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CAPE TOWN

E-PAPER

KOEBERG LONG TERM OPERATION SAFETY REPORT: AN ANALYSIS OF WHAT WAS KEPT FROM PUBLIC VIEW

A TOOL TO SUPPORT EXPERT ENGAGEMENT WITH THE KOEBERG LIFE EXTENSION DECISION PROCESS

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ABBREVIATIONS

1. Introduction and background

The Koeberg Nuclear plant is located about 26km north of Cape Town, South Africa. It is the only nuclear power plant on the African continent. Constructed in the late 1970s and commissioned in 1984, the station's forty-year lifespan is scheduled to end in July 2024.

To operate Koeberg beyond this date, South African law requires that its operator, Eskom Holdings, submit a Safety Case Report (SCR) to the National Nuclear Regulator (NNR). The SCR must describe in detail any safety issues relating to the Long Term Operation (LTO) of the plant, and what measures are in place to mitigate risks.

Eskom submitted the SCR to the NNR in July 2022, but refused to make its contents public, despite its significant importance to public interest. In January 2023, however, after it was instructed by the NNR to release the report, Eskom released a highly redacted version of the SCR – 'SCR Revision 1a' – in which hundreds of words, phrases, references and even multiple full pages were blacked out.

In June 2023, the NGO Save Bantamsklip submitted a Promotion of Access to Information Act (PAIA) request to both Eskom and the NNR for an unredacted version of the SCR. Although it was initially refused, after a detailed appeal, Eskom released 'SCR Revision 2' on 1 September 2023. While some concerning redactions remain, the majority of the previous redactions were now visible. In early November 2023, after further exchanges between Eskom and Save Bantamsklip, 'SCR Revision 3' – an entirely unredacted version, was release. Unfortunately, this version is not fully digitised or searchable. Save Bantamsklip is working to secure such a version.

A comparison of these documents can now reveal precisely what information Eskom wished to keep from the public, without valid reasons. This paper undertakes this task. As this work began was undertaken prior to the release of 'Revision 3', it presents a systemic analysis of the differences between 'Revision 1a' and 'Revision 2'. Once a digital version of all documents becomes available, the comparison will be extended. It is hoped that this analysis will be useful to experts who wish to engage with the Koeberg life extension decision process and make submissions in upcoming public consultations, scheduled for early 2024.

This document is in no way a summary of the Safety Case Reports, and should be read in conjunction with Revision 2 of the Safety Case, as well as any later versions released.

Please note:

- Abbreviations are available in the SCRs.
- Underlined sections refer to what was redacted in Revision 1a.
- Bold sections indicate content added in Revision 2.
- Italicised refers to additional comments or notes ncluded in text.

2. Revision 1a to Revision 2

There are two reasons for differences between these two documents. Firstly, previously redacted sections are now unredacted, and secondly, new sections have been added. All of these are detailed below, excepting for minor changes such as punctuation and layout changes.

2.1 Sections converted to scans

In some sections, several pages which were text (searchable) in Revision 1a are scanned (non-searchable) in Revision 2. As a result, differences between these sections have not been analysed in this report, and further work would be necessary to establish if there are differences between the revisions in these sections, and what those differences are.

The affected sections are:

4.1 Definitions

4.2 Abbreviations

9.3.1.3 Hazards Screened In

- Coastline erosion
- Extreme winds, including tornadoes
- Tropical Cyclones, Tornadoes
- Aircraft crash

9.5.1.4 Time-Limited Ageing Analyses (TLAAs)

- Note: In this section, tables 9-4 and 9-5 are scans in Revision 2 (previously partly redacted in Revision 1a)

9.5.2.2 Nuclear Island: Aseismic Bearings

- Pages 125 and 126

9.9.1 The Nuclear Management Policy and Safety Management System

- Page 180. No differences to Revision 1a could be found when checking this page manually.

11.0 Safety Analysis Report

- Page 188, which contains Table 11-1: SGR and SALTO TLAA SAR Changes

16.0 Acceptance, 17.0 Revisions, 18.0 Development Team

- Pages 195 through 227

Appendix E

- Page 253. No redactions in Revision 1a.

2.2 Contents items

Unless otherwise indicated, the following were in both Revision 1a and Revision 2, but were redacted in the version of Revision 1a that was initially released.

The affected sections are

2.2.1 Appendices

D.1.4 Practical Elimination of Significant Radioactive Releases through Defence-in-Depth

D.1.5 Human Factors and Performance Consideration in the Implementation of Defence-in-Depth

D.1.6 Impact of PSR Deviations on Defence-in-Depth – Global Assessment (GA)

D.2 Impact of Deviations on DiD Levels

D.3 Impact of Deviations on Fundamental Safety Functions

2.2.2 Figures

Figure 9-4: Number of Fuel-leaking Assemblies for Each Cycle of Each Unit

Figure 9-5: Containment Global Leak Rate Test Results

2.2.3 Tables

Table A.1-6: Knowledge Management
(Note: This was added in Revision 2)

Table D.1-1: Analysis of the Deviations on DiD Levels and FSFs

Table D.1-2: List of OT Branches Affected by More Than Five Deviations

2.3 Redactions in Revision 1a which are revealing

In the following, the headings are the headings from the Safety Case Report, with the original section numbers in brackets after the heading. Redactions which were in Revision 1a are indicated by underlined sections and where required context is provided by including the surrounding text. Words, phrases or sentences which were **added in Revision 2 are in bold**. Notes from the author of this report analysis are preceded by "Note:". The intended use of the below is for researchers to be able to identify subjects or terms of interest, read what was redacted in Revision 1a, and then study the relevant section in Revision 2 (and possibly later revisions if further are released).

2.3.1 Executive summary (1.0)

The following details the redactions in Revision 1a. All references to the "LTO integrated preparation plan (IPP)" were redacted (this also applies to the rest of the document.

In addition, several references to scheduling, i.e. the timeline for when certain tasks will be completed, were redacted.

1. The tsunami assessment revealed that the probable maximum tsunami (PMT) run-up and inundation were governed by volcanic flank collapse tsunamis. Further assessment to gain an understanding of the potential impact on the plant is being conducted. The required analysis is included in the LTO integrated preparation plan (IPP) and scheduled for completion prior to LTO. Relating to the seismic hazard, Senior Seismic Hazard Assessment Committee (SSHAC) studies are ongoing and will be completed prior to 2024.
2. These activities are included in the LTO IPP and scheduled for completion prior to LTO.
3. Mitigations have been implemented to reduce the risk to operators in the unlikely event of a nuclear accident, and a modification is planned for implementation prior to LTO (included in the LTO IPP) to resolve this deviation.
4. Safety improvements, particularly related to design extension conditions (DECs – Level 4) such as hardened water supply and water connections, were recognised, will further enhance Koeberg's DiD, and are included in the PSR IIP.
5. While practical elimination is not achieved in all cases, the level of DiD and provisions available are commendable and will be further enhanced with the implementation of the safety improvements in the LTO IIP.
6. The ICCP modification and another ILRT will be completed and are included in the LTO IPP.
7. Eskom has embarked on a recruitment campaign to ensure adequate staff for LTO.
8. The process will be implemented in all departments within the Nuclear Operating Unit (NOU) before LTO and is included in the LTO IIP. Major expenditure for Koeberg is

associated with salaries (operational cost) and the safety improvements in the nuclear technical plan (capital costs). The LTO integrated preparation plan (preLTO activities) has been sufficiently resourced and funded. A skills, time, and cost analysis were conducted for the PSR IIP and concluded that the cost requirements for the PSR IIP were in line with past approved expenditure for a similar scope of activities. Eskom has adequately funded the Koeberg operational costs over the past 38 years.

2.3.2 Applicability (3.0)

This document applies to Units 1 and 2 of the Koeberg Nuclear Power Station **and other functional areas that are covered by the LTO assessment programme, such as security, emergency planning, radiological impact on environment and human factors.**

2.3.3 Supporting Clauses (4.1 - 4.2)

Note: Section 4.1 (Definitions) and section 4.2 (Abbreviations) were text (i.e. searchable) in Revision 1a but are a scan in Revision 2 (i.e. not searchable). These sections would therefore need further work to find out what has changed.

2.3.4 References (4.3)

Entirely redacted:

- 240-167231099: Assessment of the Spent Fuel Pool for Long Term Operation
- 32-T-IPDK-002: Interim Seismic Evaluation for Koeberg NPS
- 32-T-IPDK-008: Koeberg Switchboard, Switchboard Components, and Plant Cabling Evaluation for LTO
- 331-33: PSA Updating and Maintenance
- DB2015-0020: System Design Engineering Acceptance of the Unit 1 ILRT [Outage 121] Structural Integrity Results
- DB2016-0002: System Design Engineering Acceptance of the Unit 2 ILRT [Outage 221] Structural Integrity Results

The document numbers for the following items were redacted in Revision 1a:

- 07092-A: Design Report – SGR System Design
- 07147DPDRR0012: CSB for Fuel Storage Casks
- NSIP04129: A Revised Methodology to Assess the Ionising Radiation Dose for Members of the Public from Normal Operation at the Duynefontyn Site
- PSA-R-T19-01: Risk Assessment Report

Added in Revision 2:

- **240-109728634: Environmental Qualification of Mechanical Equipment**
- **331-623: Engineering Position on Containment Structures for Long-Term Operation**
- **ASME QME-1 standard: Qualification of Mechanical Equipment Used in Nuclear Power Plants**
- **Department of Mineral Resources and Energy (DMRE), R.388, Safety Standards and Regulatory Practices (SSRP)**
- **IAEA Safety Series Report No. 31. Managing the Early Termination of Operation of Nuclear Power Plants**
- **IAEA Safety Series Report No. 62. Proactive Management of Ageing for Nuclear Power Plants**

Removed from Revision 22:

- NNR R388: Safety Standards and Regulatory Practices (SSRP)
- SSRP R388: Regulation in terms of Section 36 (read with National Nuclear Regulatory Act)

2.3.5 Design Service Life Limitation (6.1.1)

Électricité de France (EDF) is often referred to as the "technical safety reference for Koeberg" due to the similarity in design to Koeberg, its rigorous safety improvement programme, and the close co-operation between the South African and French nuclear regulators and, as such, is used to form the basis for many of the technical decisions and the general operating rules (GORs) employed at Koeberg.

Note: This redaction is particularly interesting as the French regulator is insisting on some major and very expensive modifications to plants similar to Koeberg before they will get a life extension (c.f. "Corium catcher", and "Decision number 2021-DC-0706 of the French Nuclear Safety Authority of 23 February 2021")

2.3.6 Description of the LTO Assessment Activities (7.0)

The LTO methodology is aligned with the requirements of RG-0027, except for the PSR, which was conducted in the assessment phase instead of the pre-LTO assessment phase; refer to Figure 7-1 for the adaptation. The adaptation of the methodology was accepted by the NNR. The ageing management assessments commenced prior to the PSR. (The result could be that the gaps identified in the PSR relating to ageing management were already in the process of being addressed in the ageing management assessments, which might have had an impact on the safety significance of those gaps.) Where the impact of a particular gap (also referred to as a deviation) is important for the justification of safe LTO, the details are discussed in the relevant subsections of § 9.0.

2.3.7 Periodic Safety Review (7.2)

...global assessment, which considered the cumulative impact of all the findings, that is, the strengths and deviations, and proposed safety improvements to address all the deviations and global issues <u>in a PSR integrated implementation plan (IIP)</u>;

2.3.8 Site-specific Characterisation (7.5)

Eskom has adopted the convention of referring to the site as "Duynefontyn" instead of "Koeberg", which was used during the previous revision of the site safety report. <u>This is in recognition of the potential to locate an additional nuclear installation(s) at the site</u>.

[...]

<u>Apart from providing information on site characteristics related to the current facility, the DSSR evaluates and demonstrates the suitability of the Duynefontyn site for accommodating additional new nuclear installation(s). This allows for assessing the cumulative radiological impact of the site on the public and the environment.</u>

2.3.9 Structure and Content of the Safety Case (8.1)

Not all the actions to support the arguments of the safety case will have been completed when the safety case is submitted. As a result, the approved safety case content includes <u>an LTO IIP (list of commitments), that is</u>, all actions to be resolved before entry into LTO to ensure that the safety case remains valid.

2.3.10 Outcomes of the Safety Factor Reviews (9.1.1)

Of the 113 deviations, a single deviation was graded as a "high"-risk deviation <u>related to the control room envelope (CRE) design</u> that did not meet the applicable design criteria. To address all the deviations raised, 93 safety improvements were proposed. <u>(Details of the safety improvements are discussed in § 9.1.3.)</u>

2.3.11 Plant Design Review Results (9.1.1.1)

This was evidenced by the inability to close out SRA-II (Safety Reassessment-II) identified corrective actions and by the implementation of the external event review initiative (EERI) programme of planned modifications. <u>The above may potentially be indicative of affordability, staff resourcing issues, contractor support, or the redeployment of key resources to "higher"-priority work before project finalisation. These may also represent a nuclear safety culture concern, which will be further challenged, as implementation of the PSR safety improvements is coincident with implementation of steam generator replacement (SGR) and other improvements to support LTO.</u>

2.3.12 Actual Condition of SSCs (9.1.1.2)

Although civil monitoring remained good, and the civil structures remained intact, better management focus and preventive maintenance planning were required to avoid further deterioration of civil structures. Station management was aware of issues related to examinations, maintenance, inspections, and tests that might affect plant safety; however, in the case of civil structures, a certain lack of management focus with regard to the slow repairs remained a concern.

In general, no "high" or "medium" safety significance plant and equipment health issues or adverse impact on SSCs important for safety had been reported during the review, except for a few issues highlighted, including the negative trend observed regarding the health of the personnel airlock and equipment hatch (EPP) airlock penetrations.

2.3.13 Radiological Risks (9.2.2)

The facility complies with the risk limits in the regulation for safety standards and regulatory practices (R.388). The PSA risk profile is quantified in PSA-R-T19-01 (Risk Assessment Report) [219]. The risk profile is presented in terms of the peak public risk, average public risk, peak site personnel risk, and average site personnel risk.

Public dose analyses were performed for the SG replacement project using updated assumptions (with appropriate conservatism), modelling, and methodologies such as the introduction of the reference core and alternative source term methodology, in accordance with 331-195 (Koeberg Accident Analysis Manual).

The assumptions in the PSA regarding average public risk may, however, be affected by changes to population data during LTO. Changes in the local and national population numbers affect the calculation of the average public risk in accordance with the methodology in the risk assessment report.

Requirements exist for updating the PSA assessment of public risk at regular intervals during the LTO and future decommissioning periods to quantify any public risk changes. These requirements are documented in 331-33 (PSA Updating and Maintenance).

2.3.14 Current Licensing Basis (9.2.3)

The current licensing basis for the facility remains valid, with an expected update when the DSSR studies are concluded in 2024 in accordance with RG-0027.

All the deviations were considered in the PSR global assessment to determine the impact of continued operation of the plant and to determine the relevant safety improvements. The PSR global assessment report assigned an identifier to all safety improvements related to regulations and regulatory guidelines as either H1 (High), M1 (Medium), or L1 (Low). All the H1 safety improvements are linked to the end of the current operational plant life; that is, they must be implemented prior to entry into LTO in order to meet all the LTO requirements. The detailed description of the identifiers is contained in the global assessment report . In accordance with the categorisation, the safety improvements are contained in the LTO integration preparation plan or the LTO implementation plan in § 14.0.

2.3.15 Specific Site Characterisation (9.3)

The Duynefontyn site characteristics have been assessed over the years to determine hazards that can affect the safety of the facility. The recent studies for the updated site safety report have been completed, except for the seismic hazard analysis and probabilistic tsunami assessments. These are due to be completed in 2024.

The site-specific external hazards and site conditions have been re-evaluated under the DSSR project, considering advances in knowledge and understanding of external events and changes to regulatory requirements. The scope of the DSSR is informed by the requirements of Regulation No. R.927 (Regulations on Licensing of Sites for New Nuclear Installations).

2.3.16 Hazards Screened Out Conditionally (9.3.1.2)

Loss of freshwater supply

The facility is supplied with potable water from the municipality; however, given the impact of drought as was experienced from 2015 to 2018, reliance on municipal water supply cannot be guaranteed. Based on the scarcity of conventional local and regional water supplies in the site region, it is proposed to augment potable water with a backup system of groundwater from the Aquarius wellfield supplying a desalination plant at Koeberg. Desalination of seawater offers the best short- to long-term option for the site. The loss of freshwater supply to Koeberg in the shortterm is low, since the priority of the municipality is to supply Koeberg due to its national key point status.

Note: Revision 2 Sections 4 through 6 were not searchable and so are not analysed here.

Extra-terrestrial events

The primary concern regarding extra-terrestrial events such as solar storms is the risk of an extended loss of off-site power. The risk has been mitigated by the mobile emergency backup diesel generators. 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 (with the exception of the seismic risk, for which an interim approach was taken, and the tsunami probabilistic studies, which are in progress) 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 prior to entry into LTO.

2.3.17 Plant Design (9.4)

The current design of the plant is deemed adequate for long-term operation when assessed against the licensing basis and national and international standards based on the conclusions of the PSR plant design review and the global assessment report, except for the design of the control rooms. The design of the control rooms does not meet the design basis in SAR II-4.5.1 (a design basis that is based on the general safety criteria of US NRC 10 CFR 50 Appendix A General Design Criteria No. 19) and, therefore, is not deemed adequate to protect the operators against radiation exposure during accident conditions. This design deficiency is further discussed in section § 9.4.2.1.3.

2.3.18 PWR Design Features (9.4.2)

The LTO assessments have identified plant design changes or modifications to address design life imitations and equipment qualification limitations and to improve nuclear safety in preparation for LTO, and these are listed in Appendix A.

2.3.19 The Radiation Barriers (9.4.2.1.1)

First barrier: fuel

Zircaloy-4 alloy M5TM and the Westinghouse advanced cladding alloy ZIRLOTM were selected as the cladding material for the fuel (the first safety barrier) because of their favourable mechanical properties, such as high resistance to corrosion and low neutron absorption.

Considerable operating experience has been acquired with the Framatome M5TM and the Westinghouse Zircaloy and advanced fuel cladding ZIRLOTM. Between 1989 and 2019, more than 5,4 million M5TM cladding fuel rods were operating in several reactors. The Westinghouse advanced alloy ZIRLOTM has likewise acquired a considerable amount of operating experience.

Figure 9-4 shows the number of fuel-leaking assemblies for each fuel cycle since Outages and 211 for Units 1 and 2, respectively. Since the 21st-cycle outages, there has been a decrease in the number of fuel failures. This is indicative of the robustness of the design and material choice.

Figure 9-4: Number of Fuel-leaking Assemblies for Each Cycle of Each Unit. (Note: Table 9-4 was redacted in its entirety.)

Steam generators: the steam generators will be replaced (refer to Appendix A.1 LTO Integrated Preparation Plan) due to the material being susceptible to primary water stress corrosion cracking (PWSCC) (refer to modification 07092A (SGR KNPS – Design Report – SGR System Design) . The proposed replacement steam generators include improved tube material (Ni-alloy 690) that provides significant resistance to PWSCC and extended operational life. *Note: Further references to "Ni-alloy 690" were also redacted.*

Two of the heater banks (RCP 005 and 006 RS) have a qualified life of 40 years and will be replaced in support of LTO.

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 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. The investigation analysis is documented in JN465-NSE-ESKB-R- (Long-Term Repair Strategies for the Containment Buildings – Expert Panel Report). A modification to provide such a system (based on the outcome of a mock-up) is in progress.

The PSR ageing assessment identified the obsolescence programme as having a deviation with low significance. The actions identified to improve the programme forms are contained in the LTO IIP in § 14.0. Further details regarding the obsolescence programme are discussed in § 9.5.1.5.3.

2.3.20 Spent Fuel Facilities (9.4.2.1.2)

This area is where the spent fuel is stored in racks covered by water. The design of the fuel storage is described in SAR II-1.9.4 (Fuel Building) . The facility has been modified to increase pool storage capacity. It was initially designed in accordance with ANSI N 18.2-1973 and later modified according to ANSI/ANS 57.2-1983 to install super-high-density storage racks.

An assessment – 240-167231099 (Assessment of the Spent Fuel Pool for Long Term Operation) – was performed on the spent fuel pool to evaluate the ageing effects of the neutron-absorbing materials and determine possible LTO without the requirements of an AMP.

In accordance with US design code standard ASCE 43-05, a new assessment concluded that the CSB building was not suitable for medium to long-term storage of fuel casks. Modification 07147DPDRR0012 (CSB for Fuel Storage Casks) has been raised to harden the structure against seismic hazards and other design basis external events.

2.3.21 Safety-related modifications (9.4.2.1.3)

Several mitigating actions have been implemented to reduce the radiological consequences to the control room occupants in the event of an accident with radiological releases. These mitigating actions are listed in Appendix J (Suitability for Continued Operation) of the PSR global assessment report.

The PSR plant design review found flooding of the RRI pump room on two occasions. In the second flooding incident, the plant was close to losing all RRI pumps, and therefore the incident represents itself as a common cause failure. Mitigating actions have been implemented to prevent such an incident and mitigate its consequences. Furthermore, to prevent the common cause failure of both trains, modification 03030C is to be implemented. The modification is included in the PSR integrated implementation plan.

2.3.22 Design Basis for the Facility (9.4.3)

Koeberg is a Framatome-designed plant with its nuclear safety design criteria based on the ANSI N18.2-1973 code. (Framatome obtained the original design from Westinghouse.) The design basis of Koeberg considers the general principle design criteria for nuclear power plants, 10 CFR Appendix A, to ensure that the operation of the plant is inherently safe throughout its operating life.

Koeberg performs probabilistic safety assessments (PSAs) to assess the off-site radiological risk due to accidental releases of radioactive materials and ensure that it is within the regulatory criteria specified in RD-0024. The PSA results are documented in PSA-R-T19-01 (Risk Assessment Report (RAR) to demonstrate compliance with the regulatory requirements of RD-0024. The RAR is a design basis document and forms part of the safety case for continued safe operation.

2.3.23 Application of Defence in Depth in Plant Design (9.4.4)

In accordance with RG-0028, the safety improvements will be completed within a reasonable time, following the NNR's concurrence with the plan before the next PSR. The adequacy of the design provisions for DiD is discussed in detail in Appendix D. *Note: Appendix D is redacted in Revision 2.*

2.3.24 Confinement of Radioactive Material (9.4.5.3)

The containment isolation will limit leakage by providing an *[essentially]* leak-tight barrier against the spread of radioactivity that may be released into the containment atmosphere in the unlikely event of a serious accident. *Note: The word 'essentially' was in Revision 1a but removed in Revision 2.*

Controls and monitors capable of closing discharge isolation valves are provided to ensure that releases are in accordance with the **NNR's LD-1020 (Radiation Dose Limitation at Koeberg Nuclear Power Station).**

2.3.25 Condition of the FSFs [Fundamentl Safety Functions] (9.4.5.4)

The impact analysis of the deviations for the FSFs concluded that no significant cumulative effect was identified, and no global issue was raised. The PSR plant design review found the current status of plant safety to be considered sufficient for safe operation and LTO, <u>provided the safety improvements identified in Appendix A are implemented</u>. Therefore, the FSFs were not challenged and were deemed adequate for LTO.

Safety Analyses (9.4.6.2)

The interim evaluation was based on the approach developed by EPRI, referred to as the expedited seismic evaluation process (ESEP), which the US NRC utilises. The objective of the ESEP is to demonstrate seismic margin through a review of <u>a limited, but</u> justified, scope of equipment that can be relied on for the safe shutdown of the plant following a significant seismic event without affecting regulatory safety criteria.

Note: This appears to be a disingenuous redaction in that it not simply withholds information, but actually changes the meaning of the sentence.

The equipment selection was done following the ESEP guidance and augmented with logic analysis and adaptation to the Koeberg plant design. The robustness verification was done using the ESEP guidance by computing (or scaling) the original SSE to obtain a review-level earthquake (RLE). <u>The ESEP process and evaluation are documented in 32-T-IPDK-002 (Interim Seismic Evaluation for Koeberg NPS).</u> The ESEP interim seismic evaluation provided reasonable assurance that the Koeberg units were sufficiently robust to shut down safely and cope with a significant seismic event and loss of AC power when certain activities had been performed. <u>These activities are mentioned in the conclusion of the 'Interim Seismic Evaluation for Koeberg NPS' (32-T-IPDK-002) , and these are included in the LTO Integrated Preparation Plan, Table A.1-2.</u>

2.3.26 Ageing Management for Long-Term Operation (9.5)

Additionally, the section discusses specific SSCs considered to be a risk in terms of ageing management, namely the containment, aseismic bearings, switchboards and cables. **These SSCs potentially have widespread impact and are not easily remedied.** Their risks and how these are mitigated to ensure that the SSCs can continue to reliably perform their safety functions are discussed.

2.3.27 Ageing Management Assessments (9.5.1)

The outcome of the SALTO assessment 240-156945472 (SALTO Ageing Management Assessment Report (Interim)) indicated that the plant was suitable for an additional 20 years of safe operation. The SALTO assessment concluded that, "The assessment results and recommendations have been reviewed, verified, and actioned to meet the regulatory expectations and assure safe operation into LTO. This result will form part of the application to obtain the required nuclear installation licence variation before LTO." The results of the evaluation are provided in document 240-156945472 (SALTO Ageing Management Assessment Report (Interim). The ageing management activities performed are discussed below. **Subsequent IAEA SALTO support missions have been held to provide KNPS with further suggestions and recommendations in improving preparation for safe LTO which have been incorporated into KNPS LTO preparation plans.**

2.3.28 Time-Limited Ageing Analyses (TLAAs) (9.5.1.4)

Although the reanalyses are in progress, it is envisaged that sufficient margins will be available for these components to continue operation for an additional 20 years based on operating experience <u>from EDF</u>. In the event that the reanalyses indicate that adequate margins cannot be maintained for the entire LTO period, ageing management actions required to ensure that the SCCs can meet the design functionality of SSCs are included in Table 9-4.

Note: Although the pages containing Table 9-4 are no longer redacted, they are in a non-searchable format in Revision 2.

2.3.29 Ageing Management Programmes and Processes (9.5.1.5.1)

SE 35244-049 SE: Koeberg PM templates are to be revised as required to include a failure modes and effect analysis to identify the relevant failure modes and failure causes to support the PM tasks identified. <u>The action has been completed for the electrical and mechanical domains. There is one PM template outstanding in the instrumentation domain, i.e., "RGL RCCA Inspection", which is currently in progress.</u>

Additionally, the programme met the nine attributes of an effective AMP as defined by RG0027 (Interim Regulatory Guide – Ageing Management and Long-Term Operations of Nuclear Power Plants) . F<u>urther details on how the programme met the requirements of RG-0027 are provided in Attachment C of KBA0022CHEMJUSTIF2 (Justification for the Koeberg NPS Chemistry Operating Specifications).</u>

The list of equipment requiring qualification is provided in 240-155832775 (Equipment Qualification Master List (EQML) for Harsh Environment). The list contains all qualified electrical and I&C equipment as defined by SAR II-1.11 (Environmental Qualification of Electrical Equipment for Accident Conditions in the Containment) and included in the EQ programme. **There is no formal EQ programme for mechanical or civil equipment. This is in-line with the IAEA standards. However, the equipment qualification requirements and the qualification assessment for mechanical equipment is provided in the engineering nuclear position paper, 240-109728634 (Environmental Qualification of Mechanical Equipment) . This position paper provides industry practices relating to equipment qualification of mechanical equipment, the assessment on how Koeberg assures the qualification of mechanical equipment and the justification for not having a formal mechanical equipment qualification (MEQ) programme. The assessment is based on applicable industry OE, the current Koeberg design codes and maintenance practices, and the recommended practices provided in the ASME QME-1 standard (Qualification of Mechanical Equipment Used in Nuclear Power Plants).** Requirements are in place to ensure that the qualified life of in-scope equipment is preserved for the full range of specified service conditions.

Note: Under the heading "Safety Related" the following paragraph from Revision 1a

> For qualified equipment located in a harsh environment, a qualified life has been established and included in 331-219 (Environmental Qualification Maintenance Manual for Equipment Located in Harsh Environments) , within which ageing effects would not prevent satisfactory performance of the equipment if a postulated accident were to occur within the established operating period. A qualified life is generally not required for equipment located in a mild environment that has no significant ageing mechanisms and is operated within the limits established by applicable specifications and standards.

was replaced with the following in Revision 2:

> An EQ Manual 331-219 (Environmental Qualification Maintenance Manual for Equipment Located in Harsh Environments) and 240-155832775 (Equipment Qualification Master List (EQML) for Harsh Environment) have been established to manage and preserve the qualification of qualified equipment located in harsh environments against degradation mechanisms. In accordance with the IEC/IEEE 60780-323:2016 (Nuclear Facilities – Electrical Equipment Important to Safety – Qualification), a qualified life is not required for equipment located in a mild environment and which has no significant ageing mechanisms and is operated within the limits established by applicable specifications and standards.

2.3.30 Containment Building (9.5.2.1)

A 10-yearly integrated leak rate test (ILRT) is conducted on both containment buildings and continuous operation licence-binding activities. The ILRT increases the pressure inside the containment buildings up to 400 kPa (gauge), representing the pressure the containment buildings would experience during a loss-of-coolant accident. During the pressurisation and depressurisation of ILRT, the containment buildings are closely monitored to determine their behaviour and condition. SAR II-4.2.2.2 (Test Description, Acceptance Criteria) documents the ILRT leak tightness and structural integrity acceptance criteria. The leak tightness acceptance criteria are based on the US NRC 10CFR50 Appendix J. The containment test criteria are documented in the 'SRSM' (KBA0022SRSM00000) under the EPP system.

During the last ILRTs in 2015, both the Unit 1 and 2 containment buildings demonstrated the expected behaviour and were qualified as suitable for operation. Figure 9-5 shows the containment global leak rate test results for both units. The ILRTs provided confidence that the degradation of the reinforced concrete had not compromised the structural integrity of the containment buildings. The monitoring of the containment buildings during the ILRTs also showed that the refurbished areas behaved uniformly with the remainder of the concrete. The results for the containment structure are documented in correspondence DB2015-0020 (System Design Engineering Acceptance of the Unit 1 ILRT [Outage 121] Structural Integrity Results) for Unit 1 and correspondence DB2016-0002 (System Design Engineering Acceptance of the Unit 2 ILRT [Outage 221] Structural Integrity Results) for Unit 2. Complete detailed results for the containment structure and leak rates of the ILRTs are stored at Koeberg's documentation centre and can be provided on request. Essentially, an ILRT on a containment building removes any uncertainty surrounding the integrity of the structure. Therefore, the test will be performed *[Note: a phrase was redacted here in 1a which was deleted for Revision 2]* to confirm the expected behaviour of the buildings in accordance with the ISI program requirements. Additionally, a detailed assessment of the containment structures has been documented in 331-623 (Engineering Position on Containment Structures for Long-Term Operation) which further elaborates that no structural concerns were identified. Refer to K-28880-E. The next test is scheduled for x27 and is included in the LTO Integrated Preparation Plan in Appendix A.1.

Figure 9-5: "Containment Global Leak Rate Test Results" was redacted together with its caption.

2.3.31 Nuclear Island: Aseismic Bearings (9.5.2.2)

Note: The last paragraph of '2. Test results of the inspections and tests' was redacted in both Revision 1a and Revision 2. Subsequent to the release of Revision 2, the following was revealed:

EDF has experienced an increased shear modulus. The only other plant with seismic bearings is Cruas, whose bearings consist only of neoprene components (no sliding plates). The EDF results confirmed the ultimately expected plateau of around a 37% increase in shear modulus. This value still respects the original design assumptions. Although the Koeberg shear modulus results are not of concern, given the EDF results, further evaluation of available literature, test data and operating experience has been completed to understand the ageing characteristics of the bearings. Important industry guidelines for ageing management were also benchmarked against Koeberg's ageing management programme. The outcome of the evaluation was favourable and confirmed that the aseismic bearings are fit for purpose. The results are documented in 331-645 (Elastomeric aseismic bearings – Current position and the way forward) [117] and 331-675 (Overview of the ageing management programme for the aseismic bearings) [118].

Note: Pages 125 and 126 of Revision 2 was in scanned (non-searchable) format and requires manually comparison, unless a non-scanned version of these pages can be obtained.

Pages 125-6 of Revision 2 are in a non searchable format so have not been analysed.

The phrase "is documented in 32-T-IPDK-008 …" was redacted.

switchboard spares and the unknown condition of the plant cables. The subsequent re-evaluation of the plant switchboard and cable condition, as well as suitability for LTO, is documented in 32-T-IPDK-008 (*Koeberg Switchboard, Switchboard Components and Plant Cabling Evaluation for LTO*) [91], which includes the findings of the recent SALTO ageing management assessment and PSR. The contents of this document form the basis of the arguments presented in this section relating to the ageing of the cables and switchgear for safe LTO.

2.3.32 Ageing Management of Switchboards and Cables (9.5.2.3)

Note: there were redactions in this section in both Revision 1a (page 125) and revision2 (page 126).

<u>The evaluation 32-T-IPDK-008 (Koeberg Switchboard, Switchboard Components, and Plant Cabling Evaluation for LTO) [91] did not specifically evaluate all the individual codes and standards applicable to the switchboards, switchgear, switchboard components, and cables. However, a high- level analysis was performed of the applicable codes and standards documented in the plant safety review (PSR plant design review) and the SAR.</u>

2.3.33 Design Adequacy of Switchboards and Cables (9.5.2.3.1)

The <u>Delle-Alsthom</u> switchboards have a robust design, with no indication of significant deterioration in the condition of the switchboards. The availability of switchboard component spares ensures that switchboard components that no longer meet their design tolerances are replaced or refurbished in good time according to the normal routine maintenance practices.

<u>The French electricity utility EDF has plants and electrical components similar to Koeberg in design and materials. In some cases, the EDF plants have the same switchboard types and plant cabling as Koeberg. EDF is not planning any large-scale cable replacements for its plants that exceed 40 years of operation. The EDF Saint-Alban nuclear power plant, commissioned in 1985 to 1986, has the same Delle-Alsthom-manufactured switchboards and switchgear as Koeberg and is one of the EDF plants scheduled for operation beyond 40 years; it is not planning switchboard replacements.</u>

<u>Koeberg has experienced a few cable failures mainly due to maintenance practices or the cable installation practices playing a significant role in the failure mechanism.</u>

All equipment failures are investigated through the corrective action programme (CAP), and appropriate corrective actions are implemented, including updating the maintenance basis, if required, to prevent a reoccurrence.

<u>The EDF ageing management matrix was used to develop 240-101650256 (Koeberg Ageing Management Matrix) [29].</u> A review of <u>240-156945472 (SALTO Ageing Management Assessment Report (Interim)) [56]</u> confirmed that all in-scope plant electrical switchboards, switchboard components, and plant cabling were comprehensively addressed and aligned with the IAEA IGALL requirements.

2.3.34 Switchboards (9.5.2.3.2)

The current switchboard maintenance tasks are aligned with industrygood practices recommended by EPRI, the US NRC, INPO, IAEA, <u>and EDF</u>.

Switchboard replacements are currently not expected for LTO due to observed equipment reliability and availability of spares. Should any switchboard component obsolescence or reliability issues that cannot be addressed through the obsolescence or modification process arise later during plant operation, then limited switchboard replacements could be pursued to release spares to address these concerns. Obsolete items such as the currently obsolete 6,6 kV and 380 V switchboard protection relays and fuses will continue to be replaced as required using the technical obsolescence programme.

2.3.35 Cables (9.5.2.3.3)

The ageing of power cables is mostly as a result of adverse localised environments and adverse service conditions, with the most common contributors being heat and wet environments. With water-induced cable degradation causing accelerated ageing of power cables found in environments susceptible to moisture or water ingress, Koeberg initiated a comprehensive cable ageing management programme (CAMP) in 2013, initially focusing on the 6,6 kV power cables, which were the most susceptible to ageing. The low-frequency (0,1 Hz) tan δ cable testing method was adopted at Koeberg as the most appropriate cable test method for all cables. Based on the CAMP programme, testing had not found any indication of 6,6 kV cable degradation that would preclude LTO.

2.3.36 Radiation Protection Programme

The typical equipment of this programme includes the ARGOS 6, the GEM 5, and the whole-body counter.

2.3.37 Chemistry Monitoring Programme (9.5.3.4)

The typical equipment included in this programme is the chemistry portable and laboratory equipment, Crison CM 35, Orbisphere 3650 dissolved oxygen analyser, Metrohm 912 conductometer, and Nova TRI gas analyser.

Functional responsibilities and educational and training (credential) requirements for RP positions are listed in KSH-010 (Functional Responsibilities for Radiation Protection at Koeberg Operating Unit) [180]. Although the RP organisation has experienced high rates of attrition in recent years, it has not affected the mandate of the RP organisation (which is mainly the implementation of the RP programme), and the organisation has embarked on a recruitment campaign to replenish the resources.

2.3.38 Radiation Protection Organisation (9.6.1.1)

Functional responsibilities and educational and training (credential) requirements for RP positions are listed in KSH-010 (Functional Responsibilities for Radiation Protection at

Koeberg Operating Unit) [180]. Although the RP organisation has experienced high rates of attrition in recent years, it has not affected the mandate of the RP organisation (which is mainly the implementation of the RP programme), and the organisation has embarked on a recruitment campaign to replenish the resources.

2.3.39 Radiation Worker Training (9.6.1.2)

On successful completion of the training, employees are issued with dosemeters and other protective equipment. Radiation worker authorisation is tracked through RadPro software, which is integrated software used for verifying authorisation for entry into radiation control zones.

Note: Further references to 'RadPro' were also redacted in Revision 1a.

2.3.40 Radiation Dose to the Public and the Environment (Normal Operations) (9.6.2.4)

The assessment was performed utilising software (PC-CREAM software). The software is currently undergoing a verification and validation process with the NNR, and Eskom is addressing the regulatory comments at present. PC-CREAM software is the primary tool used to model the environmental transfer and calculate the dose for the representative person utilising the consequences of releases to the environment assessment methodology (CREAM).

The prospective dose calculation was performed based on the methodology of NSIP (A Revised Methodology to Assess the Ionising Radiation Dose for Members of the Public from Normal Operation at the Duynefontyn Site)

Note: Further references to 'PC-CREAM,' 'PC-CREAM PLUME,' PC-CREAM Granis' and 'CREAM' were also redacted in Revision 1a.

2.3.41 Radiation Dose to the Public and the Environment (Normal Operations) (9.6.2.4)

In addition to assessing the dose to the public, the impact of radiological effluents on the environment was assessed using the ecological risk from ionising contaminant assessment (ERICA) software. ERICA software was developed to assist the user in formulating the problem (involving stakeholders if appropriate), performing an impact assessment, evaluating data, keeping records, and performing the necessary calculations to estimate dose rates to selected biota. The ERICA software has a built-in list of reference organisms. Each reference organism has its specified geometry and is representative of either the terrestrial, the freshwater, or the marine ecosystem. The ERICA software is described in Chapter 7 of the DSSR [211].

2.3.42 Emergency Plan and Procedures (9.7.2.1)

This information is used to assess factors around the site that can impede the implementation of the emergency plan. Thus far, the DSSR update studies *currently under way* have not found any factors around the site that can impede the implementation of the emergency plan.

Note: The italics phrase above was removed in Revision 2.

The sensitivity analysis, which simplistically increased the initial core inventory used as input in PC Cosyma 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.

The IKNEP incorporates organisations such as: … International support from the IAEA, OEM (Areva), and EDF.

2.3.43 Radioactive Waste Programme at Koeberg (9.7.3.1)

The below paragraph from Revision 1a:

> Although additional radioactive waste will be generated during the LTO, the generated volume of waste will remain unchanged; thus, the current radioactive waste management regime remains effective and adequate for safe LTO. In addition, Koeberg will continue to monitor best available techniques/methodologies to improve the programme to ensure compliance with regulatory requirements throughout the intended period of operation.

In Revision 2 was replaced with

> Although additional radioactive waste will be generated during the LTO, the average annual radioactive waste volume produced is not expected to increase as the operating processes will remain largely unchanged. However, the cumulative volume of radioactive waste produced will increase due to the extended period of operation, i.e., LTO. Koeberg will continue to monitor best available techniques/methodologies to improve the programme to ensure compliance with regulatory requirements throughout the intended period of operation.

The following paragraph from Revision 1a

> The LLWB will remain adequate to store LILW-SL throughout the period of LTO. However, it is noted that, in recent years, a backlog in the shipping of a high volume of radioactive waste has been experienced.

In Revision 2 was expanded to

> The capacity of the LLWB will remain adequate to store LILW-SL throughout the period of LTO. The classification of the radwaste stored in the LLWB and the radiological classification of the LLWB area remains unchanged. The dose rates are surveyed weekly in accordance with KAH-002 (Radiation Surveillance Programme) and remain within limits. The occupational dose continues to be monitored and does not show an adverse trend. A project plan and the methodology (NSIP (Methodology for Documenting the Use of the LLWB)) for performing the assessment was submitted and approved by the NNR. To demonstrate that the LLWB is fit for purpose for the full duration of LTO, Eskom is in the process of performing a safety assessment for the LLWB. The safety assessment will cover radiological conditions and structural integrity as per the methodology approved by the NNR. Eskom is in the process of finalising the LLWB safety assessment, and it will be submitted to the NNR for review and acceptance as per K-28588-N. The safety assessment is included in the LTO integrated preparation plan (IPP), Appendix A. However, it is noted that, in recent years, a backlog in the shipping of a high volume of radioactive waste has been experienced.

2.3.44 Plant Design Provisions for Environment Protection (9.7.4.2)

The storage tanks allow the short half-life radioactive gases to decay <u>if time allows</u>, leaving only relatively small quantities of long half-life radionuclides released into the atmosphere.

Note: Once again, this redaction changes the meaning of the sentence.

2.3.45 AADQs and Effluent Discharge Conditions (9.7.4.3)

The PSR <u>Appendix A [70]</u> concluded that the effluent discharge limits were generally well established and in line with NNR and international practice.

2.3.46 Normal Operations Environmental and Effluent Monitoring Programmes (9.7.4.4)

<u>Appendix C</u> of the PSR found that several leaks and spills had been reported at Koeberg in the past 10 years (eight in total), and these had been reported to the NNR as required.

Considering these experiences, the ageing of systems could lead to undetected leaks and spills. <u>Appendix B</u> of the PSR determined that the on-site monitoring to ensure a high probability of the prompt detection of a release of new sources of radioactive contamination to the environment from a leak or spill was inadequate (deviation graded “low”).

2.3.47 Arrangements for Human Resources (9.7.5.2)

Permanent cessation due to expiry or termination of the operating license is covered by the decommissioning strategy and decommissioning plan. It is not Eskom's intention to temporarily suspend operations (temporary cessation) at Koeberg. The arguments in the safety case pertaining to the availability of sufficient resources and technical support for the LTO period implicitly includes periods of temporary cessation of operations. Business as usual will be applicable during temporary cessation. However, it is acknowledged that for temporary cessation of operations for extended periods (for example, exceeding 12 months), a safety assessment considering the aspects discussed in IAEA SRS No. 31 (Managing the Early Termination of Operation of Nuclear Power Plants) [248] will be compiled if such temporary cessation of operation is decided/required.

In the PSR human factors review, it was concluded that the current human resource planning processes were adequate and would remain adequate to manage resource requirements for safe operations in the LTO period [69]. <u>In anticipation of LTO, Eskom has embarked on a recruitment campaign to fill vacancies (employment of permanent staff) to ensure that there are adequate resources into the LTO period. Document 240-156938857 (NOU Human Resources Position Strategy on Long-Term Operation) [55] contains the evidence that demonstrates adequate arrangements for human resources.</u>

2.3.48 Arrangements for Financial Resources (9.7.5.6)

Adequate financial resources are available to support the performance of safety-related activities. <u>Major expenditure for Koeberg is associated with salaries (operational cost) and the safety improvements in the nuclear technical plan (capital costs).</u>

2.3.49 Monitoring and Oversight of the NSC at the Nuclear Operating Unit (9.9.2)

As documented in KAA-850 (Koeberg Nuclear Power Station Safety Culture Enhancement Programme) [146] procedure, the NSC programme is regularly evaluated through self- assessments, quality assurance audits, assessments by the Nuclear Safety Assurance Department, and independent surveys conducted by external organisations. One of them is <u>Inavit IQ</u>, an organisation conducting nuclear culture surveys

2.3.50 Why it is Safe to Continue Operation (Overall Assessment for Additional 20 Years) (10.0)

The PSR confirmed that the overall safety of the plant was adequate and that the level of safety would be maintained and/or improved with the implementation of the identified safety improvements. It also confirmed that the plant would be suitable for continued operations, provided that the safety improvements were to be implemented. Fulfils RG-0027 (5.3.1); R.266 4 (c), (e).

Comprehensive training and knowledge management programmes are in place to manage the skills and expertise in the LTO period. The implementation of the KM programme is in progress and is due to be completed prior to entry into LTO. Fulfils RG-0027 (5.3.1); R.266 4 (d).

It is safe to continue operations, since it has been demonstrated that nuclear safety at the facility will be maintained in accordance with regulatory requirements and international good practices for the intended period of LTO, provided that there is timely implementation of the safety improvements contained in the LTO IIP.

2.3.51 Safety Analysis Report (11.0)

The current Koeberg SAR does not meet the format and content of RG-0019, Appendix 4. Eskom indicated, in correspondence letter K-28083-E, that the Koeberg SAR would meet all the content according to RG-0019, but not the format in Appendix 4. The NNR conditionally accepted Eskom's proposal in correspondence letter k28083N.

Note: Table 11-1 was partly redacted in Revision 1a, and was one of the 'printed and scanned' pages in Revision 2. The redacted portion was 'Projected Submission to NNR'.

Table 11-1: *SGR and SALTO TLAA SAR Changes*

SAR UPDATE PROGRESS											
	Total Number of Changed Chapters	Change Notices (CN) Generated (# of Chapter)	Change Notices not yet Generated (# of Chapters)	Under Safety Documentation Review Group (SDRG) Review (# of Chapters)	SDRG Approved (# of Chapters)	Projected Submission to NNR					
						29 July 2022	31 August 2022	30 September 2022	31 October 2022	30 November 2022	31 December 2022
SGR changes – completed	101	101	0	52	49				49	51	
TLAA changes	7	0	7	0	0	0	0	4	0	0	3

2.3.52 Adopted Long-Term Operation Programme (12.0)

Document 36-197 (Koeberg Licensing Basis Manual) was updated to reflect the ageing-management standard, as the KLBM is utilised to demonstrate the processes applicable to the fulfilment of NIL-01 Variation 19. Document 36-197 was revised recently, <u>is awaiting NNR approval, and is tracked under CR110967-001CA</u>.

2.3.53 Conclusions (15.0)

Therefore, it has been demonstrated that nuclear safety at the facility will be maintained in accordance with regulatory requirements and international good practices for the intended period of LTO <u>with timely implementation of the safety improvements contained in the LTO IIP.</u>

2.3.54 Acceptance, Revisions, Development Team, Acknowledgements (16.0-19.0)

- The names of the managers who had 'seen and accepted' the SCR were redacted in Revision 1a, but shown in Revision 2.
- The names of the compilers of the revisions were redacted in Revision 1a, but shown in Revision 2.
- The names of the compilers of the revisions were redacted in Revision 1a, but shown in Revision 2.
- The names of those acknowledged is redacted in Revision 1a and Revision 2.

2.3.55 Appendix A: LTO Integrated Implementation Plan

‚Table A.1-6: Knowledge Management' was added in Revision 2. This is includes a list of 6 departments and "Completion dates" all in July 2024. The note below for appendix B also applies.

2.3.56 Appendix B: SAR Updates for LTO

Appendices A and B consist of 24 pages of tables where the column 'Completion Date' was entirely redacted in Revision 1a. It is included in Revision 2. However, these pages are in non-searchable format) in Revision 2, despite being in searchable format in Revision 1a. Further work would thus be required to determine differences.

2.3.60 Appendix C Safety-Related Ageing Programmes

The entire Appendix is in non-searcahable format and so was not analysed.

2.3.61 Appendix D Defence-in-Depth

A new table was added in Revision 2. The redactions mean it is difficult to say which one, but must be one of:

- Table D.1-1: Analysis of the Deviations on DiD Levels and FSFs
- Table D.1-2: List of OT Branches Affected by More Than Five Deviations
- Table D.2-1: Impact of Deviations on DiD Levels
- Table D.3-1: PSR Deviations Affecting Fundamental Safety Functions

2.3.61.1 Practical Elimination of Significant Radioactive Releases through Defence-in-Dept (D.1.4)

<u>The following severe accident conditions are described in TECDOC-1791 (Considerations on the Application of the IAEA Safety Requirements for the Design of Nuclear Power Plants) [266] and which should be considered for practical elimination.</u>

Five pages were redacted in Revision 1a: Section D.1.4.1 - D.1.4.5. The text is not replicated here - refer to Revision 2 sections:

- D.1.4.1 Events that could lead to prompt reactor core damage and consequently early containment failure
- D 1.4.2 Severe Accident Phenomena which could lead to Early Containment Failure
- D 1.4.3 Severe Accident Phenomena which could lead to Late Containment Failure
- D.1.4.4 Severe Accident with Containment Bypass
- D.1.4.5 Significant Fuel Degradation in a Storage Pool

2.3.61.2 Description of the Defence-in-Depth Assessment Approach (D.1.6)

<u>The assessment was carried out by a multidisciplinary team of experts. Below is a summary of the outcomes but with an increased focus on the impact of deviations graded high and medium on each level of DiD</u>.

Note: This is followed by three pages which are redacted in Revision 1a. The text is not replicated here - refer to Revision 2 sections:

- D.1.6.2 Results of impact Analysis on Each Level of Defence-in-Depth (Page in non-searchable format).
- D.1.6.3 Results of Impact Analysis on Defence-in-Depth Objective Trees (Page in non-searchable format).
- D.1.6.4 Results of Impact Analysis on Fundamental Safety Functions

2.3.61.3 D.2 Impact of Deviations on DiD Levels

This was redacted in both Revisions. It contains 10 pages of tables titled:

- Table D.2-1: Impact of Deviations on DiD Levels
- Table D.3-1: PSR Deviations Affecting Fundamental Safety Functions

2.3.62 Appendix E: Requirements for LTO Checklist

There were no redactions in Revision 1a. However, the entire 41 page appendix is in-non-searchable formatso was not assessed.

3. Bad Faith Redactions

The full analysis provided by this report identifies the following redactions that appear to be entirely unjustified by the reasons provided in Revision 1a. Page numbers provided refert to Revision 2, section numbers are given in brackets.

Condition of the FSFs (9.4.5.4)

The PSR plant design review found the current status of plant safety to be considered sufficient for safe operation and LTO, provided the safety improvements identified in Appendix A are implemented. (Pg.95)

Safety Analyses (9.4.6.2)

The objective of the ESEP is to demonstrate seismic margin through a review of a limited, but justified, scope of equipment that can be relied on for the safe shutdown of the plant following a significant seismic event without affecting regulatory safety criteria. (Pg.99)

Radiation Dose to the Public and the Environment (Normal Operations) (9.6.2.4)

ERICA software was developed to assist the user in formulating the problem (involving stakeholders if appropriate), performing an impact assessment, evaluating data. (Pg.143)

Plant Design Provisions for Environment Protection (9.7.4.2)

The storage tanks allow the short half-life radioactive gases to decay if time allows, leaving only relatively small quantities of long half-life radionuclides released into the atmosphere. (Pg.165)

Why it is Safe to Continue Operation (Overall Assessment for Additional 20 Years) (10.0)

The PSR confirmed that the overall safety of the plant was adequate and that the level of safety would be maintained and/or improved with the implementation of the identified safety improvements. It also confirmed that the plant would be suitable for continued operations, provided that the safety improvements were to be implemented. (Pg.184)

It is safe to continue operations, since it has been demonstrated that nuclear safety at the facility will be maintained in accordance with regulatory requirements and international good practices for the intended period of LTO, provided that there is timely implementation of the safety improvements contained in the LTO IIP. (Pg.186)

Conclusions (15.0)

Therefore, it has been demonstrated that nuclear safety at the facility will be main-tained in accordance with regulatory requirements and international good practices for the intend-ed period of LTO with timely implementation of the safety improvements contained in the LTO IIP.

4. Conclusions

It should be noted that subsequent to the start of this study, Eskom, possibly due to pressure from Save Bantamsklip via the Information Regulator, released an unredacted revision 3 of the Safety Case via their website. As of date of writing, this is available at https://www.eskom.co.za/eskom-divisions/gx/nuclear/.

This list of differences is intended to be of use to researchers wishing to engage in the LTO public comment/consultation process and save them significant time. It serves as an indication where more detailed research would be useful, for example finding and looking into the document references which were previously redacted. This could be used as the basis for a discussion among local organisations where to collaborate, and possibly to locate and employ appropriate authoritative experts to produce detailed reports into specific areas.