



To: **The National Nuclear Regulator**
Attention: **The Programme Manager: Nuclear Power Plants**

By email: KoebergLTO@nnr.co.za

16 March 2023

Re: **SAFCEI – REPRESENTATIONS ON ESKOM KOBERG NUCLEAR POWER STATION (KNPS) LONG TERM OPERATION (LTO) APPLICATION**

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1. INTRODUCTION

These representations are submitted by the Southern African Faith Communities' Environment Institute (SAFCEI).

SAFCEI is a registered non-profit organisation that was established by multi-faith environmental and social justice advocates to, among other things, confront 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.

On 10 May 2021, Eskom Holdings SOC Ltd (Eskom) submitted to the National Nuclear Regulator (NNR) a revised Long Term Operation (LTO) application to operate the Koeberg Nuclear Power Station (KNPS) beyond the timeframe stipulated in its Nuclear Installation License¹ (NIL), namely beyond 21 July 2024. Eskom seeks a variation to its NIL to operate the KNPS beyond 21 July 2024 for an additional 20 years.

According to Eskom's application, in 2010 the Eskom Board endorsed the recommendation of a feasibility study to extend the operating life of the KNPS from 40 to 60 years of operation, and informed the NNR on 8 September 2010 of its proposed 'long-term asset management interventions' relating to the KNPS. In December 2015, Eskom submitted a *Koeberg Licensing Framework for Long-Term Operation (LTO)* to the NNR, and subsequently initiated a number of significant projects related to the intended extension of KNPS's operating life. These projects included the replacement of the steam generators [not yet completed], the refuelling water -storage tanks, the Unit 2 reactor pressure vessel head, and the evaluation of the ageing management documents.

On 12 January 2023, the NNR directed Eskom to serve its '*Application to operate the Koeberg Nuclear Power Station beyond the timeframe established in the Nuclear Installation License (NIL-01 Variation 19)*' upon identified municipalities, persons, organisations and government

¹ NIL-01 (Variation 19).

departments. SAFCEI is indicated as one of the bodies or persons identified by the NNR to be a person to be served a copy of the application, and in terms of this notice has been afforded an opportunity to submit, to the NNR, written representations relating to health, safety and environmental issues connected with the KNPS LTO application by no later than 16 March 2023.

In brief, SAFCEI's main concerns relating to the proposed LTO of KNPS are as follows:

- The document set made available to SAFCEI for comment includes a heavily redacted LTO Safety Case, and a number of important source documents relied upon by Eskom in the LTO Safety case have not been made available to I&APs. Furthermore, while some required safety improvements have been implemented, others remain planned for implementation either before LTO or during the period of the LTO.
- The LTO Safety Case does not provide assurance that the impacts of loadshedding on grid stability, the aging of the plant, and the increased risk of a grid collapse/blackout, have been considered and assessed.
- Best Practice is not applied to the LTO Safety Case notwithstanding the commitment of the NNR to best practice in safety governance.
- The safety of the LTO of the plant cannot be assured, as parts of the reactor are inaccessible without weakening the structure and therefore aging management of all parts cannot be assured.
- The LTO document set made available to SAFCEI indicates that no environmental authorisation is required, but fails to set out the rationale for the statement that an Environmental Impact Assessment (EIA) is 'not applicable'. Having regard to Eskom's planned thermal power uprate and modifications to radioactive waste storage capacity, on the face of it environmental authorisation is required. Even if Eskom is correct that no environmental authorisation is required, the document set does not provide adequate information showing that the social, economic and environmental impacts of the LTO have been adequately considered, assessed and evaluated (as required by the NEMA environmental management principles (and in particular section 2(4)(i) of NEMA).

- The LTO document set made available to SAFCEI does not address the health, safety and socio-economic consequences of a beyond-design catastrophic incident, such as a reactor core meltdown.
- The document set does not provide up-to-date information justifying the claim that the LTO is economically justifiable. Of particular concern, the business case for LTO is over a decade old, and fails to take into account progressive and significant reductions in the cost of alternative renewable energy alternatives. SAFCEI is further concerned that the LTO capital costs (which have not been disclosed in the LTO document set) could have a negative knock-on effect on electricity prices.
- SAFCEI has been unable to verify that the NNR directed Eskom to publish a copy of the LTO application in the *Gazette* and two newspapers as required. Furthermore, SAFCEI is concerned that no public meetings have been held with affected communities, and calls upon the Eskom Board to call for public hearings on Eskom's LTO application.

SAFCEI's representations relating to the LTO application for the KNPS are set out below.

2. INADEQUATE INFORMATION PROVIDED FOR MEANINGFUL PARTICIPATION

The document set made available to SAFCEI for comment includes a Public Information Document (PID) as well as a heavily redacted LTO Safety Case.² The PID indicates that the *'license application... is based on Eskom's safety case'*, which it states *'demonstrates that Koeberg can be safely operated for at least 60 years of commercial operation'*. The LTO Safety Case in turn relies on a number of important source documents and studies that have not been made available to I&APs. Furthermore, while some required safety improvements have been implemented, others remain planned for implementation either before LTO or during the period of the LTO.

As a consequence, SAFCEI is precluded from making informed comment regarding the portions of the LTO Safety Case that have been redacted, and is prevented from reviewing and commenting on the various documents and reports relied upon by Eskom to reach various conclusions regarding the safety, health and environmental risks of continuing the

² The Koeberg LTO PID indicates that the *'license application... is based on Eskom's safety case'*, which it states *'demonstrates that Koeberg can be safely operated for at least 60 years of commercial operation'*.

operation of the KNPS for an additional 20 years. As a further consequence, SAFCEI is unable to make fully informed representations regarding the safety improvements that are planned for implementation either before LTO or during the period of the LTO.

While it is noted that the LTO PID indicates that its purpose is *'to provide the public with sufficient information on the radiological risks to safety, health, and the environment due to extending the operational life of Koeberg by 20 years. This will enable the public to participate meaningfully in the regulatory public engagement process'*,³ SAFCEI disputes that the PID and heavily redacted *Safety Case for Long-term Operation of Koeberg Nuclear Power Station* (LTO Safety Case) provide sufficient information to enable it (and the public) to make meaningful representations to the decision-maker.

It has long been recognised that a fair decision-making process requires (among other things) that a person *'must be put in possession of such information as will render his [or her] right to make representations a real, and not an illusory one'*.⁴ Hoexter points out that there is *'a crucial link between the amount and type of information disclosed to an affected person and the quality of his or her opportunity to make representations'*.⁵

Redacted LTO Safety Case

Eskom's LTO Safety Case is replete with redactions, including redactions relating to safety-related matters.

While it is unnecessary for SAFCEI to set out all of these redactions (the redactions in the LTO Safety Case are self-evident), some of the material redactions include (but are not necessarily limited to):

- A number of referenced reports or documents are redacted or partially redacted (see LTO Safety Case, s4.3.1);
- A portion of a paragraph indicated as having been used to form the basis for many of

³ Koeberg LTO PID, p2.

⁴ *Heatherdale Farms v Deputy Minister of Agriculture* 1980 (3) SA 476 (T) (486F-G)

⁵ Hoexter (2nd edition, 2018), *Administrative Law in South Africa*, at p371, referring to by the Constitutional Court in *Bengwenyama Minerals v Genorah Resources* 2011 (4) SA 113 (CC) paras 69-74.

- the technical decisions and general operating rules employed at Koeberg (see LTO Safety Case, s6.1.1);
- A portion of a paragraph relating to ageing management assessments commenced prior to the PSR, and which is indicated as important for the justification of safe LTO (see LTO Safety Case, s7.0);
 - A portion of a sentence relating to proposed safety improvements to address all the deviations and global issues (see LTO Safety Case, s7.2);
 - Portions of the section dealing with site-specific characterisation (see LTO Safety Case, s7.5);
 - A portion of a sentence relating to the approved safety case content and actions to be resolved before entry into LTO (see LTO Safety Case, s8.1);
 - Portions of a paragraph dealing with Outcomes of the Safety Factor Reviews, including in relation to a deviation indicated as 'high'-risk (see LTO Safety Case, s9.1.1);
 - Portions of a paragraph relating to Plant Design Review Results, and in particular evidence of Eskom's inability to close out Safety Reassessment II identified corrective actions (see LTO Safety Case, s9.1.1.1);
 - Portions of paragraphs relating to Actual Condition of SSCs, and in particular civil structures and obsolescence (see LTO Safety Case, s9.1.1.2);
 - Various portions of paragraphs relating to Radiological Risks (see LTO Safety Case, s9.2.2);
 - A portion of a paragraph, as well as the entire concluding paragraph, of the section relating to the Current Licensing Basis (see LTO Safety Case, s9.2.3);
 - Various actions for TLAAs not validated for the entire LTO period have been totally redacted (see LTO Safety Case, Table 9-4);
 - Various words, sentences and paragraphs relating to the first of three physical barriers to prevent or minimise radioactive releases, namely fuel cladding (see LTO Safety Case, s9.4.2.1);
 - Various sentences and/or paragraphs relating to chloride-induced reinforcement corrosion on the Containment Building (see LTO Safety Case, s9.5.2.1);
 - A paragraph relating to the Nuclear Island Aseismic Bearings (see LTO Safety Case, s9.5.2.2.);

- Various portions relating to Ageing Management of Switchboards and Cables (see LTO Safety Case, sections 9.5.2.3, 9.5.2.3.1, 9.5.2.3.2 and 9.5.2.3.3);
- A paragraph relating to Arrangements for Human Resources (see LTO Safety Case, s9.7.5.2)
- Approximately nineteen pages relating to defence in depth (see LTO Safety Case, Appendix D, sections D1.4 and D1.6.1.

No justification is provided by Eskom for these redactions, which have the effect of frustrating SAFCEI's ability to exercise its right to procedurally fair administrative action⁶ within the context of protecting its (and the public's) right to (among other things) an environment that is not harmful to human health and well-being.⁷

Furthermore, both the PID and the LTO Safety Case are drafted by Eskom, and numerous references are made to a wide range of documents and studies that are relied upon in the Safety Case to reach various conclusions regarding the safety, health and environmental risks of continuing the operation of the KNPS for an additional 20 years. While some of these documents and studies have made it indirectly into the public realm (e.g. the IAEA's March 2022 SALTO report), most of the documents and studies referred to and relied upon in the LTO Safety Case (which is in turn relied upon by the PID) have not been made available for public comment.⁸

SAFCEI sets out below some of the documents and studies that it submits would be necessary for it (and other I&APs) to have access to in order to make meaningful submissions:

No updated Safety Analysis Report

The NNR *Interim Regulatory Guideline – Ageing Management and Long Term Operations of Nuclear Power Plants (RG-0027)* stipulates that the Safety Case should include (among other

⁶ See s33 of the South African Constitution.

⁷ See s24 of the South African Constitution.

⁸ While providing sufficient information to ensure that I&APs can make meaningful and informed representations is a fundamental component of procedurally fair administrative decision-making, the NNR *Interim Regulatory Guideline – Ageing Management and Long Term Operations of Nuclear Power Plants (RG-0027)* also stipulates that the Safety Case should include (among other things):

5.3.1(3)(e)(ii) *Ageing management and Long Term Operation programmes, supporting documents such as scoping document and time limited ageing analysis and all other relevant safety related programmes.*

things):

- An updated Safety Analysis Report (SAR).⁹
- The update to the Safety Analysis Report should also include documentation of the revalidation of the time limited ageing analyses for the period of the Long Term Operation.¹⁰

Section 11 of the LTO Safety Case indicates that it discusses 'proposed' changes to the current SAR, and reveals that an updated SAR was not included in the LTO Safety Case

Eskom explain (among other things) that the SAR for the current life of the plant defines the design service life of the nuclear steam supply system as 40 years, and concedes that the SAR must therefore be revised with the analysis of a 60-year service life for the NSSS. Eskom go on to indicate that at the submission of the safety case, some of the documentation required for the SAR update was not available, '*since the activities related to these are currently in progress, scheduled to be completed prior to entry into LTO*'.¹¹ Eskom indicates further that in accordance with an approval by the NNR, '*the updated SAR with markups for the outstanding activities will be submitted*',¹² and that a marked-up SAR was submitted to support the Safety Case. Eskom states that Appendix B provides details regarding the proposed changes to the SAR.

Appendix B to the LTO Safety Case reveals a table of activities, references to 'SAR Chapter' and a 3rd column that has been redacted. Despite its description, this table lacks any meaningful content.

The exclusion of an updated SAR from the LTO Safety Case precludes SAFCEI (and other I&APs) from assessing and making meaningful representations relating to the updated SAR (and the documents required to be included).

⁹ Section 5.3.1(3)(e)(viii).

¹⁰ Section 5.3.1(3)(e)(ix).

¹¹ Koeberg LTO Safety Case, p185.

¹² Ibid.

Furthermore, it is noteworthy that RG-0019 Appendix 4 includes (among other things) the following requirement:

19. Probabilistic Risk Assessment and Severe Accident Evaluation

The licence applicant should provide in Chapter 19 of the SAR an adequate level of documentation to enable the NNR to determine the acceptability of the risks to public health and safety associated with operation of a proposed new plant. The acceptability of the risks to public health and safety is determined from the interpretation of the results and insights of the applicant's (1) plant-specific PRA and (2) severe accident evaluations.

The LTO Safety Case signally omits to include any PRA relating to or evaluation of the health, safety and socio-economic consequences of a severe accident scenario (and in particular a worst case beyond-design accident, such as a reactor core meltdown and loss of containment).

It is also relevant to note that requirement that the update to the Safety Analysis Report should also include documentation of the revalidation of the time limited ageing analyses (TLAA) for the period of the Long Term Operation has not been complied with. Instead, the LTO Safety Case indicates that the *KNPS 3rd Periodic Safety Review Global Assessment Report and Integrated Implementation Plan Report* includes actions such as (among other things) Time-Limited Ageing Analysis (TLAA) revalidations (which on the face of it have not all yet been attended to).

In light of the above, SAFCEI submits that the LTO application and submission of the LTO Safety Case without an updated SAR - as well as without the inclusion of documentation of the revalidation of the TLAA for the period of the LTO - is premature, and constitutes a fatal flaw. On this basis alone the NNR should refuse Eskom's application.

Feasibility Studies

Section 7.1 of the LTO Safety Case refers to various reports from studies undertaken to address strategic elements, such as the need for electrical power, an economic assessment and issues concerning diversity.

Reference is also made to a Plant Life Extension Feasibility Study (K08016VAR - *Koeberg Plant Life Extension*) (PLEX Feasibility Study), while the outcomes of this study are 'discussed' in s9.4.1 of the LTO Safety Case. The LTO Safety Case indicates in s9.4.1 that the feasibility study found that certain components would require replacement. The refuelling water storage tanks are indicated as having been replaced (due to atmospheric stress corrosion), as is the reactor vessel head (due to primary water stress corrosion cracking). The study also found that the steam generators required replacement due to water stress corrosion cracking, with the replacement due to be completed in 2024. The study also identified the need for partial replacement of the high- and low pressure feedwater heaters (due to erosion, fretting and water hammer), while the LTO Safety Case indicates that these components are not discussed further in the safety case as they are not systems, structures and components (SSC) important for safety and are to be replaced during a normal engineering lifecycle management process. Cables and switchgear replacements were also identified as being required (due to potential ageing effects), while the LTO Safety Case indicates that large-scale replacement of these components is not required (which items are discussed further in s9.5.2.3 of the LTO Safety Case, portions of which have also been redacted).

Neither the various reports from studies undertaken to address the strategic elements referred to above, or the PLEX Feasibility Study, have been included in the document set available made available for comment. This precludes SAFCEI from commenting on these reports and studies, as well as the claims made in the LTO Safety Report that some of the replacements identified in the PLEX Feasibility Study are not required.

Periodic Safety Review (PSR)

The LTO Safety indicates that PSR is:

...a comprehensive review of all aspects important for safety, carried out at regular intervals, and is used in support of the decision-making process for long-term operation. It provides an effective means to obtain an overall view of actual plant safety and the quality of the safety documentation and to determine reasonable and practical safety improvements needed for an acceptably high level of safety.¹³

¹³ Koeberg LTO Safety Case, p46.

The LTO Safety Case indicates that a third PSR was commenced in August 2019, and was *'used to support the additional 20 years of intended LTO by determining the suitability of the facility for continued safe LTO'*.¹⁴ The review was reportedly conducted in four main phases, which included (among other things) a preparation phase, safety factor (aspects) review, a global assessment, and final reporting. The PSR was concluded in June 2022.

The LTO Safety Case indicates further that where deviations would have an impact on the requirements for safe entry into LTO – which might require further assessments – these assessments were performed to determine the safety improvements necessary to meet the LTO requirements. The LTO Safety Case reports that, among others, this was the case for the ageing review in the PSR: to meet the LTO requirements, ageing assessments were required prior to entry into LTO. The LTO Safety Case indicates that these ageing assessments were undertaken by way of a SALTO Ageing Management Assessment in accordance with IAEA safety standards, and was reviewed by the IAEA SALTO peer review service.

The PSR has not been made available to the public for the purpose of commenting on the LTO application. The LTO Safety Case also indicates that not all the deviations raised in the PSR review phase were included in the safety case (only deviations considered relevant to the topics being discussed are highlighted in the safety case), and that *'this is not deemed a concern because all the deviations raised in the PSR were assessed in the global assessment and are considered fully in the suitability of the plant for LTO.'*¹⁵

The unavailability of the PSR precludes SAFCEI (and the public) from making informed, meaningful comments on the various issues raised (including in respect of deviations not included in the LTO Safety Case). As far as can be determined, the 'global assessment' referred to (which is presumed to be the *KNPS 3rd Periodic Safety Review Global Assessment Report*) has also not been made available to inform public comment on Eskom's LTO application.

Koeberg/Duynfontein Site Safety Report (K/DSSR)

¹⁴ Koeberg LTO Safety Case, p46.

¹⁵ Koeberg LTO Safety Case, p52.

The LTO Safety Case indicates that the K/DSSR contains information relating to the hazards applicable to the facility, and that during the second periodic review of the plant in 2008, it was found to be outdated, *'that is, the information relating to the hazards was no longer accurate, or new hazards needed to be considered in the site characterisation, and therefore, the KSSR had to be updated'*.¹⁶ The report indicates further that the justification for LTO (as detailed in RG-0027 (*Interim Regulatory Guide - Ageing Management and Long-Term Operations of Nuclear Power Plants*)), should include a *'description of any design basis reassessment. To determine any need for design basis reassessment, studies relating to the update of the site characterisation had to be performed as part of the LTO assessments'*.¹⁷ The paragraph following this statement has been redacted.

In the context of discussing the current licensing basis, the LTO Safety Report indicates that the PSR validated the validity of the current licensing basis, and *'the only deviation raised was related to the site safety report, which had not been updated with the latest information relating to external events applicable to the facility. The studies for the update of the specific site characterisation are currently under way, scheduled to be completed prior to entry into LTO'*.¹⁸

The LTO Safety Case indicates further that in relation to specific site characterisation, LTO requires a demonstration that site characteristics have been comprehensively reviewed for applicable hazards important for safe operation of the installation and the site safety report updated to reflect changes in the hazards.¹⁹ It is stated further that recent studies for the site safety report have been completed, except for the seismic analysis and probabilistic tsunami assessments. This statement is followed by a redacted paragraph. In addition, portions of the conclusion to the specific site characterisation have been redacted:

It is demonstrated above that, although there have been changes in some hazard parameters and new hazards have been screened in, the changes in conditions [REDACTED] do not pose a risk to LTO. The impact of the seismic hazard on the screened-in hazards will be confirmed when the seismic studies are completed [REDACTED].²⁰

¹⁶ Koeberg LTO Safety Case, p50.

¹⁷ Ibid.

¹⁸ Koeberg LTO Safety Case, p70.

¹⁹ Koeberg LTO Safety Case, p71.

²⁰ Koeberg LTO Safety Case, p80.

However, the LTO Safety Case indicates in relation to the PSR hazard analysis review that the lack of an up-to-date site safety report was deemed a shortcoming in the PSR hazard analysis review, and that a deviation with a “medium” safety significance was raised to capture this issue. Again, it is indicated that the DSSR is being updated to address the identified deviation (the outstanding Senior Seismic Hazard Assessment Committee (SSHAC) study is planned to be incorporated into the DSSR by 2024, the revised DSSR submitted to the NNR for approval, and all relevant station documents is to be updated).²¹

In the absence of an updated K/DSSR, SAFCEI is precluded from making informed and meaningful representations, and submits that Eskom’s LTO application is premature.

Structural Integrity

With regard to the structural integrity of the KNPS containment buildings, the LTO Safety Case executive summary indicates that the LTO assessment identified some SSC’s important for safety with ageing mechanisms that posed a risk if not treated in a timely manner. This included the containment buildings, which are indicated as being subject to chloride-induced reinforcement corrosion, with the proposed solution being to implement an impressed current cathodic protection (ICCP) system into the concrete of the containment buildings to neutralise the corrosion effects of chlorides. The LTO Safety Case claims that the containment buildings are acceptable for operation at present based on current surveillance monitoring results, and reports that an integrated leak rate test (ILRT) was completed in 2015 (on both units).²²

The LTO Safety Case goes on to explain that the containment buildings house the nuclear reactors, steam generators, reactor coolant pumps, and other primary system equipment and act as the third barrier to prevent the release of radioactive material to the environment during normal operation and design basis accidents. The LTO Safety Case reports that:

Due to significant chloride loading into the containment civil structure from the atmosphere at Koeberg that was not anticipated during the design stage, the external

²¹ Koeberg LTO Safety Case, p100.

²² Koeberg LTO Safety Case, p10.

surfaces of the containment buildings have suffered from chloride ingress that causes rebar corrosion. Since the year 2000, various investigations, tests, and evaluations have been dedicated to the required recovery. The first was removing loose and spalled surface areas, followed by repairs. Several repair projects have been completed to date. However, it is clear that these efforts are temporary and not a permanent solution. An investigation by a group of international experts concluded that the only permanent solution was to protect the internal rebar and tendons through impressed cathodic protection.²³

The LTO Safety Case indicates that a modification to provide such a system is in progress.

While the LTO Safety Case asserts that ongoing measures to preserve and improve the condition of the containment buildings are being made and that the technical evaluation of the TLAA concluded that the containment structure integrity was ensured for the planned LTO, SAFCEI remains concerned that reliance is being placed on an 8-year old integrated leak test (which has not been made available to the public), and that the 'permanent' solution proposed has not yet been implemented (again suggesting that the LTO application is premature).

In light of the above, SAFCEI submits that it would be premature for the NNR to authorise the LTO of the KNPS before this problem has been resolved, and the effectiveness verified.

Seismic Protection

The LTO Safety Case advises regarding 'hazards screened in' that a baseline seismic hazard analysis was conducted and a baseline seismic curve for the site developed, and that:

These preliminary studies indicated an increase in peak ground acceleration compared to the original design basis safe shutdown earthquake data (that is, the site was designed for a peak ground acceleration of 0,3 g with some margin, while the preliminary studies indicated that the new peak ground acceleration was greater than the design basis peak ground acceleration), thus requiring further evaluation of the robustness of the plant against this hazard to justify LTO.²⁴

The LTO Safety indicates that the outstanding Senior Seismic Hazard Assessment Committee (SSHAC) study will be completed and incorporated into the DSSR by 2024, the revised DSSR

²³ Koeberg LTO Safety Case, p85.

²⁴ Koeberg LTO Safety Case, p74.

will be submitted to the NNR for approval, and that all relevant station documents will be updated.²⁵

SAFCEI also notes that Eskom has not yet demonstrated that the anti-seismic bearings intended to protect the reactor core and reached the conclusion that '*...testing of anti-seismic bearings is currently in progress to verify that the bearings' characteristics are suitable for the entire period of LTO.*'²⁶ Safety improvements (characterisation programme and ageing management programme) are reported to be included in the LTO IIP [Integrated Implementation Plan].²⁷

In light of the above SAFCEI is precluded from making informed and meaningful representations, and submits that Eskom's LTO application is premature.

Tsunami Hazard

The LTO Safety Case advises further regarding 'hazards screened in' that the tsunami hazard included in the KSSR was based on a magnitude 7,8 seismic upheaval at the South Sandwich Islands. In the KSSR, an estimated tsunami run-up of +4,0 m MSL was envisaged, with a maximum credible tsunami of +5,2 m MSL if combined with the highest astronomical tidal level. However, the results of the updated tsunami hazard assessment (THA) showed that the probable maximum tsunami (PMT) run-up and inundation were governed by volcanic flank collapse tsunamis, which indicated flooding of the facility nuclear terrace, located at approximately +8 m MSL. Current estimates for PMT are given at +11,82 m (2021), increasing to +13,95 m (2064).²⁸

The LTO Safety Case indicates that further analysis of the probability of occurrence of a volcanic flank collapse tsunami, as well as the potential impact of predicted flood water depths and currents on SSCs, will be performed. The required analysis is reported to be included in the LTO IPP [Integrated Preparation Plan] and scheduled for completion prior to LTO. The Safety Case indicates further that the probabilistic seismic hazard analysis (PSHA)

²⁵ Koeberg LTO Safety Case, p100.

²⁶ Koeberg LTO PID, p59.

²⁷ Koeberg LTO Safety Case, p125.

²⁸ Koeberg LTO Safety Case, p75.

results will be reviewed to verify that the local sources used in the THA are enveloped by the PSHA results, which verification will be performed on completion of the seismic hazard analysis in 2024. Should the assessment indicate a high risk, appropriate mitigations will be put in place.

Given that the further analysis of the risk of tsunamis is indicated as being required, and that the results of the PSHA will thereafter be reviewed (and appropriate mitigations put in place if a high risk is indicated), SAFCEI (and other I&APs) are precluded in this commenting period from making representations on these studies, reviews and any appropriate mitigation measures.

3. IMPACTS OF GRID INSTABILITY AND LOADSHEDDING ON LONG TERM OPERATION (LTO) OF THE KOEBERG NUCLEAR POWER STATION

Introduction/executive summary

Grid constraints and loadshedding have been a feature of the South African energy landscape since 2008, and have in recent months been increasing in intensity, with no end in sight. Loadshedding is a mechanism used by the power utility Eskom to reduce demand and stabilize the grid, where demand exceeds supply. A national state of disaster has been declared with the main intention to address the shortfall in electricity supply.²⁹ It is therefore predictable that for an indeterminate period of time, and at least 24 months there will be electricity generation shortages necessitating load shedding.³⁰

Loadshedding impacts on nuclear power plant safety both now in the future (especially if LTO is authorized) are a relevant consideration for the decision maker when it considers the application for LTO, given that continual loadshedding, and grid instability may have serious consequences for safety of the reactor and the grid as a whole.

²⁹ *The purpose of the State of Disaster* – Briefing by Minister Dlamini Zuma 3 March 2023 where it was stated that “This declaration, as announced by the President during the State of the Nation address, was in response to the severe impact of the intermittent electricity supply across the country.”

<https://www.politicsweb.co.za/politics/the-purpose-of-the-energy-state-of-disaster--ndz>

³⁰ BusinessTech 22 January 2023 *Expect near-permanent load shedding for the next 2 years: Eskom* - (quoting Eskom chairperson), <https://businesstech.co.za/news/trending/658305/expect-near-permanent-load-shedding-for-the-next-2-years-eskom/#:~:text=Expect%20near%2Dpermanent%20load%20shedding%20for%20the%20next%20%20years%20>

At the very least the impact of a constrained grid and sustained loadshedding on nuclear safety at the KNPS should have been mentioned and assessed in the application for LTO, as it was already taking place when the reports that form part of the LTO application were undertaken. Yet it is not mentioned as a consideration in the safety case for the LTO.

The LTO application should have considered the following issues and how they could impact on reactor safety:

- (i) Current and future grid instability;
- (ii) Loadshedding;
- (iii) Whether on site and off site back up is adversely affected by grid instability and/or load shedding;
- (iv) Whether continued loadshedding and loss of generation capacity can contribute to a grid collapse and what measures are in place to keep the reactor and its waste cool indefinitely if a grid collapse occurs;
- (v) Whether the relative increased contribution of the KNPS to the grid poses a safety risk in the context of grid instability and load shedding;
- (vi) Whether the unbundling of Eskom over the long term will affect the grid to the extent that it is not able to provide sufficient stable support to enable the continued operation of the KNPS (for the period of the LTO and its safe decommissioning.)

The failure to mention and assess these safety issues is a fatal flaw in the application for LTO, as the decision maker in authorizing the continuation of a nuclear power station (which is an inherently hazardous industry) must apply its mind to all relevant considerations, and in particular those provided for in the regulatory scheme locally and internationally governing nuclear safety.

Specific Safety Issues that should have been considered in the LTO Relating to Current Energy Constraints

(a) Grid Stability and Reliability – Power Requirements for the Safe Reactor Operation

and Shutdown

Nuclear power stations, unlike other conventional power sources, have unique requirements for the grids in which they are operated. The current and likely future state of the grid for the 20 years that the KNPS seeks a license to operate should have been evaluated in the application for LTO to determine whether it safely supports the reactor (which is disputed).

Unlike conventional power sources (thermal power units, or hydroelectric dams), NPPs have highly complex long-term shutdown cooling requirements that consume power and have stringent voltage and frequency limitations (imposed to assure the operability of critical emergency cooling systems). Although an automatic or manual reactor trip should dramatically slow the fission reaction almost immediately, the extremely high operating temperature of the core, along with the continuing heat from fission decay even in the shutdown state, puts tremendous stress on the materials of the core.³¹ A reliable means of short- and long-term decay heat removal is required in order to prevent overheating and possible damage to the reactor fuel rods and containment. Typically, the decay heat removal process is dependent on availability of a long-term stable source of electric power, either from the grid or from on-site power sources to enable the cooling process.

A worst case scenario would be core damage caused by the loss of sufficient cooling for the nuclear fuel within the reactor core. Although unlikely, a loss-of-coolant accident (LOCA) could occur, for example, from a rupture of a primary coolant pipe, a breach in the reactor vessel, etc. A large-break LOCA, from whatever cause, is a nearly instantaneous event requiring rapid cooling by the emergency core cooling system (ECCS).³² Whether powered from the grid, or an offsite backup, or even onsite generators, the sudden surge of power to the ECCS must be supplied with the utmost reliability. Failure or inadequate performance of the ECCS could result in serious core damage, rapid and uncontrolled venting of remaining coolant, and other failure modes.

³¹U.S. Nuclear Regulatory Commission Technical Training Center. Undated. Reactor Concepts Manual. Pressurized Water Reactor (PWR) Systems.

³² Westinghouse, 1984. The Westinghouse Pressurized Water Reactor Nuclear Power Plant. https://www.xylenepower.com/the_westinghouse_pressurized_water_react.pdf

Because the ECCS is a redundant system, and operates only as a backup in extreme cases, its failure seems very unlikely. But such a failure is closely analogous to the failures at Fukushima, where backup power supplies were destroyed in the tsunami.³³ In the case of Koeberg, instability or inadequacy of the South African power grid raises grave concerns about the reliability of both primary and backup power availability.

Legislative Context

The application for long term operation is governed by the National Nuclear Regulator Act NNR Act 47 of 1999, its regulations, as well as regulatory guides and guidelines of the International Atomic Energy Association. The Safety Case includes the IAEA guidelines “Considerations on the Application of the IAEA Safety Requirements for the Design of Nuclear Power Plants”³⁴ (otherwise referred to as AEA-TECDOC-1791).

Regulations on the Long Term Operation of Nuclear Installations, promulgated under the NNR Act³⁵ provide that:

1. The safety case for Long Term Operation shall amongst others-
 - (a) demonstrate compliance with relevant regulatory safety criteria and requirements;
 -
 - (d) demonstrate availability of financial and human resources as well as knowledge management for the period of Long Term Operation, which knowledge management shall include an integrated, systematic approach to identifying, managing and sharing an organisation's knowledge and enabling groups of people to collectively create new knowledge to help achieve the organisation's objectives;

Grid stability and safety issues are part of the design considerations of the IAEA for nuclear power plants and therefore the impact of grid instability and loadshedding should have been included for assessment in the application.

³³Acton JM and Higgs M. 2012. Why Fukushima Was Preventable. Carnegie Endowment for International Peace. <https://carnegieendowment.org/2012/03/06/why-fukushima-was-preventable-pub-47361>

³⁴ IAEA Publication IAEA-TECDOC-1791 | 978-92-0-104116-6
Considerations on the Application of the IAEA Safety Requirements for the Design of Nuclear Power Plants

AEA-TECDOC-1791-<https://www.iaea.org/publications/11069/considerations-on-the-application-of-the-iaea-safety-requirements-for-the-design-of-nuclear-power-plants>

³⁵ GNR 266 published in GG 44394 on 26th March 2021

As stated by the IAEA in its guidelines for the design of electrical power systems for nuclear power plants regarding grid stability, the electrical grid should provide stable off-site power and the trip of a nuclear power plant main generator should not jeopardise the stability of the grid:³⁶

GRID STABILITY AND RELIABILITY

6.45. The electrical grid should provide stable off-site power; that is, it should be capable of **withstanding load variations without exceeding the specified voltage limits and frequency limits.**

6.46. The grid should have **enough running inertia** to make certain that the loss of a large power generating unit, the trip of the nuclear power plant main generator or busbar faults in the grid do not jeopardize the stability of the grid.

6.47. The degree to which the grid can maintain an **uninterrupted power supply to the nuclear power plant with sufficient capacity (i.e. voltage and frequency) is a measure of the reliability of the grid.** (emphasis added)

As stated in the IAEA guideline [AEA-TECDOC-1791](#)

Numerous studies have shown that a Station Blackout (SBO) event could be a relevant contributor to the total risk from NPP accidents in some countries. Although this total risk may be small, the relative importance of SBO events was established. This finding and the accumulated Diesel generator failure experience increased the concern about SBO, particularly in plants where the **external grid is not very stable.**

The following quote from the US Nuclear Regulatory Commission, explains why off site backup by means of a stable grid is critical to nuclear safety. On site backup, which is usually limited to emergency generators and their diesel stocks, is really only used as a last resort. In the event of a nuclear trip event it is advisable to have a stable grid that provides this off site backup:

WHY DOES NRC CARE ABOUT GRID STABILITY? Nuclear power reactors must be cooled continuously, even when shut down. The numerous pumps and valves in the reactor cooling systems therefore must have access to electrical power at all times, even if the normal power supply from the grid is degraded or completely lost. As a regulator, we want to minimize the time a nuclear power plant is subjected to a complete loss of offsite power, otherwise known as Station Blackout. Even though plants are designed with emergency diesel generators to supply power to pumps and valves that keep the reactor cool when normal power is lost, we do not like to challenge those diesel generators any more than is absolutely necessary.³⁷

³⁶IAEA Publication *Design of Electrical Power Systems for Nuclear Power Plants - Specific Safety Guide No. SSG-34* 2016 <https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1673web-53477409.pdf>

³⁷ <https://www.nrc.gov/docs/ML0620/ML062050519.pdf>

Published journal articles support this view with details:

The electrical grid is the preferred power source for safe startup, operation and normal or emergency shutdown of the NPP, in addition to the necessity of the adequate capacity for exporting the produced power from the NPP (IAEA N, 2012). Hence, loss of offsite power (LOOP), (ie loss of power from the grid) is defined as the “simultaneous loss of electrical power to all safety-related buses that causes emergency power generators to start and supply power to them” (Eide et al., 2005a). LOOP stands out as the most dominant contributor to the core damage frequency of NPPs (Mohsendokht et al., 2018).³⁸

The availability of alternating current power via the electrical grid is essential for safe operation and accident recovery of nuclear power plants (NPP). Loss of offsite power (LOOP), as an initiating event, contributes more than 26 percent to the core damage frequency (CDF) of generation II reactors. The LOOP event dramatically affects plant operations because it influences the mitigation responses by placing demands on the onsite power systems.³⁹

South Africa currently operates a constrained grid with very little surplus capacity,⁴⁰ and unplanned outages can result in electricity demand exceeding available supply as it does not currently have the requisite reserves to rely on in order sustain supply. In these circumstances Eskom has resorted to load shedding. This is explained in the paragraphs 40 to 43 of the affidavit of Andre De Ruyter then CEO of Eskom:⁴¹

[40] The immediate cause of load shedding is insufficient generation capacity. Where a system generates a surplus amount of electricity, it can temporarily take various of its power stations offline in order to perform required maintenance. It can also sustain required supply during unplanned outages (or breakdowns) of power stations by relying on its reserves.

[41] Where there is little or no surplus of generation capacity, however, unplanned outages can result in electricity demand exceeding available supply, meaning that load shedding is required. Additionally, if power stations are intentionally

³⁸ *Assessment of the grid-related loss of offsite power to the nuclear power plants in the presence of wind farms* Sh Kamyab ^a, A. Ramezani ^b, M. Nematollahi ^a, P. Henneaux ^c, P.E. Labeau ^c
<https://www.sciencedirect.com/science/article/abs/pii/S0149197022003821>

³⁹ *Reducing the loss of offsite power contribution in the core damage frequency of a VVER-1000 reactor by extending the house load operation period*, January 2018 *Annals of Nuclear Energy* 116:303-313 DOI:10.1016/j.anucene.2018.01.030 Massoud Mohsendokht, Kamal Hadad, Masoud Jabary
<https://www.researchgate.net/publication/324295283> *Reducing the loss of offsite power contribution in the core damage frequency of a VVER-1000 reactor by extending the house load operation period*

⁴⁰ Affidavit of Andre Marinus de Ruyter: IN THE HIGH COURT OF SOUTH AFRICA GAUTENG DIVISION, PRETORIA CASE NUMBER: 2023/005779 In the matter between: UNITED DEMOCRATIC MOVEMENT AND 18 OTHERS Applicants and ESKOM HOLDINGS SOC LIMITED AND 7 OTHERS Respondents, paragraph 58.

⁴¹ Id.

- taken offline to perform required maintenance, electricity demand can exceed generation supply.
- [42] An additional consequence of insufficient generation capacity is that generation units must run at a higher-than-benchmarked Energy Utilisation Factor (“**EUF**”). Where a unit is run above the benchmarked EUF, it degrades faster than it otherwise would and, over time, will only be able to supply a decreasing amount of electricity. This is reflected as a decrease in the power station’s EAF, which reflects the percentage of its nominal capacity (taking into account all outages) that a power station is able to produce.”
- [58] ...from 1998 onwards Eskom’s reserve margin began to decrease. This metric reflects the amount of surplus generation capacity within an electricity system.
- [58.1] Typically, a well-run electricity system has a reserve margin of approximately 5% which allows for preventative maintenance and unplanned shut-downs without load shedding.
- [58.4] By 2001, it had dropped to 13.6%; by 2003, to just above 10%; and by 2008 to 5%.

IAEA guidelines on nuclear safety and grid reliability state that when considering siting a new nuclear power plant the reliability of the off site power will have to be calculated. The grid reliability data will be needed to assist the probabilistic safety assessment to be presented into the pre-construction safety report.⁴²

8.2. CALCULATION OF THE RELIABILITY OF THE OFF-SITE POWER

The NPP developer will need to arrange the calculation of the expected reliability of off-site power. The grid reliability data will be needed to assist the probabilistic safety assessment to be presented into the pre-construction safety report....

The calculation of the reliability of offsite power will need to use historic data on grid faults and events involving loss of grid connection, such as the information summarized in Section 4.2. It will also require a provisional design for the proposed connection scheme for the future NPP. The analysis should consider all the possible causes of loss of off-site power (LOOP), and it would be useful to provide information on which are the main causes of the LOOP events, to allow corrective actions to reduce risks. The causes could include faults within the NPP that affect the connection between the NPP and the grid, and the many types of faults on the grid summarized in Section 4.6 and listed in detail in Appendix I.

The non-site and site specific data provided should be analyzed and summarized; Table 1 gives an example of such a summary. The report on the reliability of offsite power needs to be consistent enough so it can be relied on for the nuclear site licence application.

Table 1 includes two types of data: the frequency of events that result in loss of off-site power (LOOP); and the probability that reactor transients will lead to LOOP. For each type of event, both duration and frequency shall be considered by dividing the different events into duration categories, as suggested in the table.

⁴² IAEA Nuclear Energy Series No. NG-T-3.8, 2012, *Electric Grid Reliability and Interface with Nuclear Power Plants* - available at https://www-pub.iaea.org/MTCD/publications/PDF/Pub1542_web.pdf

Grid stability and reliability is thus a key requirement in ensuring safety of nuclear power stations and the current and potential future state of grid stability in South Africa should have been analysed in the LTO Safety Case, against international best practice, to determine whether nuclear safety can be ensured by our grid over a period of 20 years. Clearly issues of supply and grid constraints were known to Eskom long before it applied for the KPNS LTO. Even as far back as 1998 there has been insufficient investment in new generation capacity, a responsibility vested in the Minister of Minerals and Energy. As a result, Eskom has had to operate with insufficient generation capacity.⁴³ As stated in the de Ruyter affidavit:⁴⁴

85. As a consequence of Eskom's high EAF, as the graph below indicates, from 2011 onwards the Energy Availability Factor of Eskom's power stations has decreased at a faster rate than the benchmarked decrease. However, even at the benchmarked rate, Eskom's fleet would have shown a deteriorating EAF.

It is submitted that the application for LTO of the KNPS should also have considered grid reliability data given the sustained changes in grid stability in recent times in South Africa. Analysis of potential loss of off site power for back up is a critical issue given the state of our electricity supply currently, as is the importance of off site power as defence in depth where the reactor trips. The LTO application has not engaged in this kind of analysis which is a fatal flaw and it is therefore not a basis for decision making.

It is also submitted that the constrained nature of the South African grid means that the assurance that it can maintain nuclear safety cannot be given and as a result the application for LTO should be refused.

(b) Loadshedding

South Africa has for experienced bouts of load shedding since 2008, and it is now a daily occurrence. According to Eskom, until the national electricity supply is increased to meet demand it will be unavoidable in order to avoid a national blackout and in its best estimation,

⁴³ Affidavit paragraph 44.1

⁴⁴ Id paragraph 85.

it could take up to 24 months to generate the additional supply required to bring an end to load shedding.⁴⁵

26.3.1 Maintaining the grid, and preventing a blackout, requires keeping electricity supply and demand levels in balance.

[12] The load shedding that South Africa is continuing to experience is implemented as a measure of last resort, because there is insufficient generation capacity – and thus insufficient electricity supply – to meet the demand for electricity in the country. On Eskom’s assessment, the current shortfall in available electricity supply is 4000 to 6000 megawatts (MW), depending on the season, time of day and customer usage patterns.

[13] Load shedding is implemented to save the national electricity grid from complete collapse and a resulting national blackout. **If supply and demand are not kept in balance on the national electricity grid, the grid will collapse and the entire country will experience a blackout or total loss in electricity supply**”. (emphasis added)

The question arises whether sustained loadshedding itself, as a mechanism to address power supply shortages, may in turn also adversely impact the safety of the KNPS. For example, does a constrained grid that is subject to frequent loadshedding contribute to more trips of the nuclear power station? And in turn does such an increased number of shutdowns could contribute to aging of the power plant as it has to be cooled and restarted more regularly? How effectively and skillfully loadshedding is managed may depend on a variety of factors such as skills, financial and technical resources and the extent to which parts of the grid are to be exempted from loadshedding, and this in turn might impact the KNPS.

These issues are within the knowledge of Eskom but were not mentioned in the LTO Safety Case. It is submitted that the information on which the application is based is incomplete and not a basis of decision making.

Accordingly, the application for LTO should be refused.

(c) Whether the Relative Increased Contribution of the KNPS to the Grid poses a Safety Risk in the context of Grid Instability and Loadshedding

The KNPS, when fully operational makes a larger relative contribution to the grid than when first constructed, given the declining availability of electricity from coal fired power plants. In

⁴⁵ Affidavit of A de Ruyter paragraph 23

1997 when South Africa began developing its new energy policy the 1840 MW from the KNPS accounted for about 3% of the national primary energy supply and 5% of the country's electricity.⁴⁶ Currently that amounts to nearly 10% of generation capacity.

Assuming a more dominant role in the grid has consequences for a NPP in an unstable or constrained grid and may contribute to grid collapse/blackout. Apart from the generally disastrous consequences of any grid collapse/blackout, the further consequences for the NPP could be a loss of offsite power to keep the reactor and its high level waste cool. As described by Bickel in his article on grid stability and nuclear safety:

3.4 NPP Trip and Cascading Grid Collapse

In a situation where an NPP, carrying a significant portion of the electrical grid, trips this can result in significant imbalance between available generation and load. Unless additional power can be quickly imported via external grid connections or generation added quickly, this can lead to degraded voltage and frequency on the alternate offsite power connections that will result in a loss of offsite power to the NPP.⁴⁷

It follows that the following issues (and possibly others) needed to be mentioned and evaluated in the application for LTO Safety Case:

- the increased contribution of the KNPS to the grid and the impact of this on nuclear safety given current grid instability and constraints;
- the available generating capacity of the system, to withstand outages of the largest unit, over the 20 years for which Eskom seeks a licence to operate the KNPS. Cognisance would need to be taken of the considerable uncertainties as to how electricity will be generated in South Africa over this period.
- whether grid constraints and continual loadshedding contribute to KNPS tripping more regularly and whether these events have an impact on the aging of the reactor.

This did not take place which is a fatal flaw. Accordingly, the application should be refused.

⁴⁶ White Paper on Energy Policy. 1998, Department of Minerals and Energy ISBN: 0-9584235-8-X
https://www.energy.gov.za/files/policies/whitepaper_energypolicy_1998.pdf

⁴⁷ Dr. John H. Bickel *Grid Stability and Safety Issues Associated with Nuclear Power Plants* (Bickel article) Evergreen Safety and Reliability Technologies, LLC available at <http://nautilus.org/wp-content/uploads/2011/12/Bickel.pdf>

(d) Loadshedding and Potential Grid Collapse

The application for LTO should have assessed what the consequences of a grid collapse would be for the KNPS now and in the future.

Specifically, if a grid collapse occurs, what measures are in place to keep the reactor and its high level waste cool indefinitely given that Eskom has stated that it is impossible at this stage to estimate how long a blackout would last? (and therefore how a blackout would impact the reactor's backup electricity supply)? The application failed to do so which is a fatal flaw.

It is submitted that a nuclear reactor operating in a constrained grid where a blackout of indefinite length is a possibility is an unacceptable risk to public health and the environment and it should not be licensed to continue operating beyond the current license.

ASSESSMENT OF THE NUCLEAR SAFETY CONSEQUENCES OF A GRID COLLAPSE

The potential for a grid collapse has become a risk that needs to be considered in an application for long term operation of the KNPS. This eventuality, though previously regarded as a remote possibility has become more real with potentially catastrophic consequences as described in the affidavit of de Ruyter.⁴⁸

“As a last resort, to save the national electricity grid from complete collapse, the System Operator will reduce the customer demand for electricity by implementing loadshedding (manual load reduction) and maintain the supply and demand balance.
<https://www.eskom.co.za/dataportal/>

He states that for the reasons explained by Eskom's General Manager of Transmission System Operator Ms Isabel Fick, Eskom estimates as to how long such a blackout would last is impossible to predict with any certainty.⁴⁹

GRID COLLAPSE AND THE LTO APPLICATION

Grid collapses/ blackouts happen from time to time for example in the USA in 1997 and more

⁴⁸ *Grid collapse catastrophic for SA*, De Ruyter warns in affidavit - Published Feb 28, 2023
<https://www.iol.co.za/business-report/economy/grid-collapse-catastrophic-for-sa-de-ruyter-warns-in-affidavit-75ac722e-1a03-4549-9356-9e51b2d04a7c>

⁴⁹ de Ruyter affidavit paragraph 14

recently in Pakistan. Load shedding to prevent grid collapse has been a concern at Eskom since 2008, and therefore the LTO Safety Case should have assessed the impacts of a grid collapse on safety at the KNPS. Even if a complete grid collapse was considered to be a remote possibility when the reports that make up the LTO application were undertaken, (which is denied) this does not excuse Eskom from evaluating the safety risks and impacts of such an event now.

The current constrained electricity generation situation makes the consequences of a blackout all the more serious and assessment of such consequences is urgently required whether or not there is an application for the extension of life of the KNPS.

The most serious consequence of a grid collapse would be the failure of offsite and onsite backup cooling systems. This might occur if there is a lack of access to sufficient diesel, as a result of interruptions in supply – caused for example by unrest and communications breakdowns. Recent looting and unrest in KZN has demonstrated how fragile the fuel and other transportation system can become when there is widespread unrest.⁵⁰

A failure to cool the plant until the grid restored after a collapse could result in a nuclear catastrophe based on similar events that took place at Fukushima when cooling backup systems failed.⁵¹

(e) Unbundling of Eskom and Nuclear Safety

The 1998 White Paper also set out the intended structural reforms of Eskom, including the unbundling of Eskom's Generation, Transmission, and Distribution divisions. Through this restructuring, it was hoped that the private sector would ultimately contribute approximately 30% of South Africa's electricity generation. The unbundling of Eskom into three separate

⁵⁰ <https://www.dailymaverick.co.za/article/2021-07-14-food-and-fuel-supplies-curtailed-in-kzn-as-looting-persists-billions-in-losses-reported/> *Food and fuel supplies curtailed in KZN as looting persists, billions in losses reported* -By [Daily Maverick Reporters and Bloomberg](#) 14 July 2021

⁵¹ World Nuclear Association- "Following a major earthquake, a 15-metre tsunami disabled the power supply and cooling of three Fukushima Daiichi reactors, causing a nuclear accident beginning on 11 March 2011. All three cores largely melted in the first three days." <https://world-nuclear.org/information-library/safety-and-security/safety-of-plants/fukushima-daiichi-accident.asp>

units — transmission, generation and distribution — was announced by President Cyril Ramaphosa in 2019.⁵² The motivation for the unbundling is evidently to improve management efficiency and competition. To quote the President, the unbundling of Eskom *“will enable a competitive market for electricity generation and the establishment of an independent state-owned transmission company.”*⁵³

Whether the unbundling of Eskom over the long term will affect the management of South Africa’s grid stability, and the reliability of off site power to back up the KNPS remains to be seen. In the USA a deregulated wholesale power market has created risks for nuclear safety, and this issue over the long term operation of a nuclear plant in South Africa should have been considered in the LTO safety case.

For example, an observation on how the provision of electricity by private entities can affect nuclear safety was made in a briefing by a Commissioner of the U. S. Nuclear Regulatory Commission in 2006 after nine nuclear power plants in the U.S.A, as well as 11 in Canada, and a host of coalfired power plants had been disconnected from the grid because of electrical instabilities, resulting in the blackout of major portions of the Northeast and Midwest in the U.S. and parts of Canada.⁵⁴

He stated:

“So, what caused the event? We would eventually find that poor maintenance of transmission lines including tree trimming, lack of sensor and relay repair or replacement, poor maintenance of control room alarms, poor communications between load dispatchers and power plant operators, and a lack of understanding of transmission system interdependencies were all major contributors to the domino effect that resulted in plant after plant tripping off line because of the collapse of the electrical grid. This event was truly a wake-up call for the North American transmission system operators as well as electricity generating companies....

⁵²Unbundling Eskom is taking too long, says CEO André de Ruyter - [Business Day](#)

BD Live <https://www.businesslive.co.za> › national › 2023-02-07-

⁵³ **LINDA NOBAZA: Eskom unbundling a good idea, but aim unlikely to be achieved Business Day 27 FEBRUARY 2022**

⁵⁴ *The NRC and Grid Stability* - Remarks by Jeffrey S. Merrifield, Commissioner U. S. Nuclear Regulatory Commission at the ANS Executive Conference on Grid Reliability, Stability and Off-Site Power Denver, Colorado July 24, 2006

Nuclear power reactors must be cooled continuously, even when shut down. The numerous pumps and valves in the reactor cooling systems therefore must have access to electrical power at all times, even if the normal power supply from the grid is degraded or completely lost. As a regulator, we want to minimize the time a nuclear power plant is subjected to a complete loss of offsite power, otherwise known as Station Blackout. Even though plants are designed with emergency diesel generators to supply power to pumps and valves that keep the reactor cool when normal power is lost, we do not like to challenge those diesel generators any more than is absolutely necessary...

As a result of deregulation, many electric utilities were split into electric generating companies and transmission and distribution companies. **Thus, nuclear power plants now must rely on outside entities to maintain the switchyard voltage within acceptable limits.** Over time, some transmission companies have become less sensitive to the potential impacts that grid voltage can have on nuclear plant operations.”

As stated above a nuclear power station requires the support of a stable grid. The unbundling of Eskom and removal of power generation from the state owned enterprise is on the cards. The question is whether this eventuality will compromise the stability of the grid and the support required to maintain a safe KNPS. The LTO is intended to extend over 20 years. This issue is relevant to safety during operation and decommissioning and should have been mentioned and assessed in the application for LTO. The failure to do so is a fatal flaw.

Conclusion

Eskom seeks the extension of life of the KNPS in a context where grid stability, a cardinal requirement for nuclear safety, cannot be assured, or at least not for the next 24 months. Various aspects of defense-in-depth relating to the grid NPP interface are compromised in the current energy landscape. The KNPS cannot be assured of robust off site power supply, and faces the prospect of a grid collapse where diesel supplies to its on site and off site power backups might fail due to the social, transportation and communications breakdowns that will in all likelihood follow such an event.

None of these issues were mentioned and their consequences for safety evaluated in the application for LTO. The decision maker is not in a position to evaluate this critical area of nuclear safety and the public has not been afforded an opportunity to comment on the issue as presented and evaluated by Eskom. The application is therefore fatally flawed and should be refused.

4. BEST PRACTICE

The NNR states on its website that its regulatory framework is based on best practice.⁵⁵

The application for LTO safety case however states that its approach to aging management is based on “international good practice.”⁵⁶ It does not state that it is based on international best practice and does not define precisely what is meant by international good practice.

What is best practice?

The NNR website states:

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. The safety standards provide the principal safety criteria relating to risk criteria, and dose limits for normal operating conditions, applicable to members of the public and workers.

The Koeberg Nuclear Power Station (KNPS, Koeberg) was built by the French company Framatome between 1978 and 1984. In line with international practice, the plant was granted a 40-year operational licence which will expire in July 2024. Its design is similar to reactors in France that have sought extension of life (Bugey in particular). Hence the French approach to LTO is not only highly relevant to the application for Koeberg’s extension of life, but France can be considered a jurisdiction that applies best practice to the regulation of LTO of nuclear power stations. France draws on the recommendations of international bodies such as the Western Europe Nuclear Regulators Association (WENRA)⁵⁷ for standard setting in regard to safety and extension of life. Best practice as it applied to the regulation of nuclear safety in France will be used in this submission to inform the requirements in this regard stated to be applicable by the NNR.

Certain aspects of international best practice should have been applied to the application for LTO but were not, including:

⁵⁵ <https://nnr.co.za/about/acts-and-regulations/>

⁵⁶ Safety Case paragraph 6.1.2

⁵⁷ <https://www.wenra.eu/>

- Limits on the length of time granted for LTO;
- Safety standards applicable to LTO;
- Compliance with performance and safety reviews, and environmental codes.

Analysis

(i) Limits on the length of time granted for LTO

France **does not** grant long term extension of life permits. Permits to operate nuclear facilities are issued by the Government after consulting ASN⁵⁸ (English=NSA), and have unlimited duration. However 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**.⁵⁹

The Koeberg application for an extension of the permit beyond the next 10 years would therefore not be in compliance with French regulatory practice, and best practice. The application for LTO does not justify why such a long period should be granted. It is not based on all the prescriptions of a final review having been met, for example the most recent reviews conducted by the IAEA. The application does not indicate that it is based on the requirements of a new reactor. It is also unclear how Eskom will ensure best practice in safety matters over a period of 20 years given its current financial woes. By the 2022 medium term budget speech Eskom's debt stood at R423 billion. Debt relief announced in march 2023 budget will come in the form of about R168 billion in capital and R86 billion in interest.

Since 2008 Eskom has received R263.4 billion in government bailouts. But as the budget document notes, these allocations "have failed to stem the collapse of Eskom's balance sheet and operations." The government guarantees R350 billion of the utility which is at risk of default."⁶⁰

⁵⁸ 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. - Wikipedia

⁵⁹ "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>

⁶⁰ Eskom to get a R254 billion lifeline, Mail and Guardian 22 February 2023

<https://mg.co.za/business/2023-02-22-eskom-to-get-a-r254-billion-lifeline/#:~:text=The%20debt%20relief%20E2%80%94%20which%20amounts,document%2C%20also%20released%20on%20Wednesday> .

It is submitted that the application for LTO beyond a 10-year period is not in line with international best practice and should be rejected.

(ii) **Safety standards applicable to LTO**

European nuclear regulators, including France, when addressing applications for LTO, must apply the standards applicable to **new reactors**. Described as a change in the “safety baseline,” issues such as the evaluation and addressing of aging of the reactors have to be considered against this new baseline. This change had been adopted by an international group, the Western Europe Nuclear Regulators Association (WENRA) association of heads of European nuclear safety authorities and can be considered best practice.⁶¹

“in its letter in reference [5], the NSA considered that the reassessment studies should be conducted with regard to the safety objectives applicable to new reactors. This position is consistent with that expressed in November 2010 by the WENRA association of heads of European nuclear safety authorities in a statement on safety goals for new nuclear power plants. Indeed, WENRA states that these targets should be used as a reference to identify reasonably practicable safety improvements for existing nuclear power plants during the ten-year safety reviews.

Reactors must be able to meet these standards for the life of the plant.

First of all, the continued operation of nuclear power plants beyond the period for which they were initially designed implies that the conformity of the equipment important for safety with the requirements set for them must be **guaranteed beyond the fourth safety review**. Moreover, in the years to come, current reactors will coexist, at the global level, with reactors, of the EPR type or equivalent, whose design meets significantly reinforced safety requirements. The current nuclear reactors must therefore be **upgraded to meet these new safety requirements, the state of the art in nuclear technologies** and the operating time targeted by EDF, in accordance with the terms of the letter in reference.⁶²

However, the KNPS application for LTO nowhere indicates that it benchmarks the safety case against the requirements for a new nuclear reactor.

(iii) ***Compliance with performance and safety reviews, and environmental codes***

⁶¹ <https://www.wenra.eu/>

⁶² ASN - Generic programme proposed by EDF for the continued operation of operating reactors beyond their fourth safety review: 28 June 2013, Ref: CODEP-DCN-2013-01346 at page 1.
<https://gazettnucleaire.org/2013/269p12.html>

Safety considerations for the extension of life of plants in France are based *inter alia* on best practice internationally, and must include verification of the compliance of the facilities with the current safety baseline, and a safety **reassessment**.⁶³

It is not clear that the KNPS would pass this test given the number of safety issues that were identified some time ago by the IAEA that remain to be addressed.

At the invitation of Eskom, the IAEA conducted a SALTO (Safety Aspects of Long Term Operation) mission at the KNPS from 22 to 31 March 2022.

The SALTO mission reviewed the status of activities related to long term operation (LTO) assessment of the plant against IAEA Safety Standards and international best practices.

The team reviewed the completed, in-progress and planned activities related to LTO, including ageing management of the structures, systems and components (SSCs) important to safety and revalidation of time limited ageing analyses (TLAAs).

The SALTO mission noted that:

IAEA team observed that despite many challenges, the plant has addressed the most important deviations in ageing management activities and preparation for safe LTO since the Pre-SALTO mission in 2019, **however many activities are still in progress to achieve full compliance with IAEA Safety Standards**. (emphasis added)

The team also identified several areas for further improvement. Fifteen issues were raised.

According to an article published regarding recent safety issues at Koeberg⁶⁴ several safety issues identified over seven years ago relating to aging management are not yet in compliance with IAEA safety standards.

⁶³ Generic guidelines for the periodic safety review associated with the fourth ten-year outages of EDF's 900 MWe reactors (VD4-900) CODEP-DCN-2016-007286 <https://www.actu-environnement.com/media/pdf/news-26685-position-asn-orientations-vd4-900mw.pdf> (Orientations génériques du réexamen périodique associé aux quatrièmes visites décennales des réacteurs de 900 MWe d'EDF (VD4-900) 20 April 2016) read together with ASN Resolution 2021-DC-0706 of 23 February 2021 setting prescriptions for Électricité de France (EDF) applicable to the reactors of the NPPs of Blayais (BNIs 86 and 110), Bugey (BNIs 78 and 89), Chinon (BNIs 107 and 132), Cruas (BNIs 111 and 112), Dampierre-en-Burly (BNIs 84 and 85), Gravelines (BNIs 96, 97 and 122), Saint-Laurent-des-Eaux (BNI 100) and Tricastin (BNIs 87 and 88) in the light of the conclusions of the generic phase of their fourth periodic safety review

⁶⁴ <https://www.iol.co.za/news/politics/opinion/its-high-time-that-sa-shelve-plans-to-extend-the-life-of-koeberg-f2117c93-460f-4b15-86ce-dc84ec0abdc4> - *Its High Time That SA Shelves Plans to Extend the Life of Koeberg* article by Ketshepaone Modise and Makoma Lekalakala

In 2015, the IAEA noted, 'the process to identify all potential degradation mechanisms and ageing effects of structures and components in LTO scope has not been identified'. Seven years later, it noted, 'completeness and consistency of scope setting of structures, systems and components for ageing management and LTO, are not ensured'. Noting further that ageing management programmes for mechanical infrastructure and cables were 'not complete' while 'ageing management programmes for civil infrastructures are not fully developed and implemented'.

The article concluded with the following statement:

These findings are extremely worrying. Just last year, cracks were found in Koeberg's containment structures, while at least five nuclear power stations in France have been switched off due to cracks and corrosion. These problems in France have been found in Pressurised Water Reactors (PWR) built by Framatome. Koeberg is a PWR built by Framatome.

It is therefore disputed that the application for LTO is in compliance with international best practice and accordingly it should not be granted.

5. GENERAL SAFETY ISSUES

There are concerns that it is not possible to completely manage the aging of all parts in a nuclear reactor as certain parts are inaccessible and cannot be renewed/replaced without weakening the integrity of the structure. This issue is not mentioned in the application for LTO safety case and is a fatal flaw.

This concern also needs to be looked at in the context of the impact on aging that loadshedding, grid instability and potential increased incidence of trips, may have on the KNPS, which has also not been evaluated in the LTO application.

The concern is summarised by Greenpeace.⁶⁵

In spite of upgrades and repairs, the overall condition of nuclear reactors deteriorates in the long term. The likelihood of an accident and the amount of potential complications increases. Nuclear reactors contain components that cannot be replaced, including the reactor pressure vessel and the containment, whose condition deteriorates over time. **While replacement of old components may reduce some risks,**

⁶⁵ <https://www.greenpeace.org/static/planet4-netherlands-stateless/2018/06/Briefing-Lifetime-extension-of-ageing-nuclear-power-plants.pdf>

it also introduces new ones: for example, in some cases large components are replaced by breaking through the reactor's containment, as a result of which the strength of this vital protective structure is inevitably impaired. Most reactors for which lifetime extension is being sought also have their power capacity uprated – further increasing the stress on the already worn systems and components. The increasing stockpile of spent nuclear fuel and high-level nuclear waste at many power plants, stored under outdated safety systems, adds a further layer of risk.

6. ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

SAFCEI notes that Eskom states in document *K-27660-E: Attachment 1* to its LTO application that an approved Environmental Impact Assessment (EIA) is 'Not applicable'.⁶⁶

The rationale for this statement is not provided by Eskom in the LTO PID or Safety Case.

However, it is noted that the LTO Safety Case makes reference to a thermal power uprate (TPU):

The sensitivity analysis, which simplistically increased the initial core inventory used as input in [REDACTED] by 10%, showed and concluded that the potential impact of the thermal power uprate (TPU) and steam generator replacement (SGR) projects on the current size of the PAZ (5 km) and UPZ (16 km) was expected to be negligible; that is, no change was expected.

This is the only reference to TPU in the LTO Safety Case (save for its inclusion in the abbreviations table).

However, further light is shed on this issue by a Memo from the National Treasury to the Minister of Finance dated 28 June 2013 (obtained by SAFCEI under the Promotion of Access to Information Act (PAIA)⁶⁷) in respect of an application by Eskom in terms of s54(2)(d) of the Public Finance Management Act (PFMA) for approval for the TPU of the KNPS. This Memo reveals that:

- The purpose of the Memo was to advise the Minister of Finance on Eskom's application for the TPU of the KNPS in accordance with the Koeberg Long-Term Asset Management Strategy;

⁶⁶ *K-27660-E: Attachment 1*, Eskom response to heading: Regulation 4(7g): Approved Environmental Impact assessment.

⁶⁷ Act 2 of 2000.

- The replacement of the Steam Generators presented an opportunity to increase the thermal power output of both Koeberg Units by 10% with significant investment benefit for Eskom;
- Based on this opportunity, the Eskom Board approved that an investigation be conducted to determine the safety and technical feasibility of a 10% TPU at the Koeberg Units. The feasibility study for the TPU was commissioned in October 2010, and completed in March 2012. This study concluded that it was technically feasible and safe to increase the core thermal power by 10% from 2775 MW to 3055 MW core power. This TPU initiative was enabled by the SG replacement project;
- These two projects form part of a life optimisation strategy for Koeberg that is in line with Eskom's approved strategy for a 60-year operational lifetime for Koeberg and is consistent with international life optimisation strategies for nuclear power plants;
- At a meeting held on 12 February 2013, the Eskom Board of Directors approved the TPU project to the value of R2.6 billion;
- In line with the requirements of the PFMA, Eskom had already submitted this application to the Department of Public Enterprises for approval, and the Minister of Public Enterprises had approved it;
- Approval of the EIA and the NNR license amendment posed the biggest risk and focussed mitigation would be applied during project execution;
- The Memo recommended that the Minister 'note' Eskom's application for the TPU of the KNPS, and recommended further that the Minister sign an attached letter addressed to the Minister of Public Enterprises if in agreement with the contents thereof.

A letter dated 10 September 2013 from the Minister of Finance to the Minister of Public Enterprises was also provided to SAFCEI. This letter concluded with the Minister of Finance stating that he was in support of the approval of this application.

Further insight into this issue is also contained in the NNR's Annual Report 2013, which states as follows:

- ii) Steam Generator Replacement Programme at Koeberg Nuclear Power Station

In the past year, the NNR received the proposed long-term asset management interventions (LTAM) at Koeberg, including TPU-SGR-PLEX (Thermal Power Uprate (TPU), Steam Generator replacement (SGR) and Plant Life Extension (PLEX) from Eskom. TPU is to involve a 10% increase in reactor thermal power. The SGR project involves the replacement of six steam generators (three from each unit), which form a major part of the primary circuit connected to the reactors via pipework. The Department of Public Enterprises has approved the SGR project. The SGR project makes provision for TPU in the sizing of the new steam generators and in the safety analysis.⁶⁸

This thermal power uprate is significant.

National Environmental Management Act⁶⁹ (NEMA) EIA Listing Notice 2⁷⁰ includes the following as a listed activity requiring environmental authorisation under NEMA:

29. The expansion and related operation of facilities for nuclear reaction including energy generation, the production, enrichment, processing, reprocessing, storage or disposal of nuclear fuels, radioactive products, nuclear waste or radioactive waste.

‘Expansion’ is defined in NEMA EIA Listing Notice 2 as meaning:

The modification, extension, alteration or upgrading of a facility, structure or infrastructure at which an activity takes place in such a manner that the capacity of the facility or the footprint of the activity is increased.

SAFCEI submits that if the LTO modifications and upgrades are intended to accommodate a TPU, such changes constitute a ‘modification, extension, alteration or upgrading’ of the KNPS that increases the capacity of the KNPS. It follows that NEMA EIA Listing Notice 29 would be triggered by the commencement of activities associated with the TPU.

It is also noted that the Safety Case indicates additional modifications and/or alterations to increase its radioactive waste storage capacity (including high level radioactive waste), including the following:

⁶⁸ Available online at: <https://nnr.co.za/wp-content/uploads/2020/10/NNR-ANNUAL-REPORT-2013-PDF-WEB.pdf>, at p32.

⁶⁹ Act 107 of 1998 (as amended).

⁷⁰ GNR. 984 of 4 December 2014: Environmental Impact Assessment Regulations Listing Notice 2 of 2014.

- Eskom plans to have a larger dry cask storage facility to ensure that there will be sufficient storage for LTO (the fuel racks inside the spent fuel pool are indicated as reaching maximum capacity as the plant approaches the end of its operating license), and that '[a]dditional spent fuel storage facilities are required to safely store the spent fuel produced during the LTO period'.⁷¹ Eskom also intended to increase the number of storage casks and store more storage casks in the Cask Storage Building (CSB). However, additional analyses and assessment in accordance with US design standard code ASCE 43-05 concluded that the CSB building was not suitable for medium and long-term storage of fuel casks. Modification [redacted] (*CSB for Fuel Storage Casks*) has been raised to harden the structure against seismic hazards and other design basis external events. The LTO Safety Case indicates that the CSB is capable of storage 11 casks for the full period of LTO, that the modification to the CSB is planned to be completed by 2024, and its structural integrity qualified for the entire period of LTO.⁷² On the face of it, this modification also triggers NEMA EIA Listing Notice 2 Activity 29. To SAFCEI's knowledge no environmental authorisation has been obtained for this increase in capacity of the CSB.
- Spent fuel is currently stored in two spent fuel pools (and a number of dry storage casks on site). The spent fuel pool capacity is insufficient for LTO. Eskom is in the process of procuring spent fuel inserts that will be used to reduce the total reactivity and use the storage spaces that are currently unavailable in the spent fuel pools due to the checkerboarding arrangement of fuel assemblies. This will make currently unusable storage cells in the spent fuel pools available, allowing for an increase in the total number of spent fuel assemblies stored in the spent fuel pools. The LTO Safety Case advises that the facility has been modified to increase pool storage capacity.⁷³ On the face of it, this modification also triggers NEMA EIA Listing Notice 2 Listed Activity 29.
- Koeberg will store casks at the transient interim storage facility (TISF), while the government is establishing the centralised interim storage facility (CISF).⁷⁴ In 2017,

⁷¹ Koeberg LTO Safety Case, p87.

⁷² Koeberg LTO Safety Case. P87.

⁷³ Koeberg LTO Safety Case, p86.

⁷⁴ Koeberg LTO Safety Case, p87.

Koeberg obtained environmental authorisation for the proposed TISF. The LTO Safety Case indicates that the granting of the nuclear installation license to construct and operate the TISF will allow storage of spent nuclear fuel up to the end of the operational life of the plant.

On the face of it, Eskom's LTO project has included a number of activities that trigger the requirement for environmental authorisation. As far as SAFCEI can ascertain, no environmental authorisations have been obtained for the planned TPU, for the modification of the CSB to store more dry storage casks, or for the modification of the spent fuel pool to increase its capacity to store used nuclear fuel.

And while environmental authorisation has been obtained to establish a TISF at the KNPS, it is unclear why the various activities described above – all of which form part of the LTO project – have not been included in a single EIA application. 'Piecemealing' these activities precludes an assessment of the LTO project impacts, as well as an assessment of the cumulative impacts of the activities forming part of the project. SAFCEI notes that it is a mandatory requirement of the NEMA EIA Regulations that if an applicant intends undertaking more than one activity as part of the same project, a single EIA application must be submitted to the competent authority.⁷⁵

In the premises, SAFCEI disputes that no environmental authorisation is required for the Eskom KNPS LTO: on the face of it, the project triggers various environmental authorisation requirements, and Eskom should have submitted a single application for the project.

Even if Eskom is correct that no environmental authorisation is required, SAFCEI submits that the LTO document-set made available to the public does not provide adequate information demonstrating that the social, economic⁷⁶ and environmental impacts of the LTO (such as,

⁷⁵ GNR. 982 of 4 December 2014, regulation 11(3): *If a proponent or applicant intends undertaking more than one activity as part of the same development within the area of jurisdiction of a competent authority, a single application must be submitted for such development and the assessment of impacts, including cumulative impacts, where applicable, and consideration of the application, undertaken in terms of these Regulations will include an assessment of all such activities forming part of the development.*

⁷⁶ For example, the LTO PID presents the lowest cost option for securing base-load electricity generation, without fully setting out the basis for this claim. And while an Eskom *Business Case Long Term Asset Management of Koeberg Nuclear Power Station* was provided to SAAFCEI in response to a PAIA application in 2020, this undated

but not limited to, the costs implicit in the long-term management and storage of high level radioactive waste, as well as the costs of decommissioning the KNPS when it reaches its end of life) have been adequately considered, assessed and evaluated - as required by the NEMA environmental management principles (and in particular section 2(4)(i) of NEMA).⁷⁷

7. FAILURE TO DESCRIBE AND ASSESS THE HEALTH, ENVIRONMENTAL AND SOCIO-ECONOMIC CONSEQUENCES OF A CATASTROPHIC BEYOND DESIGN RADIOLOGICAL RELEASE

SAFCEI submits that the Koeberg NPS LTO application document set fails to include a description and assessment of the health, environmental and socio-economic consequences of a radiological release as a consequence of catastrophic, beyond-design nuclear accident during the proposed 20 year LTO period.⁷⁸

Instead, the Koeberg LTO application acknowledges that beyond-design accidents can occur even if the likelihood is low, and sets out examples of modifications implemented to address

Business Case appears from its content to predate 2014, and is thus significantly out-of-date, and predates significant and progressive reductions in the costs of procuring new renewable energy generation and storage capacity through the various bid windows of the Renewable Energy Independent Power Producers Procurement Programme (REIPPP). For example, the solar and wind average tariff fell by 52% for wind and 26% for solar over bid windows 1-4 (see <https://www.pv-magazine.com/2021/09/30/reipp-one-of-the-worlds-best-renewable-energy-tenders-but-theres-room-for-improvement/>, Table 3).

⁷⁷ The s28(1) NEMA duty of care provision also requires that any person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment. s28(3)(a) stipulates that these reasonable measures may include (among other things) measures to investigate, assess and evaluate the impact on the environment.

⁷⁸ NEMA s2(4)(i) requires that the social, economic and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and decisions must be appropriate in the light of such consideration and assessment. As mentioned elsewhere in these representations, the NEMA s2 environmental management principles apply throughout the Republic to the actions of all organs of state that may significantly affect the environment and (among other things):

- (a) shall apply alongside all other appropriate and relevant considerations, including the State's responsibility to respect, protect, promote and fulfil the social and economic rights in Chapter 2 of the Constitution and in particular the basic needs of categories of persons disadvantaged by unfair discrimination;
- ...
- (c) serve as guidelines by reference to which any organ of state must exercise any function when taking any decision in terms of this Act or any statutory provision concerning the protection of the environment;
- ...
- (e) guide the interpretation, administration and implementation of this Act, and any other law concerned with the protection or management of the environment.

beyond design conditions, as well as additional work planned to further reduce the risk of such accidents:

The event at Fukushima has shown that conditions more severe than those postulated as design basis accidents can occur, even if the likelihood is very low. These are known as design conditions.

Koeberg has implemented several modifications to address the lessons learnt at Fukushima, and additional improvement actions are included in the PSR integrated improvement plan. Examples of modifications that have been implemented at Koeberg that address design extension conditions are additional mobile diesel generators, mobile pumps for alternative sources of cooling water to the spent fuel pools, mobile equipment to clear debris from severe earthquakes, and autocatalytic recombiners to reduce the risk of a hydrogen explosion. Additionally, Koeberg's severe accident management guidelines make provision for mobile backup emergency diesel generators in the event of a loss of the main electrical power supply from the national grid and the backup emergency diesel generators. More work is planned as part of continuous improvement efforts and to further reduce the risk of severe accidents, which is already within regulatory risk limits (see Figure 11).⁷⁹

SAFCEI submits that the LTO Safety Case should have included an assessment of the significant health, environmental and socio-economic impacts of catastrophic beyond-design nuclear accidents such as a reactor core meltdown and loss of containment - especially given the relative close proximity of the KNPS to a major metropolitan area (Cape Town), as well as rapidly increasing population density in the northern suburbs of Cape Town and areas within the KNPS's 16km urgent protective action planning zone (UPZ). The PID and LTO Safety does not adequately address this issue (if at all), and any underlying risk assessment that may speak to these issues has not been made available to the public for comment.

As a consequence, the LTO application does not comply with NEMA environmental management principle s2(4)(i), and cannot serve as a rational basis for a decision on the application.

8. NO INFORMATION PROVIDED ON THE COSTS OF LTO AND IMPACTS ON THE PRICE OF ELECTRICITY

SAFCEI is concerned that the LTO application document set does not provide up-to-date information justifying the claim that the LTO is economically justifiable. The documents do

⁷⁹ Koeberg LTO PID, p 40.

not provide any information on the costs of the LTO (including associated plant modifications and upgrades, the costs of associated with nuclear waste management and disposal resulting from an additional 20-years of operation of the KNPS,⁸⁰ as well as the economic cost of additional stages of loadshedding that are likely to result from the plant shutdowns required to implement these modifications – such as the current and planned 2024 shutdown planned to allow for the Steam Generator replacements), or the impact the LTO project may have on the price of electricity.

As a consequence, SAFCEI is unable to make informed, meaningful comment on the costs of the LTO or the potential impacts the LTO project may have on the price of electricity.

9. PUBLIC NOTICE & FAILURE TO ENSURE PARTICIPATION BY VULNERABLE AND DISADVANTAGED PERSONS

Eskom's 12 January 2023 letter to Koeberg Public Safety Information Forum (PSIF) members states that Eskom had been directed by the NNR to serve its '*Application to operate the Koeberg Nuclear Power Station beyond the timeframe established in the Nuclear Installation License (NIL-01 Variation 19)*' upon identified municipalities, persons, organisations and government departments. PSIF members were afforded an opportunity to submit, to the NNR, written representations relating to health, safety and environmental issues connected with the KNPS LTO application by no later than 16 March 2023.

The Eskom letter does not indicate that the NNR also directed it to publish a copy of the application in the *Gazette* and two newspapers circulating in the area of every municipality affected by the application. Such publication is a mandatory requirement contained in s21(3)(b) of the NNR Act.⁸¹

⁸⁰ SAFCEI is particularly concerned that while the LTO Safety Case makes provision for the storage of radioactive waste on-site, in the TISF and (in the future) in any CISF established, no solution has yet been found for the final safe disposal of long-lived high level radioactive waste. Future generations will be burdened with the responsibility and costs of managing and final disposal of high level radioactive waste.

⁸¹ NNR Act, s21(3) stipulates that the chief executive officer must direct the applicant for a nuclear installation or vessel licence to:

... (b) publish a copy of the application in the *Gazette* and two newspapers circulating in the area of every such municipality.

SAFCEI has been unable to verify that a copy of the application was published in the *Gazette* and two newspapers circulating in the area of every municipality affected by the application. If the Chief Executive Officer of the NNR has failed to direct Eskom to do so, this would constitute non-compliance with a mandatory legislative requirement, and would render the public participation process fatally flawed.

SAFCEI also notes its concern that no meetings appear to have been held by Eskom or the NNR with communities (and in particular vulnerable and disadvantaged communities) potentially affected by the proposed LTO of the KNPS to provide information on the proposal, to unpack the highly technical information contained in the LTO PID and Safety Case, and to hear their voices regarding the proposed LTO.

If no such meetings have been held, SAFCEI submits that the public participation process does not meet the public participation requirements set out in the NEMA environmental management principles, which states that the participation of all interested and affected parties in environmental governance must be promoted, and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured.⁸² These environmental management principles apply throughout the Republic to the actions of all organs of state that may significantly affect the environment and (among other things) serve as guidelines by reference to which any organ of state must exercise any function when taking any decision in terms of any statutory provision concerning the protection of the environment, and guide the interpretation, administration and implementation of this Act, and any other law concerned with the protection or management of the environment.⁸³

SAFCEI also notes that the NNR is empowered by s21(4)(b) of the NNR Act to arrange for public hearings on health, safety and environmental issues if the NNR Board is of the opinion that further public debate is necessary. SAFCEI submits that further public debate is indeed

⁸² NEMA, s2(4)(f).


⁸³ NEMA, s2(1)(c) and (e).

necessary, and calls upon the NNR Board to exercise its power and arrange for public hearings on Eskom's LTO application.

10. CONCLUSION

For the reasons set out in these representations above, SAFCEI submits that the NNR should refuse Eskom's LTO application.

Signed at Cape Town this 16th day of March 2023



Francesca de Gasparis
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