/ML1124/ML11249A008.pdf

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

Plants," and Subsection IWE, "Requirements for Class MC and Metallic Liners of Class CC Components of Light-Water-Cooled Plants," subject to the associated Code conditions. Prestressed concrete containment structures with grouted tendons are classified as Class CC concrete components.[98]
This would apply to KNPS

102.

Regulatory Guide 1.90 describes methods that the U.S. Nuclear Regulatory Commission (NRC) considers acceptable for use in developing an appropriate in-service inspection (ISI) program for prestressed concrete containment structures with grouted tendons. In particular, the guide states

if at any time the instrumentation[99] *does not remain functional, then containment integrity must be monitored using the method in Alternative B, including the performance of pressure tests every 5 years.*[100]

And:

*However, **if at any point during the life of the structure**, the installed instrumentation is not considered functional and effective at monitoring containment prestress level, the licensee should substitute Alternative B for Alternative A.*[101]

103.

ESKOM has been operating under Alternative A, which requires the plant's operator to gather information from strain gauges, thermocouples, etc. in order to understand what is happening to the containment structure. An ILRT is required to be done every 10 years under Alternative A. The Guide states the following regarding instrumentation that is required to operate under Alternative A:[102]

98 Regulatory guide NRC code.pdf, Page 1 and 2
99 Referring to containment monitoring equipment such as strain gauges and thermocouples
100 Regulatory guide NRC code.pdf, Page 6
101 ASME XI ML003744922.pdf Page 2
102 Regulatory guide NRC code.pdf, Page 5

The Green Building, Bell Crescent, Westlake Business Park, Westlake, Cape Town, South Africa PO Box 106, Kalk Bay, 7990 info@safcei.org.za +27 21 701 8145

The number of instruments and their locations play a critical role in ensuring an effective prestress monitoring program. Instrumentation should be installed in sufficient numbers at strategic locations in the containment structure so that loss in prestress levels can be detected. For example, if corrosion occurs at locations away from the instrumented sections, the corrosion would have to spread to the location within the instrument sensing area before the instrumentation readings would detect the degradation.

A sufficient number of temperature sensors or thermocouples installed at the sections where a strain-measuring instrument is located can be useful in isolating the thermal effects. The raw instrument readings can be deceptive, and adjustments may be necessary to account for the calibration constants and temperature effects. The interpretation and evaluation of the results will be simplified if the instrument is located at sections away from structural discontinuities. Licensees should provide sufficient redundancy in the instrumentation to evaluate anomalous readings and to isolate a malfunctioning measurement gauge.

104.

There is a good case to be made that an ILRT should have been done after steam generator replacement (2024). The regulation states:

Repairs and modifications that affect the containment leakage integrity require leakage rate testing (Type A testing or local leakage rate testing) prior to returning the containment to operation.[103]

For example, in 2001 Arkansas Nuclear One-Unit 2 conducted an ILRT after replacing steam generators.[104]

103 leak testing guide ML11327A025.pdf Page 22 (11 of document)
104 Arkansa 1 ML011710429.pdf, Page 4

A company not for profit REG No 2006/014388/08 NPO 053498 PBO 930024255