RESTRICTED

This Report is submitted to the Government of South Africa. Its initial distribution is restricted to the authorities concerned, the contributors to the report and responsible Agency staff. The Report will be derestricted within 90 days of the IAEA's transmittal letter unless a contrary response has been received from the Government of South Africa.

Only when it is known that the report has been ‘derestricted’ should this cover sheet be removed.

Division of Nuclear Installation Safety
International Atomic Energy Agency
P.O. Box 100
A-1400 Vienna, Austria

This page is intentionally left blank

IAEA Safety Aspects of Long Term Operation SALTO

REPORT

OF THE

SAFETY ASPECTS OF THE LONG TERM OPERATION MISSION

(SALTO)

TO THE

KOEBERG

NUCLEAR POWER PLANT UNITS 1 AND 2

South Africa

22-31 March 2022

DIVISION OF NUCLEAR INSTALLATION SAFETY
SAFETY ASPECTS OF LONG TERM OPERATION MISSION
IAEA-NSNI/SALTO/50/2022

This page is intentionally left blank

PREAMBLE

This report presents the results of the IAEA Safety Aspects of Long Term Operation (SALTO) team review of Koeberg Nuclear Power Plant, South Africa. It includes recommendations for improvements affecting ageing management and safe long term operation for consideration by the responsible South African authorities and identifies good practices for consideration by other nuclear power plants. Each recommendation, suggestion, and good practice is identified by a unique number to facilitate communication and tracking.

Any use of or reference to this report that may be made by the competent South African organizations is solely their responsibility.

This page is intentionally left blank

FOREWORD by the Director General

IAEA Member States give high priority to safe, continuing operation of nuclear power plants (NPPs) beyond their original design life (typically 30 or 40 years) as an alternative to decommissioning. In this respect, long term operation (LTO) is defined as NPP operation beyond an established time frame originally set out in the operating licence, design limits, standards or regulations. LTO is justified by a safety assessment which considers life-limiting processes and features for structures, systems and components (SSCs).

International peer review is a useful tool for Member States to exchange experiences, learn from each other and apply good practices in different activities carried out throughout the lifetime of NPPs and research reactors, including LTO. The International Atomic Energy Agency (IAEA) supports Member States in enhancing the safety of NPPs and research reactors by providing a peer review service in many areas that affect safety. The Safety Aspects of Long Term Operation (SALTO) peer review service was launched in 2005. It was designed to assist operating organizations in adopting a proper approach to ageing management and preparation for safe LTO of NPPs.

The evaluation of programmes and performance is made based on IAEA Safety Standards and uses combined expertise of the international review team. The review is neither a regulatory inspection nor an audit against national codes and standards. Rather, it is a technical exchange of experience and practices at the working level aimed at strengthening the programmes, procedures and practices implemented at the nuclear installation.

A SALTO peer review for ageing management and preparedness for safe LTO can be carried out at any time during the lifetime of an NPP or research reactor. The SALTO peer review service is beneficial for NPPs and research reactors:

- In the early phase of operation – to support development and implementation of ageing management and other related activities in compliance with latest IAEA Safety Standards;
- During preparation for safe LTO – to review ageing management and preparedness for safe LTO in compliance with latest IAEA Safety Standards;
- During operation in the LTO period – to review ageing management and LTO related activities in compliance with latest IAEA Safety Standards.

The report that follows presents the conclusions of the SALTO team, including good practices and proposals for enhanced operational safety, for consideration by the Member State and its competent authorities.

This page is intentionally left blank

EXECUTIVE SUMMARY

At the invitation of Eskom the IAEA conducted a SALTO (Safety Aspects of Long Term Operation) mission at the Koeberg Nuclear Power Plant (NPP) (further referred to as 'the plant') 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 review team consisted of two IAEA staff members (team leader and deputy team leader), six international experts and two observers, covering all six areas of the standard scope of a SALTO mission. 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). Through the review of available documents, presentations and discussions with counterparts and other members of the plant staff, the 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. The SALTO team encouraged the plant management to facilitate implementation of all remaining activities for safe LTO.

The team found the plant staff to be professional, open and receptive to proposals for improvement. The mission team observed that plant management is committed to improving plant preparedness for LTO. Walkdowns showed the plant to be in good condition. In addition, the team noted the following good performances:

- An integrated corrective action programme to extensively consider operating experience for LTO.
- A template to collect vital importance parameters from the original equipment manufacturers (OEM) to establish the extended qualified life of electrical components.
- The so-called capability index applied to characterize health, attitude and other enablers of staff members to qualify if they are fit to perform a task.

The team recognized that the plant's intention is to follow the IAEA Safety Standards in preparation for safe LTO. The team identified several areas for further improvement. Fifteen issues were raised:

- Management of the LTO programme is not effective to timely complete all actions to prepare for LTO.
- The safety analysis report (SAR) has not been adequately updated for LTO and ageing management.
- Completeness and consistency of scope setting of SSCs for ageing management and LTO are not ensured.
- The plant programmes are not comprehensively reviewed and implemented for LTO.
- Information used for ageing management review (AMR) of mechanical SSCs is not consistently managed and documented.
- Ageing management programmes (AMPs) for mechanical SSCs are not complete.
- The plant has not completely implemented a comprehensive cable ageing management programme.
- The plant has not revalidated environmental qualification for some SSCs for LTO.

- Electromagnetic compatibility has not been completely assessed.
- The plant has not revalidated the environmental qualification of qualified cables for LTO.
- A proactive approach to technological obsolescence management is not fully implemented.
- The plant has not comprehensively revalidated the TLAAs for concrete structures.
- Containment structure monitoring system is not fully functional.
- Ageing management programmes for civil structures are not fully developed and implemented.

A summary of the review was presented to the plant management during the exit meeting held on 31 March 2022. The plant management expressed a determination to address the areas identified for improvement and indicated their intention to initiate the invitation of a 'SALTO Peer Review Follow-up Mission to Koeberg Nuclear Power Plant' to be conducted in 2024.

This page is intentionally left blank

CONTENTS

1. INTRODUCTION 1
1.1. Objectives 1
1.2. Scope 1
1.3. Conduct of the mission 1
1.4. Summary information on the plant 2
1.4.1. General information 2
1.4.2. Regulatory framework for ageing management and LTO 2
1.4.3. Plant's LTO policy 2
2. MAIN CONCLUSIONS 3
3. DETAILED CONCLUSIONS FOR REVIEW AREAS 5
3.1. Organization of ageing management and LTO activities 5
3.2. Scope setting, plant programmes and corrective action programme 6
3.3. Ageing management of mechanical SSCs 7
3.4. Ageing management of electrical and I&C SSCs 8
3.5. Ageing management of civil SSCs 10
3.6. Human resources, competence and knowledge management for LTO 11
4. SUMMARY OF RECOMMENDATIONS AND SUGGESTIONS 12
5. DEFINITIONS 14
6. REFERENCES 16
7. TEAM COMPOSITIONS 18
7.1. IAEA REVIEW TEAM 18
7.2. THE PLANT AND OTHER ORGANIZATIONS 18
APPENDIX I - ISSUE SHEETS 20

This page is intentionally left blank

1. INTRODUCTION

1.1. OBJECTIVES

As agreed during the preparatory meeting held virtually on 18 June 2021 a 'SALTO Peer Review Mission for Koeberg Nuclear Power Plant' ([19]-[20]) was conducted between 22-31 March 2022. The objective was to review the status and future plans for safe LTO programmes and activities performed at the plant with comparison to the relevant IAEA Safety Standards, guidance documents and internationally accepted practices and to provide recommendations and suggestions for improvement of the preparations for safe LTO.

1.2. SCOPE

In accordance with Section 3 of IAEA SALTO Guidelines [18] and the Working Note Outlines (WNO), the scope of this SALTO mission agreed during the preparatory meeting was as follows:

A. Organization of ageing management and LTO activities;

B. Scope setting, plant programmes and corrective action programme;

C. Ageing management of mechanical SSCs;

D. Ageing management of electrical and I&C SSCs;

E. Ageing management of civil SSCs;

F. Human resources, competence and knowledge management for LTO.

1.3. CONDUCT OF THE MISSION

The following documents and information were used as the basis for the review:

– IAEA Safety Standards [1-16];

– IAEA Safety Report and Review Guidelines [17-18];

– Advance Information Package [21];

– Technical experience of the team.

IAEA Safety Requirements SSR-2/1 (Rev.1) [2], Safety Requirements SSR-2/2 (Rev.1) [3], Safety Guide SSG-48 [15], Safety Guide SSG-25 on 'Periodic Safety Review' [14] and Safety Report No. 82 [17] were the basic references for the peer review.

The list of participants, including their functions during the SALTO mission and contact information, is given in Section 7.

The mission was conducted through reviews of plant documentation, meetings and discussions between the IAEA Review Team and counterpart specialists and other staff from the plant. All meetings were held at the plant and plant walkdowns were arranged as required.

Plenary sessions and parallel discussions were organized as needed. The discussions between IAEA experts and the plant counterparts were conducted in parallel for all the areas identified above in Section 1.2.

The mission team members and the team leader informed the counterparts and plant management of the team's observations daily. Each reviewer and counterpart reached agreement on the observed facts. The host plant peer attended the daily team meetings. Before the exit meeting, the team finalized the mission report and it was presented to the counterparts and to the plant management.

This mission report summarizes the findings within the review scope, according to the SALTO Guidelines document [18]. The text reflects only those areas in which the team made an observation (either a recommendation, a suggestion, an encouragement, a good practice or a good performance). No text is included for areas of the review scope where the review did not reveal any safety related conclusions.

A formal exit meeting was held on the last day of the mission. At the exit meeting, each team member provided short conclusive statements summarizing the conclusions in the given review area.

1.4. SUMMARY INFORMATION ON THE PLANT

1.4.1. General information

Koeberg Nuclear Power Plant is the only NPP in South Africa and is owned and operated by ESKOM. It was commissioned in 1984 (Unit 1) and 1985 (Unit 2). Each unit is equipped with a reactor operating with enriched uranium (U-235) fuel and light water moderator and coolant.

The plant, unit 1 and 2, has the following characteristics:

- Reactor type: PWR
- Thermal power: 2 775 MW each
- Electric power output: 930 MW each
- Number of primary loops per unit: 3
- Mass of the primary circuit inventory: 202 t
- Volume of the primary circuit: 105 m^3 (cold) and 108 m^3 (hot)
- Pressure in the primary circuit: 15.5 MPa
- Average temperature of the primary coolant: 314.9 °C (out), 276 .9°C (in)
- Length/inner diameter of the vessel below nozzles: 11.9 m / 3.99 m
- Nominal enrichment of the fuel: 4.4 %
- Fuel quantity per unit (U mass only): ~ 72.5 t
- Number of turbines per unit: 1 high pressure and 3 low pressure

1.4.2. Regulatory framework for ageing management and LTO

The initial licenses to operate the plant were issued by the Council for Nuclear Safety (now National Nuclear Regulator (NNR)). A recent update to the licenses included an end date of July 2024. The design life of the units is 40 years. The NNR has a nearby site office and interfaces with Eskom through the Koeberg Nuclear Licensing Department. Every 10 years a Periodic Safety Review (PSR) is performed. The regulatory requirements for operation beyond 40 years are documented in the Regulatory Guide (RG) RG-0027 (Interim Regulatory Guide Ageing Management and Long Term Operations of Nuclear Power Plants) and RG-0028 (Interim Regulatory Guide Periodic Safety Review of Nuclear Power Plants) issued in 2019.

1.4.3. Plant's LTO policy

The plant was designed to operate for 40 years and the life extension plans are currently underway with the objective of extending the plant's operating life by an additional 20 years until 2045. Significant milestones and activities completed during the 40 year period include three periodic safety reviews, a post-Fukushima stress test review, two OSART reviews, regular WANO peer reviews, continued safety improvements, and modifications.

2. MAIN CONCLUSIONS

Through the review of available documents, presentations and discussions with counterparts and other members of the plant staff, the 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. The SALTO team encouraged the plant management to facilitate implementation of all remaining activities for safe LTO.

The team found the plant staff to be professional, open and receptive to suggestions for improvement and observed that the plant management is committed to improving preparedness for LTO. Walkdowns indicated that the plant is in good condition. The most significant good performances noted by the team were in the following areas:

- An integrated corrective action programme to extensively consider operating experience for long term operation.
- A template to collect vital importance parameters from the original equipment manufacturers (OEM) to establish the extended qualified life of electrical components.
- The so-called capability index applied to characterize health, attitude and other enablers of staff members to qualify if they are fit to perform a task.

The team recognised that the plant's intention is to follow the IAEA Safety Standards in preparation for safe LTO. There are some areas which should be improved to reach the level of IAEA Safety Standards and international best practices. The team identified fifteen issues resulting in either a recommendation or suggestion for improvement:

- Management of the LTO programme is not effective to timely complete all actions to prepare for LTO.
- The safety analysis report (SAR) has not been adequately updated for LTO and ageing management.
- Completeness and consistency of scope setting of SSCs for ageing management and LTO are not ensured.
- The plant programmes are not comprehensively reviewed and implemented for LTO.
- Information used for AMR of mechanical SSCs is not consistently managed and documented.
- AMPs for mechanical SSCs are not complete.
- The plant has not completely implemented a comprehensive cable ageing management programme.
- The plant has not revalidated environmental qualification for some SSCs for LTO.
- Electromagnetic compatibility has not been completely assessed.
- The plant has not revalidated the environmental qualification of qualified cables for LTO.
- A proactive approach to technological obsolescence management is not fully implemented.
- The plant has not comprehensively revalidated the TLAAs for concrete structures.
- Containment structure monitoring system is not fully functional.
- Ageing management programmes for civil structures are not fully developed and implemented.

An evaluation of each review area is contained within the relevant subsections of Section 3. Recommendations and suggestions are introduced in Section 3 and described in detail in the individual issue sheets in Appendix I.

The plant management expressed a determination to address the areas identified for improvement and indicated the intention to initiate the invitation of a 'SALTO Peer Review Follow-up Mission to Koeberg Nuclear Power Plant' to be conducted in 2024.

3. DETAILED CONCLUSIONS FOR REVIEW AREAS

3.1. ORGANIZATION OF AGEING MANAGEMENT AND LTO ACTIVITIES

Related regulatory requirements, codes and standards for AM and LTO and regulatory review

No recommendations, suggestions, encouragements, good practices or good performances were identified in this area.

Principles and approach to AM and LTO

No recommendations, suggestions, encouragements, good practices or good performances were identified in this area.

Organizational arrangements for AM and LTO

No recommendations, suggestions, encouragements, good practices or good performances were identified in this area.

Periodic safety review

The PSR reports of Safety Factor (SF)-2, SF-3 and SF-4, have not identified any deviations with high or medium safety significance. They identify only low and drop safety significance (the reports contain 6 deviations for SF-2, 4 deviations for SF-3 and 9 deviations for SF-4). There is no information in the PSR report on SF-4 that the plant identified any significant degradations of SSCs. However, in the evaluation report of SF-3, a comparison was performed between the equipment qualification programme requirements against the IEC/IEEE60780-323 (so-called dual logo) standard, but the plant did not identify as a potential gap that the design specifications for components in scope of equipment qualification do not include reference to the electromagnetic compatibility requirements. The team **encouraged** the plant to comprehensively identify potential safety improvements for LTO.

Programme for LTO

The comprehensive document ‘Safety Case for LTO’ is being prepared to demonstrate continued safe operation of the plant. The safety case is not completed and is planned to be finished by June 2022, when the plant is required to submit it to the regulatory body. The plant does not have margins for delays in any ongoing activities. Furthermore, new AMPs have not been implemented, so it is not possible to evaluate the effectiveness of AMPs on an individual nor on plant level. Revalidation of all TLAAs is not completed. Some findings from the 2nd PSR (PSR-II) and eight post Fukushima requirements are still in progress and not completed. Without effective management of the LTO programme the plant will not be able to timely implement all activities to demonstrate preparedness for safe LTO. The team made a **suggestion** in this area (issue A-1).

Configuration/modification management and design basis documentation

No recommendations, suggestions, encouragements, good practices or good performances were identified in this area.

Safety analysis report

The current revision of the SAR does not include a description of ageing management approach, ageing management programme results nor a list of TLAAs and results of revalidation of TLAAs. Results and adequate description of the PSR are not documented in the SAR. The current design basis as updated by considering new TLAAs are not documented and updated in the SAR yet. Without an adequately updated SAR for LTO and ageing management, the plant cannot ensure a complete safety documentation for LTO. The team made a **suggestion** in this area (issue A-2).

3.2. SCOPE SETTING, PLANT PROGRAMMES AND CORRECTIVE ACTION PROGRAMME

Methodology and criteria for scope setting of SSCs for AM and LTO

The plant‘s scoping methodology uses the classification which is assigned to equipment based on the safety or non-safety function of the equipment. The scoping process has covered more than 200 000 structures, systems and components of the facility, and more than 80 000 of these are finally considered for ageing management evaluation for LTO. Once the list was established, five groups were assigned to the review with a specific and clearly defined focus for each group. One group was assigned to perform a deep review, the second focused on excluded components, the third on included components, and the two last groups respectively examined the generic and specialized components scope. The team considered this original organization for reviewing the scope setting as a **good performance**.

The plant has defined a Design Extension Related (DER) class in the Importance Category to include components with a function in case of severe accidents or under extreme conditions. Although the plant is planning to perform the formal DER classification, it has not been backfitted. For future modifications of the plant, there is no written evidence that a walkdown is prescribed after modification of the plant to identify potential non-safety equipment impacting on safety equipment. In addition, the information that an SSC is included in or excluded from the LTO scope list will be stored in two separated databases, maintained by two different groups. In conclusion, completeness and consistency of scope setting of SSCs for AM and LTO are not fully ensured in time. The team made a **suggestion** in this area (issue B-1).

Maintenance programme

The plant process for determining the preventive maintenance programme requirements has been based on the ‘Equipment Reliability Process’ and aligned with the methodology employed by foreign operators. However, the preventive maintenance programme is still not fully implemented for LTO. Preventive Maintenance (PM) is based on templates which recommend PM tasks and task intervals, constituting the PM strategy. Most PM templates are ready for LTO, but six I&C components templates are not completed. The team observed that the implementation of generic PM task orders in SAP in line with the revised PM strategies is not complete. The team made a **suggestion** in this area (issue B-2).

In-service inspection programme

The in-service inspection (ISI) programme at the plant is governed by the ASME code Section XI requirements. A risk-informed approach is used for defining ISI to be performed on welds and components (safety classes 1 and 2) and it relies on consequences and risk of failure. Consequences of failure are estimated based on the plant’s probabilistic safety analysis model. On the contrary, the risk of failure is estimated with an external probabilistic model which is the property of the consultant performing the estimations. The team **encouraged** the plant to obtain more information about the model as well as guaranteed relevance of the hypothesis and data on which it relies.

Surveillance programme

In addition to the global safety-related surveillance of the plant, a specific reactor pressure vessel (RPV) surveillance programme has been issued. This programme relies on a manual that has not been reviewed against the nine attributes of an effective ageing management programme. The revision of the RPV Surveillance Programme manual is still not completed (planned for completion by mid-2022). The team made a **suggestion** in this area (issue B-2).

Water Chemistry Programme

No recommendations, suggestions, encouragements, good practices or good performances were identified in this area.

Corrective action programme

A corrective action programme has been developed and implemented to identify, report, investigate, and trend occurrences, problems, events, conditions, and near misses as well as ageing-related degradations. The identification and reporting of occurrences, problems, incidents, conditions, events, or near misses, including ageing-related degradations, is the responsibility of each person working at the plant. Events are investigated following a multistage process designed to cover, on a periodical basis, all internal events as well as the numerous external events received from different external sources, including other operators or industry related sources. This programme allows to address events that ageing could cause and provide engineers, designers and also maintenance staff and operators, with relevant outcomes and in an effective manner. The team considered this as a **good performance**.

In an LTO perspective, the corrective action programme outcomes need to be routinely reviewed by individuals responsible for the relevant AM. The plant prescribes an annual review. However, this prescription is not implemented yet and no records of the review are available. The team made a **suggestion** in this area (issue B-2).

3.3. AGEING MANAGEMENT OF MECHANICAL SSCS

AMR of mechanical SSCs

For ageing management review (AMR) of mechanical SSCs the existing plant Ageing Management Matrix (AMM) and the IGALL AMR table version 2018 were the basis. The plant reviewed the methodology for AMR. The consistent use of IGALL AMR in the comprehensive AMR report is not demonstrated, for example some of the IGALL AMR table information is missing from it. The plant decided to transfer Ageing Management Matrix information to COMSY (Condition-Oriented Aging Management System). Terminology used in the comprehensive AMR report and COMSY is not fully consistent. At the time of the mission the COMSY software was not available due to technical problems. As a consequence it was not possible for the team to confirm COMSY capabilities and real data transferred from AMM and comprehensive AM report. The team made a **suggestion** in this area (issue C-1).

AMPs of mechanical SSCs

Identification of appropriate programmes for ageing management was based on existing plant programmes and IGALL AMPs. Review of existing programmes against the 9 attributes was performed in a comparison report. Updated plant programmes are aligned with the 9 attributes of an effective ageing management programme. New AMPs (e.g. One-Time Inspections) are planned

to follow the IGALL AMPs structure. In the comparison report of IGALL AMPs with existing plant programmes the plant did not identify a gap regarding the non-consideration of the inspection of component external surfaces that are insulated and exposed to condensation. Development of new or not fully implemented AMPs has been initiated for main mechanical components (e.g. pressurizer, main coolant piping), based on the comprehensive AMR report and the comparison report. The team made a **suggestion** in this area (issue C-2).

TLAAs of mechanical SSCs

An approved methodology document for identification of TLAAs was developed. The information sources for screening of TLAAs were defined and used. The verified list of existing plant TLAAs was reviewed. Based on existing plant and vendor documentation, international practice and IAEA requirements, the plant systematically identified all TLAAs, and the comprehensive list of TLAAs was documented. The validation of TLAAs of 8 mechanical SSCs have not been finalized yet, however it is not expected that these will require updates to any AMPs. The team made a **suggestion** in area A (issue A-1).

Scope setting results verification for mechanical SSCs

Scoping for LTO and AMR of mechanical components was performed based on MS Excel sheets. Scoping results of mechanical SSCs are distributed in different databases (e.g. COMSY). Long term consistency of these databases may be challenged. The team made a **suggestion** in area B (B-1).

Data collection and record keeping for mechanical SSCs

No recommendations, suggestions, encouragements, good practices or good performances were identified in this area.

Documentation of AM and documentation in support of LTO for mechanical SSCs

No recommendations, suggestions, encouragements, good practices or good performances were identified in this area.

3.4. AGEING MANAGEMENT OF ELECTRICAL AND I&C SSCS

AMR of electrical and I&C SSCs

Interaction between the Environmental Condition Monitoring Programme (ECMP) and COMSY is included in the draft version of ECMP as a flowchart. Specific instructions and a procedure with special consideration on how the identification of hot spots will affect the equipment in scope of LTO are not available. The team made a **suggestion** in this area (issue C-1).

AMPs of electrical and I&C SSCs

The verification of in-scope cables for LTO was not systematically assessed in terms of comparison with connection lines indicating intermediate components. Current collected data, databases and databases architecture compromise the handling of information to address properly the effects of hot spots in cables. Material specific ageing related degradation mechanism effects and internal operating experience have not been incorporated to plant guidelines for cable management. The team made a **suggestion** in this area (issue D-1).

Equipment qualification programme for all SSCs

Local Temperature and Radiation (T&R) measurement devices will be installed inside the containment during the outage in 2022 of unit 2 in order to have at least one relevant reference data campaign before steam generator replacement. Mechanical equipment was excluded from the scope of environmental qualification without specific and systematic assessment to compare equipment design and operating experience with relevant standards for qualification of mechanical equipment. Environmental qualification of coatings was not properly documented or revalidated for LTO. There was no assessment to confirm that the applied coatings required to be LOCA (loss of coolant accident) proof meet the plant requirements. No further analysis for the validity of original qualification was planned. The team made a **suggestion** in this area (issue D-2).

Currently there is not enough data to establish electromagnetic compatibility (EMC) requirements for the equipment in scope of the Equipment Qualification Programme (EQP). The plant has not defined a specific standard to deal with EMC requirements such as IEC 62003. The plant has established a list of important locations in order to monitor different relevant parameters for electromagnetic interference (EMI) in the draft version of ECMP. However, the plant did not define a standard framework for the evaluation of the results. The team made a **suggestion** in this area (issue D-3)

Results of the equipment qualification TLAA indicate that for qualified cables, the qualification is not valid for the intended LTO period. The plan for requalification of these cables is still in progress. The proposed sample removal testing plan from the plant aligns with international practice. Currently the plant has not performed a detailed assessment regarding the use of cable specific qualification standards, represented samples, material specific parameters (e.g. material formulation, validity of activation energy, etc.), installed environment, work condition such as temperature (environmental temperature and self-heating effects), exposure dose rate, etc. The team made a **recommendation** in this area (issue D-4)

Technological obsolescence management for all SSCs

There is an established methodology for handling and tracking problems related to obsolescence issues, however, this Technological Obsolescence Programme (TOP) has not been implemented for addressing obsolescence in a proactive way. The team made a **suggestion** in this area (issue D-5)

Scope setting results verification for electrical and I&C SSCs

No recommendations, suggestions, encouragements, good practices or good performances were identified in this area.

Data collection and record keeping for electrical and I&C SSCs

No recommendations, suggestions, encouragements, good practices or good performances were identified in this area.

Documentation of AM and documentation in support of LTO for electrical and I&C SSCs

The plant has established an Equipment Qualification File Template. This template is used to collect qualification parameters vital for the evaluation of the component qualification and determination of the qualified life. This has proven to be useful especially in cases where the equipment qualification test reports were not available from the supplier/OEM at the design evaluation stage. The supplier/OEM has to complete the template and demonstrate that the

equipment to be supplied meets the plant's equipment qualification requirements as stated in the SAR and the design specifications. The team recognized this as a **good performance**.

3.5. AGEING MANAGEMENT OF CIVIL SSCS

AMR of civil SSCs

No recommendations, suggestions, encouragements, good practices or good performances were identified in this area.

AMPs of civil SSCs

The containment monitoring system is not fully functional. Some thermocouples linked to the strain gauges of the containment monitoring system are not functional. Some strain gauges are out of service or provide erratic values. Four pendulums in unit 1 show non-realistic behaviour compared to strain gauge evaluations in the same area. The pendulums need to be examined, refurbished and re-set. Without a fully functional containment monitoring system, the data required to demonstrate structural integrity of the containment during LTO may not be sufficient. The team made a **recommendation** in this area (issue E-2).

Some remedial measures related to safety related structures were identified for implementation on an immediate basis during the last outage and are still pending. The various activities related to monitoring of spent fuel pools are currently performed by different departments whose analysis is not integrated. The development of an AMP related to spent fuel pools is not complete. Leakages have been noted in unlined sumps of the Nuclear Auxiliary Building. The procedure for corrective measures is in progress. The team made a **suggestion** in this area (issue E-3).

TLAAs of civil SSCs

A TLAA for creep and shrinkage of concrete structures has not been identified as required. TLAA301: "Containment reanalysis" revalidates concrete containment tendon pre-stress of units 1 and 2 without incorporation of effects of various repaired defects such as large-scale delamination, progressing concrete carbonation front and chloride front, concrete cracks, exposed and corroded reinforcement bars. The analysis utilizes measurements of the containment monitoring system, which has many limitations. The team made a **suggestion** in this area (issue E-1).

The structural revalidation of aseismic bearings for the LTO period is completed yet. The team made a **suggestion** in this area (issue A-1)

Scope setting results verification for civil SSCs

No recommendations, suggestions, encouragements, good practices or good performances were identified in this area.

Data collection and record keeping for civil SSCs

No recommendations, suggestions, encouragements, good practices or good performances were identified in this area.

Documentation of AM and documentation in support of LTO for civil SSCs

No recommendations, suggestions, encouragements, good practices or good performances were identified in this area.

3.6. HUMAN RESOURCES, COMPETENCE AND KNOWLEDGE MANAGEMENT FOR LTO

Human resources policy and strategy to support LTO

No recommendations, suggestions, encouragements, good practices or good performances were identified in this area.

Competence management for LTO and recruitment and training/ qualification processes for personnel involved in LTO activities

The plant works on creating LTO awareness through:

- Leadership engagement sessions where topics on LTO were communicated;
- Nuclear Awareness Seminars specific on LTO;
- A specific survey on LTO awareness has been performed;
- Open forums for all employees in which LTO topics: October/November 2021 & March 2022 is for all employees;
- Quarterly Nuclear News publications by the Chief Nuclear Officer;
- Daily Newsletters;
- Meetings with trade unions where LTO topics are discussed.

The team considered this as a **good performance.**

The plant has an Authorization Index in place; the plant recognized that not only technical skills and knowledge are important to perform a job, but also health, attitude, and enablers to perform specific jobs without assistance have to be taken into account to decide if someone is fit to perform a task in the plant. Therefore, a so-called Capability Index has been created. It is supported by a web based tool in which the employees can check their own profile (capability, development actions, and training) and line managers can do real-time analysis of authorizations and capabilities, identify development opportunities and perform projections (simulations) to meet future needs for their team with regard to the impact of employees leaving the team due to retirement, promotion, and leave. Based on this simulation line managers can, on a proactive way, assure that knowledge and competences are not lost and stay at the needed level. The team considered this as a **good performance.**

Knowledge management and knowledge transfer for LTO

A knowledge management process is set up. It was tested at a part of the Nuclear Engineering Department as a pilot. Afterwards it was implemented throughout the whole Nuclear Engineering Department. Initiatives are started for further implementation. The team **encouraged** the plant to fully implement the knowledge management process for the whole nuclear organization unit.

4. SUMMARY OF RECOMMENDATIONS AND SUGGESTIONS

The following table summarises the issues identified by the hosting organization (Self R/ Self S) and by the IAEA team (R/ S) in the six main 'Review Areas': the complete set of issue sheets is presented in Appendix I of this report.

Issue No.	Fundamental Overall Problem	Rec./Sugg.
Review Area A: Organization of ageing management and LTO activities		
A-1	Management of the LTO programme is not effective to timely complete all actions to prepare for LTO.	S
A-2	The safety analysis report (SAR) has not been adequately updated for LTO and ageing management.	S
Review Area B: Scope setting, plant programmes and corrective action programme		
B-1	Completeness and consistency of scope setting of SSCs for ageing management and LTO are not ensured.	S
B-2	The plant programmes are not comprehensively reviewed and implemented for LTO.	S
Review Area C: Ageing management of mechanical SSCs		
C-1	Information used for AMR of mechanical SSCs is not consistently managed and documented.	S
C-2	AMPs for mechanical SSCs are not complete.	S
Review Area D: Ageing management of electrical and I&C SSCs		
D-1	The plant has not completely implemented a comprehensive cable ageing management programme.	S
D-2	The plant has not revalidated environmental qualification for some SSCs for LTO.	S
D-3	Electromagnetic compatibility has not been completely assessed.	S
D-4	The plant has not revalidated environmental qualification of qualified cables for LTO.	R
D-5	A proactive approach to technological obsolescence management is not fully implemented.	S
Review Area E: Ageing management of civil SSCs		
E-1	The plant has not comprehensively revalidated the TLAAs for concrete structures.	S
E-2	Containment structure monitoring system is not fully functional.	R

E-3	Ageing management programmes for civil structures are not fully developed and implemented.	S
Review Area F: Human resources, competence and knowledge management for LTO		
	No issue identified	

5. DEFINITIONS

Recommendation

A recommendation is advice on what improvements in operational safety should be made in the activity or programme that has been evaluated. It is based on inadequate conformance with the IAEA Safety Requirements and addresses the general concern rather than the symptoms of the identified concern. Recommendations are specific, realistic and designed to result in tangible improvements.

Suggestion

A suggestion is advice on an opportunity for safety improvement not directly related to inadequate conformance with the IAEA Safety Requirements. It is primarily intended to make performance more effective, to indicate useful expansions to existing programmes and to point out possible superior alternatives to ongoing work.

Good Practice

A good practice is an outstanding and proven programme, activity or equipment in use that contributes directly or indirectly to operational safety and sustained good performance. A good practice is markedly superior to that observed elsewhere, not just the fulfilment of current requirements or expectations. It should be superior enough and have broad enough application to be brought to the attention of other nuclear power plants and be worthy of their consideration in the general drive for excellence. A good practice:

- is novel;
- has a proven benefit;
- is replicable (it can be used at other plants); and
- does not contradict an issue.

Normally, good practices are brought to the attention of the team on the initiative of the plant.

Encouragement

If an item does not have sufficient safety significance to meet the criteria of a ‘recommendation’ or ‘suggestion’, but the expert or the team feels that mentioning it is still desirable, the given topic may be described in the text of the report using the phrase ‘encouragement’ (e.g. the team encouraged the plant/research reactor to…).

Good performance

A good performance is a superior objective that has been achieved or a good technique or programme that contributes directly or indirectly to operational safety and sustained good performance, that works well at the nuclear installation. However, it might not be necessary to recommend its adoption by other nuclear installation, because of financial considerations, differences in design or other reasons.

Issue resolved

All necessary actions have been taken to deal with the root causes of the recommendation rather than to address each individual fact identified by the team. A management review has been carried out to ensure that actions taken have eliminated the root cause. Actions have also been taken to

check that it does not recur. Alternatively, the issue is no longer valid due to, for example, changes in the hosting organization.

Satisfactory progress to date

Actions have been taken, including root cause determination, which lead to a high level of confidence that the recommendation will be resolved within a reasonable timeframe, after the follow-up mission. These actions might include budget commitments, staffing, document preparation, increased or modified training, equipment purchases, etc. This category implies that the recommendation could not reasonably have been resolved prior to the follow-up visit, either due to its complexity or the need for long-term actions. This category also includes recommendations, which have been resolved using temporary or informal methods, or when resolution has only recently taken place and its effectiveness has not been fully assessed.

Insufficient progress to date

Actions taken or planned do not lead to the conclusion that the issue will be resolved within a reasonable timeframe. This category includes issues in response to which no action has been taken.

6. REFERENCES

[1] INTERNATIONAL ATOMIC ENERGY AGENCY, Leadership and Management for Safety, General Safety Requirements No. GSR Part 2, IAEA, Vienna (2016).

[2] INTERNATIONAL ATOMIC ENERGY AGENCY, Safety of Nuclear Power Plants: Design, Specific Safety Requirements No. SSR-2/1 (Rev.1), IAEA, Vienna (2016).

[3] INTERNATIONAL ATOMIC ENERGY AGENCY, Safety of Nuclear Power Plants: Commissioning and Operation, Specific Safety Requirements No. SSR-2/2 (Rev.1), IAEA, Vienna (2016).

[4] INTERNATIONAL ATOMIC ENERGY AGENCY, Application of Management system for Facilities and Activities, Safety Guide No. GS-G-3.1, IAEA, Vienna (2006).

[5] INTERNATIONAL ATOMIC ENERGY AGENCY, Management System for Nuclear Installations, Safety Guide No. GS-G-3.5, IAEA, Vienna (2009).

[6] INTERNATIONAL ATOMIC ENERGY AGENCY, Format and Content of the Safety Analysis Report for Nuclear Power Plants, Safety Guide No. GS-G-4.1, IAEA, Vienna (2004).

[7] INTERNATIONAL ATOMIC ENERGY AGENCY, Modifications to Nuclear Power Plants, Safety Guide No. NS-G-2.3, IAEA, Vienna (2001).

[8] INTERNATIONAL ATOMIC ENERGY AGENCY, The Operating Organization for Nuclear Power Plants, Safety Guide No. NS-G-2.4, IAEA, Vienna (2001).

[9] INTERNATIONAL ATOMIC ENERGY AGENCY, Maintenance, Surveillance and In-service Inspection of Nuclear Power Plants, Safety Guide No. NS-G-2.6, IAEA, Vienna (2002).

[10] INTERNATIONAL ATOMIC ENERGY AGENCY, Recruitment, Qualification and Training of Personnel for Nuclear Power Plants, Safety Guide No. NS-G-2.8, IAEA, Vienna (2002).

[11] INTERNATIONAL ATOMIC ENERGY AGENCY, Operating Experience Feedback for Nuclear Installations, Safety Guide SSG-50, IAEA, Vienna (2018).

[12] INTERNATIONAL ATOMIC ENERGY AGENCY, Evaluation of Seismic Safety for Existing Nuclear Installations, Safety Guide No. NS-G-2.13, IAEA, Vienna (2009).

[13] INTERNATIONAL ATOMIC ENERGY AGENCY, Chemistry Programme for Water Cooled Nuclear Power Plants, Specific Safety Guide No. SSG-13, IAEA Vienna (2012).

[14] INTERNATIONAL ATOMIC ENERGY AGENCY, Periodic Safety Review for Nuclear Power Plants, Specific Safety Guide No. No. SSG-25, IAEA, Vienna (2013).

[15] INTERNATIONAL ATOMIC ENERGY AGENCY, Ageing Management and Development of a Programme for Long Term Operation of Nuclear Power Plants, Specific Safety Guide No. SSG-48, IAEA, Vienna (2018).

[16] INTERNATIONAL ATOMIC ENERGY AGENCY, Equipment Qualification for Nuclear Installations, IAEA Safety Standards Series No. SSG-96, IAEA, Vienna, (2021).

[17] INTERNATIONAL ATOMIC ENERGY AGENCY, Ageing Management for Nuclear Power Plants: International Generic Ageing Lessons Learned (IGALL), Safety Report Series No. 82 (Rev. 1), IAEA, Vienna (2020).

[18] INTERNATIONAL ATOMIC ENERGY AGENCY, SALTO Peer Review Guidelines, Guidelines for Peer Review of Safety Aspects of Long Term Operation of Nuclear Power Plants and Research Reactors, IAEA Services Series No. 26 (Rev.1), IAEA, Vienna (2021).

[19] Preparatory Meeting Report, Safe Long Term Operation (SALTO) Peer Review Service Terms of Reference for a Peer Review Mission for Koeberg Nuclear Power Plant in South Africa, IAEA, Vienna, June 2021

[20] Preparatory Meeting Minutes of ‘A SALTO Peer Review Mission for Koeberg Nuclear Power Plant in South Africa, IAEA, Vienna, June 2021

[21] KOEBERG NUCLEAR POWER PLANT, SALTO Mission at Koeberg Nuclear Power Plant - Advance Information Package, 240-164487877, Koeberg, South Africa, 3 December 2021

7. TEAM COMPOSITIONS

7.1. IAEA REVIEW TEAM

IAEA STAFF MEMBERS:		
Mr. Gabor Petofi	Team Leader	IAEA, NSNI, OSS,
Mr. Martin Marchena	Deputy Team Leader	IAEA, NSNI, OSS,
IAEA EXTERNAL EXPERTS:		
Mr. Pavel Hala	Reviewer A	CEZ, Dukovany NPP, Head of Ageing Management and LTO Department
Mr. Olivier Loiseau	Reviewer B	IRSN, Head of Department
Mr. Pal Weisz	Reviewer C	MVM Paks NPP, Senior Ageing Management Expert
Mr. Jorge Zorrilla	Reviewer D	CNEA, Head of Equipment Qualification Department
Mr. Javed Iqbal	Reviewer E	PAEC, Head of Corporate Ageing Management Department
Mr. Wim Hofkens	Reviewer F	Engie Electrabel, Programme Manager
OBSERVERS:		
Mr. Victor Garcia	Observer Area C	– IDOM, Plant Coordinator for Ageing Management and Equipment Qualification
Mr. Andreas Uhre	Observer Area B	– OKG, Oskarshamn NPP, Competence Developer

7.2. THE PLANT AND OTHER ORGANIZATIONS

KOEBERG NUCLEAR POWER PLANT COUNTERPARTS:		
Mr. Anton Kotze	Host plant peer	Chief Engineer
Mr. Ashley Oosthuizen	Area A	SALTO Project Engineer
Mr. Raymond Maapola	Area B	Design Engineer
Ms. Garetshose Mdluli	Area C	Mechanical Engineer
Mr. Alan Nambiar	Area D	Electrical Engineer
Ms. Magrieta Koopman	Area E	Civil Engineer

Ms. Linda Lukwe	Area F	Acting Integrated Management and Training Manager

APPENDIX I - ISSUE SHEETS

1. ISSUE IDENTIFICATION	**Issue Number: A-1**
NPP: Koeberg	**Unit: 1 and 2**
Reviewed Area: Organization of ageing management and LTO activities	

1.1 – ISSUE TITLE:

Ineffective management of the LTO programme

1.2 – FUNDAMENTAL OVERALL PROBLEM:

Management of the LTO programme is not effective to timely complete all actions to prepare for LTO.

2. ASSESSMENT OF THE STATUS	**Date:** 31/03/2022

2.1 – FACTS:

F1) The station risks and challenges resulting from preparation of LTO identified by the management of the LTO Programme and presented to Eskom management on February 28, 2022 (presentation "LTO Dashboard") are: resources, completion of TLAAs and AMPs implementation.

F2) The comprehensive document, 'Safety Case for LTO' is to demonstrate continued safe operation of the plant and will be submitted for approval to the regulator body. The safety case is not completed and is planned to be finished in by June 2022, when the plant is required to submit the safety case to the regulatory body. The plant does not provide margins for delays in any ongoing activities.

F3) The plant intends to include in the safety case among others:

- effectiveness of the ageing management programme necessary for ensuring that required safety functions of structures, systems and components are fulfilled over the period of LTO of the nuclear installation;
- revalidation of the TLAAs to ensure continued acceptability of the analysed structures, systems or components for the planned period of LTO;
- utilization of the results of the periodic safety review to justify LTO of the nuclear installation.

The new AMPs have not been implemented, so it is not possible to evaluate the effectiveness of AMPs on individual nor on a plant level. Revalidation of all TLAAs is not completed.

F4) Nuclear Project Management and Design Engineering deliverables (Technical Requirements Specification, Detailed Design, Safety Evaluation…) are captured in various storage places. However, there is no single software application that support the entire process.

F5) The validation of TLAAs of 8 mechanical SSCs have not been finalized yet, some of them are still not contracted (e.g. TLAA106 Environmentally-assisted fatigue; RPV internals neutron embrittlement – fast fracture analyses).

F6) The structural revalidation of aseismic bearings for the LTO period is not completed and is scheduled for completion in 2024.

F7) Some findings from PSR-II and eight post Fukushima requirements are still in progress and not completed.

F8) Different plant databases contain different parts of the design basis documentation. Some of the documents are in the Excalibur database and some of them in the PIGO database. The plant is preparing a project to substitute these two databases by a software (SPO).

2.2 – SAFETY CONSEQUENCE:

Without effective management of the LTO programme the plant will not be able to timely implement all activities to demonstrate preparedness for safe LTO.

2.3 – RECOMMENDATION/SUGGESTION:

S) The plant should consider ensuring effective management to the LTO programme to timely complete all actions.

2.4 – IAEA BASIS:

GSR Part 2

Requirement 10: Management of processes and activities

Processes and activities shall be developed and shall be effectively managed to achieve the organization's goals without compromising safety.

4.28. Each process shall be developed and shall be managed to ensure that requirements are met without compromising safety. Processes shall be documented and the necessary supporting documentation shall be maintained. It shall be ensured that process documentation is consistent with any existing documents of the organization. Records to demonstrate that the results of the respective process have been achieved shall be specified in the process documentation.

GS-G-3.1

3.17. Senior management should be fully committed to the management system and should regard it as a tool for use in managing the organization. The commitment of senior management should foster long term commitment and engagement on the part of the management and of all individuals of the organization, through a process of participation and consultation.

GS-G-3.5

2.3. Senior management of the operating organization should be the sole source of operational direction for the installation. The management system should define the responsibilities of those persons responsible for each process (sometimes referred to as 'process owners') and of the managers and functions in the organizational structure, so that there are clear lines of authority and accountability. The persons responsible for each process should support the

operational direction by assuming responsibility for developing effective processes and ensuring that they remain effective. The managers and functions in the organization should implement the processes within their areas of responsibility. More information regarding the operating organization can be found in Ref. [3].

SSG-48

7.3. The operating organization should adopt a comprehensive project structure or similar organizational arrangements for the preparation and implementation of the programme for long term operation, which should take into account the arrangements for the management of physical ageing, as described in Section 5. The organizational arrangements for the management of physical ageing, including technological obsolescence, should be properly implemented and should be one of the prerequisites for a decision to pursue long term operation of the nuclear power plant.

7.4. In addition to the existing obligations associated with ageing management, the operating organization should clearly define the additional responsibilities and authorities associated with the preparation for, and implementation of, long term operation, after considering all the regulatory requirements relevant to long term operation. The operating organization should ensure that appropriate resources are available to support these assigned responsibilities and accountabilities.

2.5 – DOCUMENTS REVIEWED:

- R. 266 National Nuclear Regulator Act (47/1999): Regulations on the long term operation of Nuclear Installations, March 2021;
- RG-0027, Rev. 0 Interim Regulatory Guide, Ageing Management and Long Term Operations of Nuclear Power Plants, March 2019;
- 240-157754316, Rev. 1 Structure and Content of the LTO Safety, 22/03/19;
- 240-160692496, Rev. 3 Long Term Operation (LTO) Programme Management Manual, 2021/09/22;
- 240-160692514, Rev. 2 Long Term Operations Programme Organisation, 05/2021
- 240-149139512, Rev.1 Ageing Management Requirements for Koeberg Nuclear Power Station, 12/2020;
- 08016-S-LIC, Rev.2 Nuclear Licensing Strategy for Koeberg SALTO Assessment Project, 03/2017;
- 36-197, Rev.2 Koeberg Licensing Basis Manual, 10/2021;
- 08016-S-PMP, Rev. 2 Nuclear Project Management Plan (PMP) , 2020/02/25
- 238-6, Rev 5, Nuclear document and records management requirements, 2020/06/27;
- 240-106374366, Rev. 2 SALTO Project Scope and Work Breakdown Structure (WBS) Report, 2021/01/20;
- 240-106374672, Rev. 1 SE 35244: Koeberg Pre-SALTO Self-Assessment Report , 2017/10/24;
- 240-108035478, Rev. 2 The Eskom Nuclear Objectives, 2019/06/05;
- 240-164729849, Rev. 1 Original Designer Control Strategy, 2021/08/27;
- 240-84975495, Rev. 5, Engineering Change Management Committee for Koeberg Operating Unit, 2021/08/31;
- 240-88257644, Rev. 5 Nuclear Operating Unit Functional Organisation Structure (F.O.S) Nuclear Engineering, 2021/05/31;
- 240-99837788, Rev 2 NOU Configuration Management Process Manual, 2020/03/19;
- 240-160692514, Rev. 2 Long Term Operations Programme Organisation, 05/2021;

– 331-148, Rev. 3 Programme Engineer's Guide, 2021/03/02; – 331-149, Rev. 2 Engineering Programmes Change Control Process, 2020/07/30; – 331-85, Rev. 4 Design Documentation Change Process, 2020/10/29; – 331-86, Rev. 3 Design Changes to Plant, Plant Structures or Operating Parameters , 2021/11/25; – KAA-501, Rev. 11 Project Management Process for Koeberg Nuclear Power Station Modifications , 2019/09/23; – Rev 0 , Nuclear News - October 2021 - Strategic Projects; – Rev 0, LTO Dashboard presentation - Status shown as of 28 February 2022.

3. HOSTING ORGANIZATION ACTIONS TO RESOLVE ISSUE	**Date:** D2/M2/YYY2
3.1 – RESULTS OF THE ISSUE ANALYSIS: n.a.	
3.2 – CORRECTIVE ACTIONS: n.a.	
3.3 – STATUS OF CORRECTIVE ACTIONS IMPLEMENTATION: n.a.	
4. FOLLOW-UP ASSESSMENT BY THE IAEA REVIEW TEAM	**Date:** D3/M3/YYY3
4.1 – FACTS: F1) n.a.	
4.2 – DOCUMENTS REVIEWED: n.a.	
4.3 – RESOLUTION DEGREE:	

1.	**Insufficient progress to date**	n.a.
2.	**Satisfactory progress to date**	n.a.
3.	**Issue resolved**	n.a.

n.a.: not applicable for the present mission.

1. ISSUE IDENTIFICATION	**Issue Number: A-2**
NPP: Koeberg	**Unit: 1 and 2**
Reviewed Area: Organization of ageing management and LTO activities	
1.1 – ISSUE TITLE:	

Safety analysis report not updated for LTO

1.2 – FUNDAMENTAL OVERALL PROBLEM:

The safety analysis report (SAR) has not been adequately updated for LTO and ageing management.

2. ASSESSMENT OF THE STATUS	**Date:** 31/03/2022

2.1 – FACTS:

F1) The current revision of the SAR does not include a description of ageing management approach, ageing management programme results nor a list of TLAAs and results of revalidation of TLAAs.

F2) The current design basis as updated by considering new TLAAs are not documented and updated in the SAR yet.

F3) The current licensing basis (for example R. 266 National Nuclear Regulator Act (47/1999): Regulations on the LTO of Nuclear Installations and 36-197, Rev.2 Koeberg Licensing Basis Manual) is not described nor updated in the SAR.

F4) The results and adequate description of the PSR are not documented in the SAR.

2.2 – SAFETY CONSEQUENCE:

Without an adequately updated SAR for LTO and ageing management, the plant cannot ensure a complete safety documentation for LTO.

2.3 – RECOMMENDATION/SUGGESTION:

S) The plant should consider updating the safety analysis report for safe LTO.

2.4 – IAEA BASIS:

SSR-2/2 (Rev. 1)

Requirement 15: Records and reports

The operating organization shall establish and maintain a system for the control of records and reports.

4.52. The operating organization shall identify the types of record and report, as specified by the regulatory body, that are relevant for the safe operation of the plant. Records of operation, including maintenance and surveillance, shall be kept available from initial testing during the startup of each plant system important to safety, including relevant off-site tests. The records of operation shall be retained in proper archives for the periods required by the regulatory body. All records shall be kept readable, complete, identifiable and easily retrievable [3]. Retention times for records and reports shall be commensurate with their level of importance for the purposes of operation and plant licensing and for future decommissioning.

SSG-25

3.8. Where the PSR is to be used in decision making for long term operation or licence renewal, the review should pay particular attention to the following plant programmes and documentation, as these are of significant importance for continued safe operation:

- Plant programmes to support the safety factors relating to plant design, the actual condition of SSCs important to safety, equipment qualification and ageing;
- A management system that addresses quality management and configuration management;
- Safety analyses involving time limiting assumptions relating to the proposed lifetime;
- Programmes for promoting safety culture focused on the pursuit of excellence in all aspects of safety management and human factors.

3.9. The programmes and documentation listed in para. 3.8 should be properly documented in an updated final safety analysis report for long term operation and/or in other licensing basis documents, and a clear and adequate description should be provided of the current licensing documents or the current design basis requirements for operation of the nuclear power plant.

SSG-48

3.11. Ageing management should be addressed in the safety analysis report and other licensing documents. The description of ageing management in the safety analysis report should include general information on the following topics:

- The strategy for ageing management and prerequisites for its implementation;
- Identification of all SSCs of the plant that could be affected by ageing and are in the scope of the ageing management;
- Proposals for appropriate materials monitoring and sampling programmes in cases where it is found that ageing effects may occur that may affect the capability of SSCs to perform their intended function throughout the lifetime of the plant;
- Ageing management for different types of in-scope SSCs (e.g. concrete structures, mechanical components and equipment, electrical equipment and cables and instrumentation and control equipment and cables) and means to monitor their degradation;
- Design inputs for equipment qualification (see Section 4) of the in-scope SSCs, including required equipment, and equipment functions that need to be qualified for service conditions in normal operation and associated with postulated initiating events;
- General principles stating how the environment of an SSC is to be maintained within specified service conditions (e.g. by means of proper location of ventilation, insulation of hot SSCs, radiation shielding, damping of vibrations, avoiding submerged conditions and proper selection of cable routes);
- Appropriate consideration of the analysis of feedback of operating experience with respect to ageing.

4.2 Each plant programme and analysis should be properly documented in safety analysis reports or in other current licensing basis documents, which should clearly and adequately

describe the current licensing basis or the current design basis requirements for operation of the nuclear power plant.

4.3 The policy on ageing management and the justification of long term operation should be properly documented in the current licensing basis, in particular in such documents as the safety analysis report, reports of periodic safety reviews (if applicable) or other licensing basis documents.

4.4 The safety analysis report should be kept updated to reflect the results of the ageing management review.

4.5 The safety analysis report or other licensing documents should provide descriptions of activities in support of safe long term operation to ensure that the operating organization maintains the necessary information to reflect the current status of the plant and addresses new issues as they arise.

2.5 – DOCUMENTS REVIEWED:

- Nuclear Energy Act, 47/1999 – high level document;
- R. 266 National Nuclear Regulator Act (47/1999): Regulations on the long term operation of Nuclear Installations, March 2021;
- RG-0019, Rev 0, INTERIM GUIDANCE ON SAFETY ASSESSMENTS OF NUCLEAR FACILITIES, 2020;
- 238-8, Rev. 5, Nuclear Safety and Quality Manual, 07/2020;
- 240-107926907, Rev.1 Nuclear Licensing Strategy for Koeberg SALTO Assessment Project, 03/2017;
- 08016-S-LIC, Rev.2 Nuclear Licensing Strategy for Koeberg SALTO Assessment Project, 03/2017;
- 238-6, Rev 5, Nuclear document and records management requirements, 2020/06/27
- 240-119744497, Rev 2, Control of the Safety Analysis Report, 2020/11/30;
- 240-163876252, Rev 1, KNPS 3 PSR Global Assessment and Integrated Implementation Plan Methodology, 2021/08/23.

3. HOSTING ORGANIZATION ACTIONS TO RESOLVE ISSUE	**Date:** D2/M2/YYY2

3.1 – RESULTS OF THE ISSUE ANALYSIS:

n.a.

3.2 – CORRECTIVE ACTIONS:

n.a.

3.3 – STATUS OF CORRECTIVE ACTIONS IMPLEMENTATION:

n.a.

4. FOLLOW-UP ASSESSMENT BY THE IAEA REVIEW TEAM	**Date:** D3/M3/YYY3

4.1 – FACTS:

F1) n.a.

4.2 – DOCUMENTS REVIEWED:		
n.a.		
4.3 – RESOLUTION DEGREE:		
1.	**Insufficient progress to date**	n.a.
2.	**Satisfactory progress to date**	n.a.
3.	**Issue resolved**	n.a.

n.a.: not applicable for the present mission.

1. ISSUE IDENTIFICATION	**Issue Number: B-1**
NPP: Koeberg	**Unit: 1 and 2**
Reviewed Area: B	
1.1 – ISSUE TITLE:	
Incomplete scope setting of SSCs for ageing management and LTO	
1.2 – FUNDAMENTAL OVERALL PROBLEM:	
Completeness and consistency of scope setting of SSCs for ageing management and LTO are not ensured.	
2. ASSESSMENT OF THE STATUS	**Date:** 31/03/2022
2.1 – FACTS:	
F1) There has not been systematic walkdowns for reviewing every room containing safety class SSCs for identification of non-safety related SSCs whose failure may prevent SSCs from fulfilling their intended safety functions components. F2) No deterministic analysis was used to define the rooms for scope setting review with the walkdowns for all safety class components, except for previous fire, explosion, and seismic oriented walkdowns implemented several years ago. The walkdowns for confirming the comprehensiveness of the scope were limited to the most significant components based on PSA. F3) Scoping results are distributed in two databases (e.g. COMSY, design classification database), there is no process to check the long term consistency of these databases as they are maintained by two different groups. Currently the modification process is used to ensure consistency between the two databases. F5) In the scoping list (L1124-GN-LIS-020) there are 4 steam generators with level 1 safety classification and 2 steam generators with level 2 safety classification. A task order of the SALTO Project is still not completed for managing the anomalies discovered during the scoping process (began in June 2021 and still on-going until Mid-2022 at least).	

F6) Classification of SSCs (for safety and other classifications) is recorded in a classification database. The LTO scope inclusion is automated based on the classification status. However, it has to be done manually for certain cases (fire, explosion or flooding hazards) of SSCs.

F7) The plant has defined a Design Extension Related (DER) class in the Importance Category to include components with a function in severe accident or extreme condition. DER was introduced in 2018. Although the components for Design Extension Condition (DEC) events were identified during scope setting and the plant is planning to perform the formal DER, the classification is not in place yet for most of the SSCs in the scope of AM.

F8) Cable materials and manufacturers are included in the consideration for scoping and grouping of cables in the Cable Ageing Management Programme (CAMP, 331-127) and associated CAMP manuals (240-98789629, 240-98789276). However, reconstruction of manufacture data is still in progress and not fully incorporated in the CAMP scope list.

F9) There is no written evidence that a walkdown is prescribed before or after modification of the plant to identify non-safety related SSCs whose failure may prevent SSCs from fulfilling their intended safety functions.

2.2 – SAFETY CONSEQUENCE:

With incomplete or inconsistent scope setting of SSCs, ageing management and safety function of some SSCs important to safety could be compromised.

2.3 – RECOMMENDATION/SUGGESTION:

S) The plant should consider ensuring completeness and consistency of ageing management scope of SSCs for LTO.

2.4 – IAEA BASIS:

SSR-2/2 (Rev.1)

Requirement 16: Programme for long term operation

Where applicable, the operating organization shall establish and implement a comprehensive programme for ensuring the long term safe operation of the plant beyond a time-frame established in the licence conditions, design limits, safety standards and/or regulations.

SSR-2/2 (Rev.1)

4.54. The comprehensive programme for long term operation shall address:

(a) Preconditions (including the current licensing basis, safety upgrading and verification, and operational programmes);

(b) Setting the scope for all structures, systems and components important to safety;

(c) Categorization of structures, systems and components with regard to degradation and ageing processes;

(d) Revalidation of safety analyses made on the basis of time limited assumptions;

(e) Review of ageing management programmes in accordance with national regulations;

(f) The implementation programme for long term operation.

SSG-48

5.16. The following SSCs should be included in the scope of ageing management:

(a) SSCs important to safety that are necessary to fulfil the fundamental safety functions [1]:

- Control of reactivity;
- Removal of heat from the reactor and from the fuel store;
- Confinement of radioactive material, shielding against radiation and control of planned radioactive releases, and limitation of accidental radioactive releases.

(b) Other SSCs whose failure may prevent SSCs important to safety from fulfilling their intended functions. Examples of such potential failures are:

- Missile impact from rotating machines;
- Failures of lifting equipment;
- Flooding;
- High energy line break;
- Leakage of liquids (e.g. from piping or other pressure boundary components).

(c) Other SSCs that are credited in the safety analyses (deterministic and probabilistic) as performing the function of coping with certain types of event, consistent with national regulatory requirements, such as:

- SSCs needed to cope with internal events (e.g. internal fire and internal flooding);
- SSCs needed to cope with external hazards (e.g. extreme weather conditions, earthquakes, tsunamis, external flooding, tornados and external fire);
- SSCs needed to cope with specific regulated events (e.g. pressurized thermal shock, anticipated transient without scram and station blackout);
- SSCs needed to cope with design extension conditions [1] or to mitigate the consequences of severe accidents.

2.5 – DOCUMENTS REVIEWED:

- 240-89294359, Rev. 02, Nuclear Safety, Seismic, Environmental, Quality, Importance and Management System Level Classification Standard, 2021-03-26;
- 331-93, Rev. 03, Guide for Classification of Plant Components, Structures, Parts Services and Software. 2021-06-29;
- Ref. JN195/NCI/ESCOM/J2/365, Rev. 00, Koeberg Nuclear Power Station Internal Flooding Analysis, June 2002;
- 07C03014-S2, Rev. 01, Seismic Event Fall-Down Hazard Report for Koeberg NPP, March 2008;
- 08016.ROD.012, Rev. 0.2, SALTO Non-Safety affecting Safety equipment scope verification, 2019-12-12;

- 240-125839632, Rev. 02, Koeberg Safety Aspect of Long Term Operation (SALTO) Scoping Methodology, 2020-10-20;
- 240-149139512, Rev. 01, Ageing Management Requirements for Koeberg Nuclear Power Station, 2020-06-12;
- 240-156945472, Rev. 01, SALTO Ageing Management Assessment Report (Interim), 2020-11-09;
- KAA-501, Rev. 11, Project Management Process for Koeberg Nuclear Power Station Modifications, 2019-09-23;
- KGU-023, Rev. 06a, Guide for Components Engineers, 2020-10-01;
- KGU-035, Rev. 04, Integrated Equipment Reliability Process: Scoping & Classification of Components, 2019-11-18;
- L1124-EL-LIS-001, Rev. 02, Complete List of in-scope items for SALTO EQ TLAA, 2020-01-30;
- L1124-EL-LIS-003, Rev. 03, Cable List, Missing (Date of file: 2019-12-06);
- L1124-GN-LIS-006A, Rev. 02, IGALL Commodity group linking table, 2020-01-29;
- L1124-GN-LIS-006B, Rev. 02, Ageing Management Matrix_linking table, 2020-0-10;
- L1124-GN-LIS-020, Rev. 03, Comprehensive List of all SSCs, 2020-02-27;
- L1124-GN-LIS-027, Rev. 03, AMR Data Tables for Commodity Groups, 2021-03-17;
- L1124-GN-RPT-004, Rev. 04, Boundary Definition by Bigramme, 2019-09-30,

3. HOSTING ORGANIZATION ACTIONS TO RESOLVE ISSUE	**Date:** D2/M2/YYY2

3.1 – RESULTS OF THE ISSUE ANALYSIS:

n.a.

3.2 – CORRECTIVE ACTIONS:

n.a.

3.3 – STATUS OF CORRECTIVE ACTIONS IMPLEMENTATION:

n.a.

4. FOLLOW-UP ASSESSMENT BY THE IAEA REVIEW TEAM	**Date:** D3/M3/YYY3

4.1 – FACTS:

F1) n.a.

4.2 – DOCUMENTS REVIEWED:

n.a.

4.3 – RESOLUTION DEGREE:

1.	**Insufficient progress to date**	n.a.
2.	**Satisfactory progress to date**	n.a.

3.	**Issue resolved**	n.a.

n.a.: not applicable for the present mission.

1. ISSUE IDENTIFICATION	**Issue Number: B-2**
NPP: Koeberg	**Unit: 1 and 2**
Reviewed Area: B	
1.1 – ISSUE TITLE: Incomprehensive review and implementation of plant programmes	
1.2 – FUNDAMENTAL OVERALL PROBLEM: The plant programmes are not comprehensively reviewed and implemented for LTO.	
2. ASSESSMENT OF THE STATUS	**Date:** 29/03/2022

2.1 – FACTS:

F1) The process for the development and control of ageing management at the plant prescribes an annual review of all equipment (component) failures to confirm that these are covered in the ageing management matrix. However, this prescription is not implemented yet and no record of the review is available.

F2) A preventive maintenance template is a pre-defined maintenance approach for a particular component type (or family of components) that lists significant failure modes and failure causes, constituting the failure mode analysis (FMA). The preventive maintenance template also recommends preventive maintenance tasks and task intervals, constituting the preventive maintenance strategy. For I&C components, six preventive maintenance templates are not completed yet.

F3) The objective of the plant is to have all preventive maintenance tasks directly assigned to the maintenance staff in SAP as an automated outcome of the preventive maintenance software IQ Review. However, the implementation of generic preventive maintenance task orders in SAP in line with the revised preventive maintenance strategies of IQ Review is not complete. In that case, preventive maintenance task orders in line with the revised preventive maintenance strategies of IQ Review will thus have to be issued manually as standalone task orders for the upcoming outages.

F4) The RPV surveillance programme relies on a manual that has not been reviewed against the 9 attributes of an effective ageing management programme. Revision of the RPV surveillance programme manual is still in progress (planned for completion by mid-2022).

F5) There is a list of critical spare parts but there is no critical spare parts programme to help in prioritizing actions among the numerous spare parts which belong to safety class components.

F6) The chemistry programme was reviewed against IGALL AMP103 and the conclusion of the comparison report between existing plant programmes and IGALL AMP requirements is that there are no gaps. However, the review was not documented, and there is no written

evidence of the review result nor reference to AMP103 in the justification for the plant's Chemistry Operating Specification document.

2.2 – SAFETY CONSEQUENCE:

Without comprehensive revision and implementation of the plant programmes, safety function of SCCs in scope of plant programmes cannot be ensured.

2.3 – RECOMMENDATION/SUGGESTION:

S) The plant should consider comprehensively reviewing and implementing all plant programmes for LTO.

2.4 – IAEA BASIS:

SSR-2/2 (Rev.1)

Requirement 31: Maintenance, testing, surveillance and inspection programmes

The operating organization shall ensure that effective programmes for maintenance, testing, surveillance and inspection are established and implemented.

8.1. Maintenance, testing, surveillance and inspection programmes shall be established that include predictive, preventive and corrective maintenance activities. These maintenance activities shall be conducted to maintain availability during the service life of structures, systems and components by controlling degradation and preventing failures. In the event that failures do occur, maintenance activities shall be conducted to restore the capability of failed structures, systems and components to function within acceptance criteria.

8.3. The operating organization shall develop procedures for all maintenance, testing, surveillance and inspection tasks. These procedures shall be prepared, reviewed, modified when required, validated, approved and distributed in accordance with procedures established under the management system.

SSG-48:

3.21. The operating organization should ensure that programmes and documentation relevant to the management of ageing (see Sections 4 and 5) and technological obsolescence (see Section 6) are implemented during the operation stage. Where necessary, new programmes and documentation should be developed or existing programmes and documentation should be reviewed and modified to ensure that they will be effective for managing ageing.

4.17. Existing programmes that are credited for ageing management and used in evaluations for long term operation should be consistent with the nine attributes listed in Table 2, in Section 5.

4.42. Surveillance programmes using representative material samples (e.g. material specimens for surveillance of the reactor pressure vessel, cable samples and corrosion coupons) should be reviewed and extended or supplemented for ageing within the period of long term operation, if necessary.

4.44. Appropriate testing procedures and evaluation methods should be considered for defining the set of specimens to be included in the supplementary material surveillance programme for the reactor pressure vessel, if necessary, in particular for alternative assessments such as the master curve approach for assessing fracture toughness.

2.5 – DOCUMENTS REVIEWED:

- 331-275, Rev. 02, Process for the Development and Control of Ageing Management at Koeberg Operating Unit, 2018-04-06;
- 240-97087308, Rev. 03, Fourth Interval In-Service Testing Programme Requirements Manual (ISTPRM), 2019-08-08;
- KOEB-005-001, Rev. 01, Risk-Informed ISI Periodic Evaluation and Update for the Koeberg Nuclear Power Station in Conjunction with End of the First Period of the Fourth Interval, 2021-08-22;
- 240-101650256, Rev. 02, Ageing Management Matrix, 2021-06-28;
- 240-102103854, Rev. 01, Review of the Koeberg plant programmes to assess alignment with the IAEA Ageing Management Programmes, 2015-11-13;
- 240-110745414, Rev. 03, Standard for the In-Service Inspection Programme at Koeberg Nuclear Power Station, 2020-02-03;
- 240-119362012, Rev. 02, Fourth Interval In-Service Inspection Programme Requirements Manual (ISIPRM) for Koeberg Nuclear Power Station, 2021-08-03;
- 240-143109187, Rev. 01, Reactor Pressure Vessel Management Programme Manual, 2019-04-05;
- 240-149139512, Rev. 01, Ageing Management Requirements for Koeberg Nuclear Power Station, 2020-06-12;
- 240-156945472, Rev. 01, SALTO Ageing Management Assessment Report (Interim), 2020-11-09,
- 331-23, Rev. 04, Processing of industry Operating Experience in Nuclear Engineering, 2020-12-07;
- 08016.ROD.025, Rev. 0.3, Comparison of the existing Plant Programmes with IAEA IGALL-AMP Requirements, 2020-06-25;
- KBA 0022 N NEPO NEPP 176, Rev. 02, Critical Spares Listing, 2020-12-28;
- KAA-716, Rev. 04, Shelf Life Process, 2019-10-31;
- KSA 012, Rev. 04, The Storage and Preservation of Spare Parts at Koeberg Nuclear Power Station, 2020-10-28;
- L1124-GN-RPT-030, Rev. 04, Comparison Report Existing KNPS Plant Programs with IGALL-AMP requirements, 2020-02-17;
- KAA-614, Rev. 10, Control of Spares Assessments and New Stock Applications, 2021-07-06;
- KAA-617, Rev. 05a, Identification and Resolution od Spares Problems and Anomalies, 2013-04-23;
- KAA-852, Rev. 03, Equipment Reliability Index, 2019-10-30;
- KAA-913, Rev. 02, The Integrated Equipment Reliability Process, 2021-02-26;
- KAD-025, Rev. 02, Processing of Operating Experience, 2019-09-26;
- KAA 830, Rev. 02, Justification for Koeberg NPS Chemistry Operating Specifications, 2019-05-06,
- KBA-0022-SRSM-000-00, Rev. 01, Safety Related Surveillance Manual, 2011-11-14;
- KGU-033, Rev. 04, Failure Investigation of Plant Equipment and Evaluation of Experience, 2020-07-27;
- KGU-034, Rev. 02, Guide for Reliability Engineers, 2019-05-31;

- KGU-035, Rev. 04, Integrated Equipment Reliability Process: Scoping & Classification of Components, 2019-11-18;
- KGU-037, Rev. 02, Integrated Equipment Reliability Process: Developing PM Templates, 2021-03-25;
- KGU-039, Rev. 02, Integrated Equipment Reliability Process: Developing PM Strategies, 2021-03-25;
- KLA-005, Rev. 03, Koeberg Event Classification and Reporting Criteria Listing, 2020-09-01;
- KLM-005, Rev. 21, Mandatory Preventive Maintenance Listing, 2020-03-30;
- KNC-001, Rev. 17, Chemistry Operating Specifications for Safety Related Systems, 2020-09-08;
- KNC-002, Rev. 10, Chemistry Operating Specifications for Availability Related Systems, 2021-10-06;
- KNM-001, Rev. 06, Maintenance Welding Programme, 2020-07-29;
- KSA 012, Rev. 04, the Storage and Preservation of Spare Parts at Koeberg Nuclear Power Station, 2020-10-28;
- KSA-913, Rev. 01, Integrated Equipment Reliability Standard, 2020-10-22;
- KSC-003, Rev. 06, The Chemistry Programme, 2020-09-25;
- KSC-006, Rev. 10, Chemistry Standards and Expectations, 2020-09-25;
- KSM-015, Rev. 09, Maintenance History Recordings, 2020-10-27;
- L1124-GN-RPT-027, Rev. 02, Report on OE for the Review of Existing TLAAs, 2019-07-18;
- L1124-GN-RPT-030, Rev. 04, Comparison Report Existing KNPS Plant Programs with IGALL-AMP requirements, 2020-02-17;
- KSA-011, Rev. 14, The Requirements for Controlled Documents, 2017-12-20;
- KSA-038, Rev. 06, Requirements for Quality Records, 2020-07-08;
- 240-153945942, Rev. 01, User Requirements Specification for Management of SALTO Anomalies Evaluation and Rectification, 2020-06-24;
- EA-20-160, Response to CR 115457-015_017, 2020-11-06;
- KAA-638,1Rev. 04, Communication Process with EDF, 2019-07-25;
- KAA-688, Rev. 09, Corrective Action Process, 2020-06-30;
- KGA-035, Rev. 04, Processing of Experience Feedback Received Through the EDF Co-Operation Agreement, 2019-06-24.

3. HOSTING ORGANIZATION ACTIONS TO RESOLVE ISSUE	**Date:** D2/M2/YYY2

3.1 – RESULTS OF THE ISSUE ANALYSIS:

n.a.

3.2 – CORRECTIVE ACTIONS:

n.a.

3.3 – STATUS OF CORRECTIVE ACTIONS IMPLEMENTATION:

n.a.

4. FOLLOW-UP ASSESSMENT BY THE IAEA REVIEW TEAM	**Date:** D3/M3/YYY3

4.1 – FACTS:		
F1) n.a.		
4.2 – DOCUMENTS REVIEWED:		
n.a.		
4.3 – RESOLUTION DEGREE:		
1.	**Insufficient progress to date**	n.a.
2.	**Satisfactory progress to date**	n.a.
3.	**Issue resolved**	n.a.

n.a.: not applicable for the present mission.

1. ISSUE IDENTIFICATION	**Issue Number: C-1**
NPP: Koeberg	**Unit: 1 and 2**
Reviewed Area: Ageing management of mechanical SSCs	
1.1 – ISSUE TITLE:	
Inconsistent information management for AMR of mechanical SSCs	
1.2 – FUNDAMENTAL OVERALL PROBLEM:	
Information used for AMR of mechanical SSCs is not consistently managed and documented.	
2. ASSESSMENT OF THE STATUS	**Date:** 31/03/2022
2.1 – FACTS:	

F1) The plant performed a data transfer from the ageing assessment including the previous AMM (Aging Management Matrix) to COMSY. The objective for the implementation of COMSY is to provide access to several stakeholders involved in ageing management such as design engineers, maintenance, and system engineer. Data related to environmental and condition monitoring of SSCs in the scope of LTO are also expected to be handled and distributed through this software tool. At the time of the mission the COMSY software was not available due to technical problems. As a consequence it was not possible for the team to confirm COMSY's capabilities and real data.

F2) Report 331-275 is being updated in order to incorporate COMSY as a replacement of the previous AMM. The update has not been issued yet.

F3) Information from L1124-GN-RPT-023 (AMR comprehensive report) was migrated to COMSY, however the following inconsistencies were identified:

- Terminology used for degradation mechanisms and other ageing management related terms in AMR comprehensive report and COMSY is not consistent, e.g. for

pressurizer 'cyclic loading' (see 4.3.1. "IGALL" in L1124-GN-RPT-023) vs. 'fatigue'.

- For pressurizer, fatigue was not referenced in the AMR comprehensive report (L1124-GN-RPT-023 p. 40) based on IGALL AMR, nevertheless fatigue was added to COMSY based on the AMM.
- TLAA106 for "Pressurizer" was not listed, regardless the high initial CUF=0.889 for heather sleeves (without environmentally assisted fatigue).
- AMP119 is foreseen only for the Pressurizer Spray Head (p. 42/1108), regardless of the future potential critical results of TLAA106 for pressurizer (e.g. for heater sleeves).
- Steam generator closure bolting is not indicated neither in nor out of the scope of the table extracted from COMSY, however in L1124-GN-RPT-023 Chapter 7 AMR Class 1-3 and non-classified bolting are reported.
- IGALL AMP114 for steam generator was not listed in the AMR comprehensive report (L1124-GN-RPT-023 p. 64) based on IGALL AMR, however they are included in the COMSY database.
- There are 3 different commodity groups (CGs) for the Steam Turbine System valves (L1124-GN-RPT-023 p. 485-488), however in the list of CGs in L1124-GN-LIS-027 there is only 1 line (Nr. 362).
- There are 6 different CGs for Fire Protection Pumps (L1124-GN-RPT-023 p. 103), however in the list of CGs in L1124-GN-LIS-027 there are only 5 lines for pumps (365, 380, 381, 789 and 793).
- For Diesel Fuel Oil System there are 3 CGs (L1124-GN-RPT-023 p. 106), however in the list of CGs in L1124-GN-LIS-027 there are 2 more CGs for this system: "Ducting and Components" and "AnyMT".

F4) Edition 2018 of the IGALL AMR table was the basis for the AMR report (L1124-GN-RPT-023), however systematic use of that IGALL AMR table is not evident, since some of the IGALL AMR table information is missing, e.g.:

- In the final conclusion for main components (RPV, steam generator, pressurizer etc.) critical locations with the ageing effect and degradation mechanism are not explicitly connected to the relevant TLAA in L1124-GN-RPT-023.
- For pressurizer components (p. 39/1108) the IGALL line with 'Cracking due to fatigue' is not mentioned.
- AMP115 bolting is not mentioned for the pressurizer as a connected IGALL AMP (p. 40/1108).
- Selective leaching is considered for CG 'WWS_V_03_B_0_CM' (p. 579/1108), however in conclusion AMP120 is not listed.

F5) According to L1124-GN-RPT-023 (p.23/1108) for valves: "IAEA IGALL degradation mechanisms only consider the pressure boundary (body) of valves". Nevertheless, the IAEA IGALL AMP143 Safety Related Valves was referred as basic document, the review of ageing effects and degradation mechanisms for components with active function is not a part of L1124-GN-RPT-023.

F6) Based on L1124-GN-RPT-023 (p. 25/1108) for pumps, there is no information of maintenance on active safety function in the comprehensive ageing management report.

F7) Identification of potential ageing effects and degradation mechanism for components with an active safety function is essential for AMR, however it is stated in the Advance Information Package (p. 54) that "not all Koeberg PM templates identify the relevant failure modes and causes". Based on SE 35244-049SE the status of this action is 90% complete.

2.2 – SAFETY CONSEQUENCE:

Without consistent management and documentation of information, the ageing management review of mechanical SSCs cannot identify in a consistent manner ageing effects that can challenge safety functions for LTO.

2.3 – RECOMMENDATION/SUGGESTION:

S) The plant should consider consistently managing and documenting information for AMR of mechanical SSCs.

2.4 – IAEA BASIS:

SSR-2/2 (Rev. 1)

Requirement 14: Ageing management

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

4.50. The ageing management programme shall determine the consequences of ageing and the activities necessary to maintain the operability and reliability of structures, systems and components. The ageing management programme shall be coordinated with, and be consistent with, other relevant programmes, including the programme for periodic safety review. A systematic approach shall be taken to provide for the development, implementation and continuous improvement of ageing management programmes.

4.51. Long term effects arising from operational and environmental conditions (i.e. temperature conditions, radiation conditions, corrosion effects or other degradations in the plant that may affect the long term reliability of plant equipment or structures) shall be evaluated and assessed as part of the ageing management programme. Account shall be taken in the programme of the safety relevance of structures, systems and components.

SSG-48

5.22. An ageing management review for in-scope SSCs should be performed to ensure and demonstrate that ageing will be effectively managed.

5.23. The ageing management review should systematically assess ageing effects and the related degradation mechanisms that have been experienced or are anticipated. The assessment should include an evaluation of the impact of the ageing effect on the in-scope SSCs' capability to perform their intended functions as specified in para. 5.16, including consideration of the current condition of the SSC.

5.26. An ageing management review should be performed for each in-scope structure or component or commodity group of structures or components and should consist of the following essential elements:

(a) Assessment of the current condition of the structure or component;

(b) Identification of ageing effects and degradation mechanisms on the basis of fundamental knowledge for understanding ageing (e.g. the design basis, materials, the environment and stressors; see 'Understanding ageing' in Fig. 1);

(c) Identification of the appropriate programme for ageing management;

(d) Reporting of the ageing management review to demonstrate that the ageing effects and degradation mechanisms are being managed effectively.

5.33. Once the approach for managing ageing effects and degradation mechanisms has been determined, documentation should be prepared that logically demonstrates that the ageing effects will be adequately managed.

7.25. The ageing management review should provide a clear demonstration that ageing effects will continue to be identified and managed for each structure or component in the scope of long term operation for the planned period of long term operation.

2.5 – DOCUMENTS REVIEWED:

- 08016.ROD.023, Review of the Mechanical Ageing Management Evaluation (AME) Consortium Report L1124-GN-RPT-023 and Decisions by Eskom, 2020, July
- 240-101650256, Ageing Management Matrix, 2020, November 23
- 331-275, Process for the Development and Control of Ageing matrix Management at Koeberg Operating Unit, 2019, July 01
- L1124-GN-LIS-020, Comprehensive List of all SSCs, 2020, February 27
- L1124-GN-RPT-023, AME Degradation Assessment Results Mechanical, 2020, March 26

3. HOSTING ORGANIZATION ACTIONS TO RESOLVE ISSUE	**Date:** D2/M2/YYY2

3.1 – RESULTS OF THE ISSUE ANALYSIS:

n.a.

3.2 – CORRECTIVE ACTIONS:

n.a.

3.3 – STATUS OF CORRECTIVE ACTIONS IMPLEMENTATION:

n.a.

4. FOLLOW-UP ASSESSMENT BY THE IAEA REVIEW TEAM	**Date:** D3/M3/YYY3

4.1 – FACTS:

n.a.

4.2 – DOCUMENTS REVIEWED:

n.a.

4.3 – RESOLUTION DEGREE:		
1.	**Insufficient progress to date**	n.a.
2.	**Satisfactory progress to date**	n.a.
3.	**Issue resolved**	n.a.

n.a.: not applicable for the present mission.

1. ISSUE IDENTIFICATION	**Issue Number: C-2**
NPP: Koeberg	**Unit: 1 and 2**
Reviewed Area: Ageing management of mechanical SSCs	
1.1 – ISSUE TITLE: Incomplete AMPs for mechanical SSCs	
1.2 – FUNDAMENTAL OVERALL PROBLEM: AMPs for mechanical SSCs are not complete.	
2. ASSESSMENT OF THE STATUS	**Date:** 31/03/2022

2.1 – FACTS:

F1) The plant's strategy to manage one-time inspections is not described, the programme is not developed (see page 65 of AIP). The plant is developing a programme in compliance with IGALL AMP119.

F2) The plant developed a list of about 3000 items for the scope of the one-time inspection programme, but the relevance of components in the list and the completeness of the list is not demonstrated.

F3) A 'Failure' column appears in the spreadsheet containing the list of components in the scope of the one-time inspection programme and this column shows a failure mode acronym for some 153 components; the origin and the use of this information is not indicated.

F4) According to document L1124-GN-RPT-030, which compares IGALL AMPs with existing plant programmes, it is stated that there are no gaps for AMP134. It was checked that component external surfaces that are insulated and exposed to condensation have to be periodically inspected every 10 years; this requirement has not been taken into account in any of the existing plant programmes.

F5) Review and updating of existing AMPs are finished, however the following new AMPs are being developed with their effectiveness not demonstrated and their status is as follows:

- AMP 120 - Selective leaching (comments addressed, ready for approval);
- AMP 121 - One-time inspections Class 1 small-bore piping (manual review comments are addressed);

- AMP 135 - Inspection of internal surfaces in miscellaneous piping and ducting components (manual review comments are addressed);
- AMP 137 - Monitoring of neutron absorbers other than Boraflex (manual still under development);
- AMP 154 - PWR pressuriser (manual review comments are addressed);
- AMP 156 - PWR main coolant piping (manual review comments are addressed);
- AMP 157 - Internal coatings and linings (manual review comments are addressed).

2.2 – SAFETY CONSEQUENCE:

Without complete AMPs for mechanical SSCs, the plant cannot ensure preserving the safety function of SSCs for LTO.

2.3 – RECOMMENDATION/SUGGESTION:

S) The plant should consider completing the AMPs for mechanical SSCs.

2.4 – IAEA BASIS:

SSR-2/2 (Rev. 1)

Requirement 14: Ageing management

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

4.50. The ageing management programme shall determine the consequences of ageing and the activities necessary to maintain the operability and reliability of structures, systems and components. The ageing management programme shall be coordinated with, and be consistent with, other relevant programmes, including the programme for periodic safety review. A systematic approach shall be taken to provide for the development, implementation and continuous improvement of ageing management programmes.

4.51. Long term effects arising from operational and environmental conditions (i.e. temperature conditions, radiation conditions, corrosion effects or other degradations in the plant that may affect the long term reliability of plant equipment or structures) shall be evaluated and assessed as part of the ageing management programme. Account shall be taken in the programme of the safety relevance of structures, systems and components.

SSG-48

3.24. The operating organization should ensure the timely detection and characterization of significant ageing effects through the inspection and monitoring of in-scope structures or components, and the assessment of observed ageing effects to determine the type and timing of any actions required.

5.51. The ageing management programmes should be implemented in a timely manner to ensure that the intended functions of structures or components continue to be performed.

5.52. Detailed implementation procedures that describe preventive and mitigatory actions, monitoring or inspection and assessment actions, acceptance criteria, and corrective actions

should be established and shared among the different units of the nuclear power plant (e.g. operations, maintenance and engineering units) that are responsible for implementing ageing management programmes.

5.53. As part of the implementation of the ageing management programmes, appropriate data should be collected and recorded to provide a basis for decisions on the type and timing of ageing management actions.

2.5 – DOCUMENTS REVIEWED:

- 08016.ROD.023, Review of the Mechanical Ageing Management Evaluation (AME) Consortium Report L1124-GN-RPT-023 and Decisions by Eskom, 2020, July
- 240-101650256, Ageing Management Matrix, 2020, November 23
- 331-275, Process for the Development and Control of Ageing matrix Management at Koeberg Operating Unit, 2019, July 01
- KAA-652, Accounting of Transients, 2020, January 30
- KBA 00 22 E00 006, NSSS Design Transients, 2001, July 13

3. HOSTING ORGANIZATION ACTIONS TO RESOLVE ISSUE	**Date:** D2/M2/YYY2

3.1 – RESULTS OF THE ISSUE ANALYSIS:

n.a.

3.2 – CORRECTIVE ACTIONS:

n.a.

3.3 – STATUS OF CORRECTIVE ACTIONS IMPLEMENTATION:

n.a.

4. FOLLOW-UP ASSESSMENT BY THE IAEA REVIEW TEAM	**Date:** D3/M3/YYY3

4.1 – FACTS:

n.a.

4.2 – DOCUMENTS REVIEWED:

n.a.

4.3 – RESOLUTION DEGREE:

1.	**Insufficient progress to date**	n.a.
2.	**Satisfactory progress to date**	n.a.
3.	**Issue resolved**	n.a.

n.a.: not applicable for the present mission.

1. ISSUE IDENTIFICATION	**Issue Number: D-1**
NPP: Koeberg	**Unit: 1 and 2**
Reviewed Area: Ageing management of electrical and I&C SSCs	

1.1 – ISSUE TITLE:

Incomplete implementation of the cable ageing management programme

1.2 – FUNDAMENTAL OVERALL PROBLEM:

The plant has not completely implemented a comprehensive cable ageing management programme.

2. ASSESSMENT OF THE STATUS	**Date:** 31/03/2022

2.1 – FACTS:

F1) The verification of in-scope cables for LTO was not systematically assessed in terms of comparison with connection lines indicating intermediate components.

F2) Material's information of cables has been incorporated recently but has not been considered for prioritization for the cable ageing management programme (CAMP) related activities such as condition monitoring techniques, frequency of inspections, etc.

F3) Currently the Pericles database has all relevant information regarding cable and cable trays for supporting CAMP related activities. However, it is not user-friendly and database architecture is limited.

Example: Pericles can be used for identification of cables, cable routes (cable trays and rooms), however a full list of cable trays associated with a specific room in the plant cannot be readily and directly obtained. This can be done by searching on drawings of cable trays but most of them are available only in hard copy. This can impact the correct identification of hot spots.

The plant is in the process of migrating Pericles to an Access database through an in-house project. In the long term the plant is planning to migrate fully to a cable database.

F4) Interaction between Environmental Condition Monitoring Programme (ECMP) and COMSY is included in the draft version of ECMP as a flowchart. Specific instructions and a procedure with special consideration on how the identification of hot spots will affect the equipment in scope of LTO are not available.

F5) Document 331-417 is used as a guideline for visual inspection of cables. Material specific ARDM effects such as plasticizer migration or extrusion in PVC cables are not incorporated. Internal operating experience from visual inspections such as EA-18-329 has not been incorporated yet.

F6) There is still an open action in DevonWay database for training regarding enhancement of visual inspection of cables (128539-007GA).

F7) From plant walkdown:

- Several cable trays or cable supporting structures such as ‘cable case’ had no visible label from floor level.
- Cable manufacture information is difficult to identify from cables trays due to aggrupation and overlapping of cables.

On the cabling floor L341 close to battery rooms/electrical building HLX- LAA-LBA electrical buildings HLY LBF LBB LCB. Corridor W350, the following were observed:

- Some parts in cable corridors presents poor illumination.
- Cable trays overloaded in terms of space in the cable trays. In consequence some cable parts are not completely supported by a cable supporting structure.
- There is a big concentration of cables in very small area in the cable corridors especially when cables pass through a fire wall.
- It is not possible to identify a singular cable in the cable trays just by visual inspection. Nevertheless it is normally possible to identify the cable train through periodic colour marks along the cable layout.

Cables in room L511 relaying common:

- cable trays present overload in terms of space and some cables were partially not supported by metal supporting structure. Generally the addition of a new cable in current cable trays is a complicated task.

F8) The manuals for CAMP refer to a non-approved document (ECMP) as if it was already implemented.

2.2 – SAFETY CONSEQUENCE:

Without implementing a comprehensive ageing management programme, safety function of safety related cables cannot be demonstrated.

2.3 – RECOMMENDATION/SUGGESTION:

S) The plant should consider completing the implementation of the cable ageing management programme.

2.4 – IAEA BASIS:

SSG-48

5.38 Each ageing management programme should be consistent with the generic attributes of an effective ageing management programme listed in Table 2.

5.41 If the programme used to manage ageing effects involves inspection by sampling from a specific population of structures or components, the programme should describe and justify the methods used for selecting the samples to be inspected and the sample size, and should demonstrate that the sampling is adequate to provide reasonable assurance that ageing effects on the structure or component will not prevent the performance of its intended functions throughout its lifetime.

5.43 Ageing management programmes specific to ageing effects and degradation mechanisms or specific to structures and components should be developed. Existing plant programmes should be coordinated and maintained to cover the activities shown in para. 5.39. If necessary,

a new programme that includes or supplements these activities should be developed. Such existing or newly developed programmes can be at different levels of detail (e.g. at a structure or component level, commodity group level or system level) depending on their complexity and importance to safety.

5.46 All programmes developed should comply with relevant national regulatory requirements, codes and standards and the ageing management policy of the plant (see para. 4.3) and should be consistent with the nine attributes of Table 2. If a programme is of such a nature that doesn't meet all of the nine attributes, its use should be properly justified and the justification should be documented.

4.42 Surveillance programmes using representative material samples (such as material specimens for surveillance of the reactor pressure vessel, cable samples and corrosion coupons) should be reviewed and extended or supplemented for ageing within the period of long term operation, if necessary.

4.43 The documentation on the relevant initial conditions of the material samples used for surveillance should be identified, the adequacy of the information should be assessed, and the documentation should be supplemented as necessary.

5.51 The ageing management programmes should be implemented in a timely manner to ensure that the intended functions of structures or components continue to be met.

5.9 Data collection and record keeping system should be in place as a necessary base for the support of ageing management. Examples of data that should be included in the data collection and record keeping system are described in Ref. [21].

2.5 – DOCUMENTS REVIEWED:

- 331-127, Rev 2, Cable Ageing Management Programme at Koeberg Operating Unit (2019)
- 240-98789629: Cable Ageing Management Manual for Instrumentation, Control and Measurement Cables and Cable Systems.
- 240-98789276: Cable Ageing Management Manual for Low Voltage Electrical Cables and Cable Systems.
- 331-417, Visual and tactile inspections for medium voltage, low voltage, and Instrument and Control Cables, Rev 2, (2020).

3. HOSTING ORGANIZATION ACTIONS TO RESOLVE ISSUE	**Date:** D2/M2/YYY2

3.1 – RESULTS OF THE ISSUE ANALYSIS:

n.a.

3.2 – CORRECTIVE ACTIONS:

n.a.

3.3 – STATUS OF CORRECTIVE ACTIONS IMPLEMENTATION:

n.a.

4. FOLLOW-UP ASSESSMENT BY THE IAEA REVIEW TEAM	**Date:** D3/M3/YYY3
4.1 – FACTS: F1) n.a.	
4.2 – DOCUMENTS REVIEWED: n.a.	
4.3 – RESOLUTION DEGREE:	

1.	**Insufficient progress to date**	n.a.
2.	**Satisfactory progress to date**	n.a.
3.	**Issue resolved**	n.a.

n.a.: not applicable for the present mission.

1. ISSUE IDENTIFICATION	**Issue Number: D-2**
NPP: Koeberg	**Unit: 1 and 2**
Reviewed Area: Ageing management of electrical and I&C SSCs	
1.1 – ISSUE TITLE: Incomplete revalidation of environmental qualification for LTO	
1.2 – FUNDAMENTAL OVERALL PROBLEM: The plant has not revalidated environmental qualification for some SSCs for LTO.	
2. ASSESSMENT OF THE STATUS	**Date:** 31/03/2022

2.1 – FACTS:

F1) The plant performed several local temperature measurements campaigns in addition to live data available in the 'InSQL' (database for online plant measurements retrievable from the beginning of operation) since 2012. Localized radiation measurements were not performed.

F2) The environmental condition monitoring programme is still in draft and it is planned to be approved in the next two months. This programme will include localized measurement of temperature and radiation. Results are expected to be reported through Programme Health Reports.

F3) Combined temperature and radiation (T&R) measurement devices will be installed inside the containment during the outage in 2022 of Unit 2 in order to have at least one relevant reference data before the steam generator replacement. The same combined T&R measurements devices are to be installed in Unit 1 after the steam generator replacement. The plant assumes that local T&D data from the previous year of operation of unit 2 will be

representative for both units since in the case of unit 1 there will be no data measured before the replacement.

F4) Mechanical equipment was excluded from the scope of environmental qualification based on justification provided in document report 240-109728634. It contains only general statements and there is no equipment specific and systematic assessment to compare original equipment design and operating experience with relevant standards for qualification of mechanical equipment (such as ASME QME-1).

F5) The report 331-170 (requirements for protective coatings for use at the plant) does not mention nor refer to other documents with DBA requirements (accident profile, total integrated dose, etc.) or specific standards for qualification of LOCA proof coating.

F6) There was no assessment to confirm that the applied coatings required to be LOCA proof meet the plant requirements. The plant has performed visual inspection and the coatings are in good condition, but no further analysis for the validity of original qualification was planned.

F7) The KAA-771 (Outage Scope Control Process, rev 9 (2021)) contains the form KFX-001 "Outage scope control removal form", rev 14, (issued in 2020) that mentions the control of "Environmental qualification section" instead of "Equipment qualification programme" (that includes seismic).

2.2 – SAFETY CONSEQUENCE:

Without a complete revalidation of environmental qualification of the relevant components, their ability to perform safety functions cannot be demonstrated for LTO.

2.3 – RECOMMENDATION/SUGGESTION:

S) The plant should consider completing the revalidation of environmental qualification for all the SSCs in the scope of the environmental qualification programme.

2.4 – IAEA BASIS:

SSR-2/2 (Rev. 1)

Requirement 13. The operating organization shall ensure that a systematic assessment is carried out to provide reliable confirmation that safety related items are capable of the required performance for all operational states and for accident conditions.

4.48. Appropriate concepts and the scope and process of equipment qualification shall be established, and effective and practicable methods shall be used to upgrade and preserve equipment qualification. A programme to establish, to confirm and to maintain required equipment qualification shall be launched from the initial phases of design, supply and installation of the equipment. The effectiveness of equipment qualification programmes shall be periodically reviewed.

4.49. The scope and details of the equipment qualification process, in terms of the required inspection area(s), method(s) of non-destructive testing, possible defects inspected for and required effectiveness of inspection, shall be documented and submitted to the regulatory body for review and approval. Relevant national and international experience shall be taken into account in accordance with national regulations.

SSG-48

4.23 An equipment qualification programme to achieve and maintain the qualified status of in-scope SSCs should be in place in order to meet Requirement 30 of SSR-2/1 (Rev. 1) and Requirement 13 of SSR-2/2 (Rev. 1).

4.25 Environmental qualification should demonstrate that, at the end of its qualified life, the equipment will still be capable of performing its intended function(s) under the full range of specified service conditions.

7.17 Time limited ageing analyses should be re-evaluated for the planned period of long term operation and it should be demonstrated that they meet the criteria of para. 5.67.

SSG-69

2.14. Qualified life is the period for which a structure, system or component has been demonstrated, through testing, analysis or experience, to be capable of functioning within acceptance criteria during specific operating conditions while retaining the ability to perform its safety functions in accident conditions for a design basis accident or a design basis earthquake.

2.15. A qualified life should be established for all equipment that is subject to significant performance degradation mechanisms that could occur under the range of specified service conditions for operational states.

3.23. Harsh environments result from design basis accidents such as loss of coolant accidents, high energy line breaks and main steam line breaks. The accident conditions for design basis accidents are characterized by changes in temperature, pressure, humidity, radiation levels, submergence and vibrations or by simultaneous changes in process fluid conditions, chemical composition and mechanical loads. Other postulated initiating events might need to be considered in the equipment qualification programme if they produce conditions that are more severe than those produced by loss of coolant accidents or high energy line breaks.

3.24. The bounding thermodynamic profiles and chemical effects associated with each postulated initiating event should be derived from the design basis and the safety analysis report for the nuclear installation.

3.25. Service conditions resulting from postulated initiating events such as an SL-2 earthquake or aircraft crash should be considered in the equipment qualification programme.

3.26. Equipment qualification should take into account the mission time for the equipment in applicable accident conditions.

5.26. As qualified equipment approaches the end of its qualified life, additional periodic monitoring of its condition should be implemented to determine whether actual ageing is occurring at a slower rate than expected, which would indicate that it may be possible to extend the qualified life of the equipment.

5.27. The combination of monitoring environmental conditions and monitoring the condition of equipment should be used to support the reassessment of the qualified life of equipment.

2.5 – DOCUMENTS REVIEWED:

- L1124-GN-RPT-018, Rev 4, Time Limited Ageing Analysis Based on Intial Qualification, (2020)
- 331-219 Equipment Qualification Maintenance Manual for Equipment Located in Harsh Environments, Rev 3, (2021).
- D02-ARV-01-189-248 Requalification Program for Qualified Cables Installed Inside the Containment and other Installation Positions Pertaining to the Harsh Environment at Koeberg Nuclear Power Station, Rev B, (2022)
- KAA-771, Outage Scope Control Process, Rev 9 (2021)
- KFX-001 "Outage scope control removal form" (rev 14, issued in 2020)
- 240-105643933, Specification for Reactor Coolant Pump Speed Measurement, Rev 0, (2016)
- 240-90276632, Instrument Specification for Safety Class 1E Absolute, Differential and Relative Pressure Transmitters, Rev 1, (2015)
- 331-170, Requirements for Protective Coatings for use at Koeberg Nuclear Power Station, (2019)

3. HOSTING ORGANIZATION ACTIONS TO RESOLVE ISSUE	**Date:** D2/M2/YYY2

3.1 – RESULTS OF THE ISSUE ANALYSIS:

n.a.

3.2 – CORRECTIVE ACTIONS:

n.a.

3.3 – STATUS OF CORRECTIVE ACTIONS IMPLEMENTATION:

n.a.

4. FOLLOW-UP ASSESSMENT BY THE IAEA REVIEW TEAM	**Date:** D3/M3/YYY3

4.1 – FACTS:

F1) n.a.

4.2 – DOCUMENTS REVIEWED:

n.a.

4.3 – RESOLUTION DEGREE:

1.	**Insufficient progress to date**	n.a.
2.	**Satisfactory progress to date**	n.a.

3.	**Issue resolved**	n.a.

n.a.: not applicable for the present mission.

1. ISSUE IDENTIFICATION	**Issue Number: D-3**
NPP: Koeberg	**Unit: 1 and 2**
Reviewed Area: Ageing management of electrical and I&C SSCs	
1.1 – ISSUE TITLE: Incomplete assessment of electromagnetic compatibility	
1.2 – FUNDAMENTAL OVERALL PROBLEM: Electromagnetic compatibility has not been completely assessed.	
2. ASSESSMENT OF THE STATUS	**Date:** 31/03/2022

2.1 – FACTS:

F1) Currently there is not enough data to establish electromagnetic compatibility (EMC) requirements for the equipment in scope of the Equipment Qualification Programme (EQP). The plant has not defined a specific standard to apply EMC requirements such as IEC 62003.

F2) In the DevonWay database there was a corrective action (CA35071) opened and closed in 2015 to include the electromagnetic interference (EMI) in the equivalency check sheet (used for replacement of equipment). The field was included in the check list without further information regarding standards or requirements to be considered.

F3) The plant raised an action in DevonWay (RC17486) to perform electromagnetic field mapping in order to address EMC. This action does not define any reference standard, framework for acceptance criteria or limits for the results. The mapping was not performed. The action was closed in 2015 and there was no definition for any standard or requirement framework to be used in future.

F4) In 2016 the plant raised a general action (DevonWay CR96957-002 GA) to perform an impact assessment on potential generators/transmitters of EMI which could affect the plant instruments. The action was still not completed.

F5) The plant has established a list of important locations in order to monitor different relevant parameters for EMI in the draft version of the environmental condition monitoring programme. There is no explicit standards and codes framework for the evaluation of the results.

F6) The design specifications (240-105643933) for speed sensors and (240-90276632) for transmitters, which also include the connectors, do not have reference to specific qualification standards apart from IEEE 323-74. There is no EMC specific requirement.

F7) The document 331-186 defines equipment qualification as the sum of environmental qualification and seismic qualification, without any consideration of EMC.

2.2 – SAFETY CONSEQUENCE:

Without a complete assessment of electromagnetic compatibility, the safety function of electrical components with regard to EMC cannot be demonstrated.

2.3 – RECOMMENDATION/SUGGESTION:

S) The plant should consider completing an assessment of electromagnetic compatibility.

2.4 – IAEA BASIS:

SSR-2/2 (Rev. 1)

Requirement 13. The operating organization shall ensure that a systematic assessment is carried out to provide reliable confirmation that safety related items are capable of the required performance for all operational states and for accident conditions.

4.48. Appropriate concepts and the scope and process of equipment qualification shall be established, and effective and practicable methods shall be used to upgrade and preserve equipment qualification. A programme to establish, to confirm and to maintain required equipment qualification shall be launched from the initial phases of design, supply and installation of the equipment. The effectiveness of equipment qualification programmes shall be periodically reviewed.

4.49. The scope and details of the equipment qualification process, in terms of the required inspection area(s), method(s) of non-destructive testing, possible defects inspected for and required effectiveness of inspection, shall be documented and submitted to the regulatory body for review and approval. Relevant national and international experience shall be taken into account in accordance with national regulations.

SSG-69

2.5. As indicated in para. 2.1, equipment qualification is required to demonstrate that the equipment will be capable of performing its intended safety functions under the range of service conditions specified for the nuclear installation in operational states and accident conditions. This includes an evaluation of the ability of systems or components to perform these safety functions under the effects caused by specified service conditions during plant states and during external events not excluded by the design of the nuclear installation (e.g. seismic events, electromagnetic phenomena such as arcing, lightning). In contrast, internal fires, explosions, internal flooding, tornadoes and hurricanes are not normally considered in equipment qualification because the design generally protects the equipment from the effects of these events.

2.30. Test specifications, test reports and analysis reports should be prepared for each type of qualification (e.g. seismic, environmental and electromagnetic compatibility, functionality testing under specified dynamic loading conditions, ageing and wear through functional cycling).

3.8. The set of specified service conditions should include operating conditions and environmental conditions associated with all plant states. The operating conditions are generally defined by the service conditions of the systems (e.g. vibration, electromagnetic

interference caused by voltage surge), operating conditions (e.g. voltage, current, temperature, pressure, radiation levels), fluid conditions (e.g. differential pressure, temperature, flow, chemical content) and environmental conditions in all plant states. The environmental conditions are generally defined by the ambient conditions associated with plant states within the area, also referred to as a 'zone', of the nuclear installation where the equipment is installed. The localized environmental conditions within these areas, (e.g. temperature and radiation levels) should be considered, where appropriate. Other stressors (e.g. wear, operational cycles, temperature cycles) causing ageing degradation should also be considered.

3.13. Relevant operating conditions for operational states typically include the following:

- Power surges;
- Operating cycles (e.g. electrical, mechanical, water hammer);
- Electrical loading parameters (e.g. voltage, frequency, current);
- Mechanical loads (e.g. thrust; torque; displacement; non-seismic vibration including flow induced vibration, condensing mode vibration and quenching vibration);
- Process fluid conditions (e.g. pressure, temperature, chemical composition, flow rate, water hammer);
- Chemical composition;
- Loads and duty cycles;
- Self-heating;
- Submergence;
- Electromagnetic interference.

3.16. Electromagnetic interference, including radiofrequency interference, can be caused by electrical equipment, electrical surges (e.g. voltage spikes resulting from switching transients or lightning) and electrostatic discharges.

3.17. Electromagnetic interference can affect electrical equipment including instrumentation and control systems and components. Equipment qualification for electromagnetic interference should address the combination of the system design and the component design to minimize the coupling of electromagnetic interference between the source and other electrical components.

3.18. Detailed equipment qualification specifications and acceptance criteria for electromagnetic interference should be determined in accordance with international industry standards or, alternatively, on the basis of individual system requirements. A list of international standards relating to equipment qualification is provided in the Annex.

3.19. A site survey of sources of electromagnetic interference should be performed during normal operation and should include monitoring for the effects of operating and maintenance activities to establish and verify the basis for equipment qualification.

3.20. Electromagnetic fields within a specified location within a nuclear installation may change with time as a result of the operation of equipment or replacement of equipment in the area (zone). Therefore, when changes to electrical inputs or electrical equipment occur within an area (zone), additional site survey measurements of electromagnetic fields should be performed to identify and quantify sources of electromagnetic interference in order to ensure that the status of qualified equipment will be preserved.

2.5 – DOCUMENTS REVIEWED:

- DevonWay data base.
- 331-186, Rev 2, Equipment Qualification Programme, (2020).
- 331-219 Equipment Qualification Maintenance Manual for Equipment Located in Harsh Environments, Rev 3, (2021).
- 240-105643933, Specification for Reactor Coolant Pump Speed Measurement, Rev 0, (2016).
- 240-90276632, Instrument Specification for Safety Class 1E Absolute, Differential and Relative Pressure Transmiters, Rev 1, (2015).

3. HOSTING ORGANIZATION ACTIONS TO RESOLVE ISSUE	**Date:** D2/M2/YYY2

3.1 – RESULTS OF THE ISSUE ANALYSIS:

n.a.

3.2 – CORRECTIVE ACTIONS:

n.a.

3.3 – STATUS OF CORRECTIVE ACTIONS IMPLEMENTATION:

n.a.

4. FOLLOW-UP ASSESSMENT BY THE IAEA REVIEW TEAM	**Date:** D3/M3/YYY3

4.1 – FACTS:

F1) n.a.

4.2 – DOCUMENTS REVIEWED:

n.a.

4.3 – RESOLUTION DEGREE:

1.	**Insufficient progress to date**	n.a.
2.	**Satisfactory progress to date**	n.a.
3.	**Issue resolved**	n.a.

n.a.: not applicable for the present mission.

1. ISSUE IDENTIFICATION	**Issue Number: D-4**
NPP: Koeberg	**Unit: 1 and 2**
Reviewed Area: Ageing management of electrical and I&C SSCs	

1.1 – ISSUE TITLE:

Incomplete revalidation of environmental qualification of qualified cables

1.2 – FUNDAMENTAL OVERALL PROBLEM:

The plant has not revalidated the environmental qualification of qualified cables for LTO.

2. ASSESSMENT OF THE STATUS	**Date:** 31/03/2022

2.1 – FACTS:

F1) One of the results of the equipment qualification TLAA issued in 2020 (L1124-GN-RPT-018) is that for qualified cables in harsh environments, the qualification is valid until the end of current operational license term. The plant received from its contractor guidelines and recommendations for the requalification of qualified cables. The development of the plan for the requalification of cables is still in progress.

F2) D02-ARV-01-189-248 contains a proposal for requalification of cables in line with AMP210 of condition monitoring of qualified cables for LTO. However, a specific cable qualification standard is not referred and consideration of fire-retardant behaviour is not addressed in this document.

F3) The proposed sample removal testing plan aligns with international practice, however a detailed assessment of the represented samples has not considered: material specific parameters (e.g. material formulation, validity of Activation Energy, etc.), installed environment, work condition such as temperature (environmental temperature and self-heating effects), exposure dose rate, etc.

F4) An assessment on the amount and length of samples required to satisfy the requalification process requirements as well as future condition based qualification testing have not been performed.

2.2 – SAFETY CONSEQUENCE:

Without a complete revalidation of environmental qualification of cables, the ability to perform their safety functions cannot be demonstrated.

2.3 – RECOMMENDATION/SUGGESTION:

R) The plant should complete the revalidation of environmental qualification for qualified cables.

2.4 – IAEA BASIS:

SSR-2/2 (Rev. 1)

Requirement 13. The operating organization shall ensure that a systematic assessment is carried out to provide reliable confirmation that safety related items are capable of the required performance for all operational states and for accident conditions.

4.48. Appropriate concepts and the scope and process of equipment qualification shall be established, and effective and practicable methods shall be used to upgrade and preserve equipment qualification. A programme to establish, to confirm and to maintain required

equipment qualification shall be launched from the initial phases of design, supply and installation of the equipment. The effectiveness of equipment qualification programmes shall be periodically reviewed.

4.49. The scope and details of the equipment qualification process, in terms of the required inspection area(s), method(s) of non-destructive testing, possible defects inspected for and required effectiveness of inspection, shall be documented and submitted to the regulatory body for review and approval. Relevant national and international experience shall be taken into account in accordance with national regulations.

SSG-48

4.23 An equipment qualification programme to achieve and maintain the qualified status of in-scope SSCs should be in place in order to meet Requirement 30 of SSR-2/1 (Rev. 1) and Requirement 13 of SSR-2/2 (Rev. 1).

4.25 Environmental qualification should demonstrate that, at the end of its qualified life, the equipment will still be capable of performing its intended function(s) under the full range of specified service conditions.

7.17 Time limited ageing analyses should be re-evaluated for the planned period of long term operation and it should be demonstrated that they meet the criteria of para. 5.67.

SSG-69

2.14. Qualified life is the period for which a structure, system or component has been demonstrated, through testing, analysis or experience, to be capable of functioning within acceptance criteria during specific operating conditions while retaining the ability to perform its safety functions in accident conditions for a design basis accident or a design basis earthquake.

2.15. A qualified life should be established for all equipment that is subject to significant performance degradation mechanisms that could occur under the range of specified service conditions for operational states.

3.23. Harsh environments result from design basis accidents such as loss of coolant accidents, high energy line breaks and main steam line breaks. The accident conditions for design basis accidents are characterized by changes in temperature, pressure, humidity, radiation levels, submergence and vibrations or by simultaneous changes in process fluid conditions, chemical composition and mechanical loads. Other postulated initiating events might need to be considered in the equipment qualification programme if they produce conditions that are more severe than those produced by loss of coolant accidents or high energy line breaks.

3.24. The bounding thermodynamic profiles and chemical effects associated with each postulated initiating event should be derived from the design basis and the safety analysis report for the nuclear installation.

3.25. Service conditions resulting from postulated initiating events such as an SL-2 earthquake or aircraft crash should be considered in the equipment qualification programme.

3.26. Equipment qualification should take into account the mission time for the equipment in applicable accident conditions.

5.26. As qualified equipment approaches the end of its qualified life, additional periodic monitoring of its condition should be implemented to determine whether actual ageing is occurring at a slower rate than expected, which would indicate that it may be possible to extend the qualified life of the equipment.

5.27. The combination of monitoring environmental conditions and monitoring the condition of equipment should be used to support the reassessment of the qualified life of equipment.

2.5 – DOCUMENTS REVIEWED:

- L1124-GN-RPT-018, Rev 4, Time Limited Ageing Analysis Based on Intial Qualification, (2020)
- 331-219 Equipment Qualification Maintenance Manual for Equipment Located in Harsh Environments, Rev 3, (2021).
- D02-ARV-01-189-248 Requalification Program for Qualified Cables Installed Inside the Containment and other Installation Positions Pertaining to the Harsh Environment at Koeberg Nuclear Power Station, Rev B, (2022)
- KAA-771, Outage Scope Control Process, Rev 9 (2021)
- KFX-001 “Outage scope control removal form” (rev 14, issued in 2020)
- 240-105643933, Specification for Reactor Coolant Pump Speed Measurement, Rev 0, (2016)
- 240-90276632, Instrument Specification for Safety Class 1E Absolute, Differential and Relative Pressure Transmitters, Rev 1, (2015)
- 331-170, Requirements for Protective Coatings for use at Koeberg Nuclear Power Station, (2019)

3. HOSTING ORGANIZATION ACTIONS TO RESOLVE ISSUE	**Date:** D2/M2/YYY2

3.1 – RESULTS OF THE ISSUE ANALYSIS:

n.a.

3.2 – CORRECTIVE ACTIONS:

n.a.

3.3 – STATUS OF CORRECTIVE ACTIONS IMPLEMENTATION:

n.a.

4. FOLLOW-UP ASSESSMENT BY THE IAEA REVIEW TEAM	**Date:** D3/M3/YYY3

4.1 – FACTS:

F1) n.a.

4.2 – DOCUMENTS REVIEWED:		
n.a.		
4.3 – RESOLUTION DEGREE:		
1.	**Insufficient progress to date**	n.a.
2.	**Satisfactory progress to date**	n.a.
3.	**Issue resolved**	n.a.

n.a.: not applicable for the present mission.

1. ISSUE IDENTIFICATION	**Issue Number: D-5**
NPP: Koeberg	**Unit: 1 and 2**
Reviewed Area: Ageing management of electrical and I&C SSCs	
1.1 – ISSUE TITLE:	
Lack of proactive management of technological obsolescence	
1.2 – FUNDAMENTAL OVERALL PROBLEM:	
A proactive approach to technological obsolescence management is not fully implemented.	
2. ASSESSMENT OF THE STATUS	**Date:** 31/03/2022
2.1 – FACTS:	
F1) There is an established methodology for handling and tracking problems related to obsolescence issues, this TOP (Technological Obsolescence Programme) methodology has been implemented, however the proactive part of the process has not been fully implemented. F2) The plant previously adopted the POMS as a tool for a proactive approach. The licence of POMS expired, and the plant is in the process of acquiring a new service for the obsolescence management tool. The plant does not have access to any tool to proactively identify obsolescence. F3) The plant established an Obsolescence Management Process (331-146) since 2019, which has been reviewed 3 times. One of the outcomes was the establishment of the Obsolescence Steering Committee and a requirement for periodic meetings to decide on obsolescence resolution strategies. However, the monthly meetings of this Committee only started recently. F4) The 331-146 Obsolescence Management Process is expected to establish and report the top 10 list of obsolete items according to international practices. This information is to be tracked at the Steering Committee and reported in the Programme Health Report (PHR). The last PHR does not contain or refer to the Top 10 list.	

F5) The Obsolescence Management Process provides factors to be considered in the prioritization matrix. However, the details regarding the weighing of each factor to be considered is not provided in the document.

F6) The current procedure will be updated in order to describe how the findings of the TOP will influence the prioritization in the procurement process. These changes are expected to be introduced in Revision 4 of the procedure (in draft).

2.2 – SAFETY CONSEQUENCE:

Without a proactive technological obsolescence management, the plant risks unavailability of SSCs important to safety.

2.3 – RECOMMENDATION/SUGGESTION:

S) The plant should consider completing the implementation of a proactive approach to technological obsolescence.

2.4 – IAEA BASIS:

SSG-48
6.1 Technological obsolescence of the SSCs in the plant should be managed through a dedicated plant programme with foresight and anticipation and should be resolved before any associated decrease in reliability and availability occur.
6.2 A technological obsolescence programme should be prepared and implemented to address all SSCs important to safety and spare parts required to maintain those SSCs.
6.3 The technological obsolescence programme should involve participation of the engineering, maintenance, operations and work planning units, plant senior management, and supply chain organizations
6.5 The technological obsolescence programme should be made available to the regulatory body for review and assessment at a level of detail defined by national regulatory requirements.
6.11 The operating organization should periodically assess the effectiveness of the technological obsolescence programme and should continuously seek to improve performance and efficiency. Self-assessments should be performed concerning the obsolescence programme, its implementation and its effectiveness and any lessons learned should be acted on.

2.5 – DOCUMENTS REVIEWED:

- 331-146, Rev 3., Obsolescence Management Process, 2021

3. HOSTING ORGANIZATION ACTIONS TO RESOLVE ISSUE	**Date:** D2/M2/YYY2

3.1 – RESULTS OF THE ISSUE ANALYSIS:

n.a.

3.2 – CORRECTIVE ACTIONS:

n.a.

3.3 – STATUS OF CORRECTIVE ACTIONS IMPLEMENTATION:

n.a.

4. FOLLOW-UP ASSESSMENT BY THE IAEA REVIEW TEAM	**Date:** D3/M3/YYY3

4.1 – FACTS:

F1) n.a.

4.2 – DOCUMENTS REVIEWED:

n.a.

4.3 – RESOLUTION DEGREE:

1.	**Insufficient progress to date**	n.a.
2.	**Satisfactory progress to date**	n.a.
3.	**Issue resolved**	n.a.

n.a.: not applicable for the present mission.

1. ISSUE IDENTIFICATION	**Issue Number: E-1**
NPP: Koeberg	**Unit: 1 and 2**

Reviewed Area: Ageing management of civil SSCs

1.1 – ISSUE TITLE:

Incomprehensive revalidation of TLAAs for concrete structures

1.2 – FUNDAMENTAL OVERALL PROBLEM:

The plant has not comprehensively revalidated the TLAAs for concrete structures.

2. ASSESSMENT OF THE STATUS	**Date:** 31/03/2022

2.1 – FACTS:

F1) The TLAA for creep and shrinkage of concrete structures has not been identified.

F2) TLAA301: “Containment reanalysis” revalidates containment tendon pre-stress of units 1 and 2 with the original design data. The recent containment inspection reports clearly describe numerous surface damages as large scale delamination, progressing concrete carbonation front and chloride front, concrete cracks, exposed and corroded reinforcement bars and required repair measures to avoid further deterioration of the concrete structure. The effects of these deteriorations in the behaviour of the structures have not been incorporated in the analysis.

F3) The analysis is not based on finite element model which can be used for modelling of complex containment structure including concrete, rebars, tendons and liner. Instead, the excel files used for trending of monitored data of containment monitoring system, were used for TLAA301.

F4) Monitored strain gauge results are extrapolated to LTO from 40 years to 60 years. However, there are only a few strain gauges available for unit 1 and 2 containment dome. The plant has not evaluated the risk of failure of additional strain gauges during the next 20 years in LTO and has not taken action to perform compensatory measures to supplement the missing data. The evaluation to address this risk is in progress.

F5) There is missing or inadequate temperature calibration/correction of strain gauge measurements. Temperature monitoring is a precondition for accurate evaluation of results of strain gauges, pendulums and invar wires.

F6) Due to wire breakages and loss of data, data collection of Invar wire has started from 2005. The available data of invar wire measurements was not sufficient to analyse the global ageing behaviour of the containment structure during design lifetime. Therefore, monitoring data of Invar wire was not used in the report.

2.2 – SAFETY CONSEQUENCE: Without comprehensive revalidation of the TLAAs, the plant cannot demonstrate maintenance of the safety function of concrete structures.

2.3 – RECOMMENDATION/SUGGESTION:

S) The plant should consider improving revalidation of TLAAs for concrete structures.

2.4 – IAEA BASIS:

SSR-2/2 (Rev.1)

4.54 The comprehensive programme for long term operation shall address: (d) Revalidation of safety analyses made on the basis of time limited assumptions;

SSG-48

2.32. If a decision is taken to pursue long term operation, justification of the adequacy of ageing management for the planned period of long term operation should be provided, based on the results of periodic safety reviews [7] or the results of an adequate evaluation process (that includes scope setting, ageing management review and revalidation of time limited ageing analyses, as described in this Safety Guide), and this justification should be evaluated for adequacy by the regulatory body.

3.34. For in-scope structures or components, the operating organization should identify all time limited ageing analyses and should demonstrate either that all these analyses will remain valid for the planned period of long term operation, or that the structures or components will be replaced, or that further operation maintenance or ageing management actions will be implemented.

5.67. The validity of time limited ageing analyses over the intended period of operation should be ascertained by demonstrating satisfaction against one of the following criteria [5]: (a) The analysis should remain valid for the intended period of operation. The time dependent parameter value for the intended operating period should not exceed the time dependent

parameter value used in the existing analysis. (b) The analysis should have been projected to the end of the intended period of operation. The value of the analysis parameter value should be changed on the basis of the time dependent parameter projected for the intended operating period, and the value of the analysis parameter should continue to meet the regulatory limit or criterion. (c) The effects of ageing on the intended function(s) of the structure or component should be adequately managed for the intended period of operation. The value of the analysis parameter should be managed (using an ageing management programme) to ensure that ageing effects are adequately managed and that the value of the analysis parameter will continue to meet the regulatory limit or criterion throughout the intended period of operation.

7.28. Time limited ageing analyses should be reviewed to determine the continued acceptability of the analysed structure or component for the planned period of long term operation, in accordance with para. 5.67. The time dependent parameter should be determined from a re-evaluation or analysis of the operating history of the plant (including its projection to the end of the planned period of long term operation) to define a value of the parameter that applies to or bounds the expected value of the parameter at the end of the planned period of long term operation. The value of the time dependent parameter applicable to the period of long term operation should be used to re-evaluate the time limited ageing analyses, as described in para. 5.67.

2.5 – DOCUMENTS REVIEWED:

- Format: ID, Rev. XX (where appropriate), Title, Date (at least year);
- TLAA 301: D02-ARV-01-183-095_Kooeber, Rev. C. “Containment Reanalysis”, 11-10-2021
- L1124-GN-RPT-027, Rev. 2, Report on Operational Experience for the review of existing Koeberg TLAAs, 18-07-2019
- L1124-GN-RPT-045, Rev. 0, KNPS Civil TLAA 304 Foundation Settlement Assessment Report, 15-08-2019

3. HOSTING ORGANIZATION ACTIONS TO RESOLVE ISSUE	**Date:** D2/M2/YYY2

3.1 – RESULTS OF THE ISSUE ANALYSIS:

n.a.

3.2 – CORRECTIVE ACTIONS:

n.a.

3.3 – STATUS OF CORRECTIVE ACTIONS IMPLEMENTATION:

n.a.

4. FOLLOW-UP ASSESSMENT BY THE IAEA REVIEW TEAM	**Date:** D3/M3/YYY3

4.1 – FACTS:

F1) n.a.

4.2 – DOCUMENTS REVIEWED:		
n.a.		
4.3 – RESOLUTION DEGREE:		
1.	**Insufficient progress to date**	n.a.
2.	**Satisfactory progress to date**	n.a.
3.	**Issue resolved**	n.a.

n.a.: not applicable for the present mission.

1. ISSUE IDENTIFICATION	**Issue Number: E-2**
NPP: Koeberg	**Unit: 1 and 2**
Reviewed Area: Ageing management of civil SSCs	
1.1 – ISSUE TITLE: Not fully functional containment structure monitoring system	
1.2 – FUNDAMENTAL OVERALL PROBLEM: Containment structure monitoring system is not fully functional.	
2. ASSESSMENT OF THE STATUS	**Date:** 31/03/2022

2.1 – FACTS:

F1) Temperature monitoring is a precondition for accurate evaluation of results of strain gauges, pendulums and invar wires. However, some thermocouples linked to the strain gauges of containment monitoring system of unit -1 are not functional. The temperatures were calculated from coil resistances. This method does not provide accurate temperature values.

F2) Some strain gauges of containment dome of unit 1 are partially out of service and the strain gauges of unit 2 are out of service or are providing erratic values.

F3) The modification of the containment monitoring system is in the initial stage.

F4) Four pendulums in unit 1 named P2-A, P4-A, P1-B and P3-B show non-realistic behaviour compared to strain gauge evaluations in the same area. According to TLAA 301 (containment reanalysis report), one possible cause of the non-realistic behaviour is concrete repairs in this area with the consequence of corrosion effects. According to TLAA301, these pendulums need to be intrusively examined, refurbished and re-set, which is not completed.

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

2.3 – RECOMMENDATION/SUGGESTION:

R) The plant should ensure full functionality of the containment structure monitoring system.

2.4 – IAEA BASIS:

SSR-2/2 (Rev.1)

Requirement 14: Ageing management

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

4.51. Long term effects arising from operational and environmental conditions (i.e. temperature conditions, radiation conditions, corrosion effects or other degradations in the plant that may affect the long term reliability of plant equipment or structures) shall be evaluated and assessed as part of the ageing management programme. Account shall be taken in the programme of the safety relevance of structures, systems and components.

Requirement 16: Programme for long term operation

Where applicable, the operating organization shall establish and implement a comprehensive programme for ensuring the long term safe operation of the plant beyond a time-frame established in the licence conditions, design limits, safety standards and/or regulations.

Requirement 31: Maintenance, testing, surveillance and inspection programmes

The operating organization shall ensure that effective programmes for maintenance, testing, surveillance and inspection are established and implemented.

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

SSG-48

4.37. Surveillance programmes, including functional tests, that are consistent with NS-G-2.6 [10] should be in place and properly implemented for ageing management and evaluations for the long term operation of applicable in-scope SSCs.

NS G 2.6

8.51 Defective items, whether or not they have been removed from the plant, should be repaired in accordance with established procedures such as those for issuing equipment isolation work permits and work order authorizations, as appropriate.

2.5 – DOCUMENTS REVIEWED:

- TLAA 301: D02-ARV-01-183-095_Kooeber, Rev. C. “Containment Reanalysis”, 11-10-2021;

– KWR-IP-CIV-017, Rev. 0, Online Containment Monitoring – Measuring Vertical Displacement Using the Vertical Invar Wires, 08-11-2017; KWR-IP-CIV-018, Rev. 0, Pendulum wire measurements, 08-11-2017.
3. HOSTING ORGANIZATION ACTIONS TO RESOLVE ISSUE — **Date:** D2/M2/YYY2
3.1 – RESULTS OF THE ISSUE ANALYSIS: n.a.
3.2 – CORRECTIVE ACTIONS: n.a.
3.3 – STATUS OF CORRECTIVE ACTIONS IMPLEMENTATION: n.a.
4. FOLLOW-UP ASSESSMENT BY THE IAEA REVIEW TEAM — **Date:** D3/M3/YYY3
4.1 – FACTS: F1) n.a.
4.2 – DOCUMENTS REVIEWED: n.a.
4.3 – RESOLUTION DEGREE:

1.	**Insufficient progress to date**	n.a.
2.	**Satisfactory progress to date**	n.a.
3.	**Issue resolved**	n.a.

n.a.: not applicable for the present mission.

1. ISSUE IDENTIFICATION	**Issue Number: E-3**
NPP: Koeberg	**Unit: 1 and 2**
Reviewed Area: Ageing management of civil SSCs	
1.1 – ISSUE TITLE: Incomplete development and implementation of ageing management programmes for civil SSCs	
1.2 – FUNDAMENTAL OVERALL PROBLEM:	

Ageing management programmes for civil structures are not fully developed and implemented.

2. ASSESSMENT OF THE STATUS	**Date:** 31/03/2022

2.1 – FACTS:

F1) Leakage through leakage collection system of spent fuel pool of unit 2 was observed irregularly during the plant life, it has even stopped for a few years. An investigation was performed, but the root cause of the leak and disappearance of leak could not be found.

F2) Some remedial measures related to safety related structures were identified for implementation on an immediate basis during the last outage or inspection cycle (for example in Unit 2 Containment during External Outage 223 and External Outage 224) are still pending as confirmed from the SAP database.

F3) Leakages have been noted in sumps of the Nuclear Auxiliary Building 2, e.g. sumps located in N281 and N032 which belong to the Nuclear Islands Vents and Drains System (RPE). White residue and deposits are observed along cracks in the concrete on structural elements around or below these sumps. In both cases the sumps are unlined, and their contents are highly radioactive. The procedure to address unlined sumps is not completed yet.

F4) According to "Section 2.6: Process for Monitoring" of "331-148, Programme Engineer's Guide", the reporting frequency of programme Health Reports (PHRs) by the programme engineer is defined. However, the frequency to evaluate the effectiveness of the PHRs and impact on the plant safety and reliability by the Programme Oversight Committee (POC) and Engineering Programmes Technical Review Meeting is not defined.

F5) The various activities related to monitoring of spent fuel pool are currently performed by different departments whose analysis are not integrated.

F6) The development of an AMP related to spent fuel pool is not completed yet.

F7) The Table 1 of 240-165425812, Civil Ageing Management Programme Requirements Manual identifies the need for trending of concrete coating degradation. The related inspection procedure is being updated.

2.2 – SAFETY CONSEQUENCE:

Without complete implementation of ageing management programmes for civil SSCs, preservation of safety functions cannot be ensured.

2.3 – RECOMMENDATION/SUGGESTION:

S) The plant should consider completing and implementing the ageing management programmes of civil SSCs.

2.4 – IAEA BASIS:

SSR-2/2 (Rev.1)

Requirement 14: Ageing management

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

4.51. Long term effects arising from operational and environmental conditions (i.e. temperature conditions, radiation conditions, corrosion effects or other degradations in the plant that may affect the long term reliability of plant equipment or structures) shall be evaluated and assessed as part of the ageing management programme. Account shall be taken in the programme of the safety relevance of structures, systems and components.

Requirement 16: Programme for long term operation

Where applicable, the operating organization shall establish and implement a comprehensive programme for ensuring the long term safe operation of the plant beyond a time-frame established in the licence conditions, design limits, safety standards and/or regulations.

SSG-48

5.51. The ageing management programmes should be implemented in a timely manner to ensure that the intended functions of structures or components continue to be performed.

5.52. Detailed implementation procedures that describe preventive and mitigatory actions, monitoring or inspection and assessment actions, acceptance criteria, and corrective actions should be established and shared among the different units of the nuclear power plant (e.g. operations, maintenance and engineering units) that are responsible for implementing ageing management programmes. 5.53. As part of the implementation of the ageing management programmes, appropriate data should be collected and recorded to provide a basis for decisions on the type and timing of ageing management actions.

2.5 – DOCUMENTS REVIEWED:

- 1607525, Civil structure Inspection Report: Containment Unit 1- Visual Inspection (Vertical), 19-04-2021
- 1591696, Civil structure Inspection Report: Containment Unit 1- Visual Inspection (External) , 16-03-2020
- 1575355, Civil structure Inspection Report: Unit 2 Containment Structure Internal Outage 223, 04-10-2019
- Draft Report 240-166959159, Rev.0, AMP for stainless steel lined compartments and epoxy coated sumps, (in progress)

3. HOSTING ORGANIZATION ACTIONS TO RESOLVE ISSUE	**Date:** D2/M2/YYY2

3.1 – RESULTS OF THE ISSUE ANALYSIS:

n.a.

3.2 – CORRECTIVE ACTIONS:

n.a.

3.3 – STATUS OF CORRECTIVE ACTIONS IMPLEMENTATION:

n.a.		
4. FOLLOW-UP ASSESSMENT BY THE IAEA REVIEW TEAM	**Date:** D3/M3/YYY3	
4.1 – FACTS: F1) n.a.		
4.2 – DOCUMENTS REVIEWED: n.a.		
4.3 – RESOLUTION DEGREE:		
1.	**Insufficient progress to date**	n.a.
2.	**Satisfactory progress to date**	n.a.
3.	**Issue resolved**	n.a.

n.a.: not applicable for the present mission.