AGEING MANAGEMENT & LONG TERM OPERATION OF NPP

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The nuclear sector in South Africa is mainly governed by:
- Nuclear Energy Act, (Act no. 46 of 1999)
- National Nuclear Regulator Act (NNRA), (Act no. 47 of 1999)

These Acts are administrated by the Minister of Energy, through the Department of Energy (DoE).

The DoE has overall responsibility for nuclear energy in South Africa.

The DoE is also responsible for the national implementation of South Africa’s international obligations in the area of safeguards, as well as the safety and security of nuclear material and facilities.
REGULATORY FRAMEWORK

- NNR Act (No. 47 of 1999), which defines the authority of the regulator.
- The NNR exercises regulatory control for NPP through the nuclear installation licence NIL-01 issued in terms of the NNR Act, which includes conditions to ensure that the safety related aspects of the plant design are complied with.
- Regulatory requirements & guidance documents
  - LG 1041: A guide to the licensing requirement for ISI of NI
- Industry documents which are captured in the licences, and which are therefore binding on the holder.
  - E.g. KLBM-37-197 Rev.1
KOEBERG NUCLEAR POWER STATION

• South Africa has one Nuclear Power Station, owned and operated by Eskom
• KNPS consists of two 3-loop PWR’s, each rated to 2785MWth, that are constructed to the French Framatome design.
• Koeberg NPP is designed for an operating life of 40 years
The Principal Safety Requirements formulated in the SSRP form the basis for the stipulation of the Basic Licensing Requirements (BLR) for the nuclear installation.

The licensee has the prime responsibility for safety throughout the lifetime of the installation and the responsibility cannot be delegated.

The BLR for the nuclear installations are established with the objective of assuring an acceptable level of safety to the public and workers from radiation hazards.

Includes the SAR, GOR, nuclear safety requirements, principal safety documentation that demonstrates compliance with these requirements, and all licence-binding documentation.
LICENSING BASIS FOR KNPS (2/2)

- Constitutes the basis for the safe operation of nuclear installation and the issuance of the NIL.
- In order for the NNR to grant a licence to operate, the following principles amongst others must be applied for all activities which have an impact on nuclear safety.
  - Good Engineering Practice
  - Accident prevention and mitigation
  - Defence in Depth
  - Optimization of protection and safety
  - Fundamental safety criteria
  - Safety Culture
• To ensure safety of the installation the licensee is guided by the principles that are presented in the SSRP.

• SSRP (4.3): The maintenance and Inspection programme must be implemented to ensure that the reliability and integrity of installations, equipment and plant having an impact on radiation and nuclear safety are commensurate with the dose limits and risk limits.

• The licensee is responsible to ensure that all operational safety related programmes are implemented and maintained accordingly.

• The licensee must ensure that a system of record keeping for all records specified in nuclear authorisation is established, implemented and maintained.
THE REQUIREMENTS ON LICENSEES (2/3)

• To develop and maintain a documented safety case which demonstrates compliance with the requirements of the NNR regulations and international standards.

• To establish and implement an inspection programme to ensure compliance with the requirements of the nuclear installation licence and provide any information at a frequency required by the NNR.
  – This includes: Incident and accident notification, investigation and closeout reports, QA and audit reports including closeout reports, Environmental monitoring reports, etc.
• The Nuclear Installation Licence (NIL) requires that the licensee must comply with the provisions specified in 36-197: “Koeberg Licensing Basis Manual”, regarding the following:
  – In-service inspection of components, including the monitoring of the RPV for radiation embrittlement.
  – Monitoring and maintenance of the plant.
The issues related to the ageing of the plant (1/2)

- The Koeberg Ageing Management Programme is conducted in line with international practice to ensure the availability of safety related equipment throughout the life time of the plant.
- This is a process of addressing physical degradation of safety related SSC’s.
- The Koeberg maintenance programme followed the maintenance regimes prescribed by the original OEM’s and influenced by Koeberg and EDF plant operating experience.
- The ISI Programme for Koeberg is aligned with the requirements of ASME Section XI and has added an augmented portion that caters for expected specific degradation.
The life cycle management process manages several plant-ageing concerns which are then integrated into:

- plant maintenance,
- refurbishment,
- inspection, and
- environmental monitoring programmes.

Plant ageing is one of the aspects assessed during the PSR.
• The NNR ensures that the licensee meets its primary responsibility by conducting a compliance assurance programme.

• The compliance assurance programme is based on safety goals that were developed from the principal radiation protection and nuclear safety requirements of the Safety Standards and Regulatory Practices (SSRP).

• The compliance assurance programme provides assurance of
  – the state of health of plant,
  – processes,
  – organisation and
  – environment in terms of identified safety goals.
• NNR regularly assess the monitoring and inspection programme implemented by the licensee, to ensure compliance with the nuclear authorization.

• The monitoring processes implemented by the NNR include the following:
  – Periodic reviews and safety assessments
  – Technical assessments and reviews conducted on submissions by the licensee
  – Inspections, audits and surveillances conducted in terms of the compliance inspection programme
PERIODIC SAFETY REVIEW

• The nuclear installation licence for KNPS requires that the safety assessment of the plant must be maintained and updated on a regular basis and at a frequency that is accepted by the NNR.

• Eskom adopted the international accepted practice of a 10 yearly frequency for the periodic safety re-assessment.

• The periodic safety re-assessment for KNPS take into account the:
  – Cumulative effect of plant ageing and modifications
  – Local and international operating experience
  – Technical development
  – Validation of an up to date safety assessment to ensure a focused licensing process.
LONG TERM OPERATION (1/4)

• KNPS was commissioned in 1984 (Unit 1) and 1985 (Unit 2)
• The expected design operating lifespan of 40yrs will be reached in 2024/5.
• Eskom has informed NNR of its intent to operate Koeberg beyond the operation life of 40yrs.
• Eskom submitted the licensing basis updates to support the Long Term Operation of Koeberg Unit 1&2
• The work covered under the project includes:
  – Replacement of the Steam Generators for both Units
  – Refuelling Water Storage (PTR Tank) replacement
  – Unit 2 Reactor Pressure Vessel Head Replacement.
  – Exploring options for additional fuel storage capacity
LONG TERM OPERATION (2/4)

• Eskom has embarked on the programme that would:
  – Improve the current suite of Ageing Management programmes
  – Review and update Koeberg’s time limited ageing analyses
• In conjunction with NNR requirements, Koeberg will utilise the IAEA SALTO process as the guideline for assessing and updating the Koeberg licensing basis for LTO.
  – IAEA SR-57: Safe Long Term Operation of Nuclear Power Plants
• Eskom has submitted the licensing framework for LTO to the NNR and it is under review.
In 2014 the IAEA started the process of Safety Aspects of Long Term Operation (SALTO) peer review service for KNPS.

The SALTO program of support runs for a period of 8 years and ends in 2022.

The work will be conducted as a project, called the Koeberg SALTO Assessment Project, which will follow the requirements of the IAEA SALTO process.

Eskom hosted the IAEA Pre-SALTO Mission in November 2015, precursor to the actual SALTO mission in 2020.
• NNR received the Pre-SALTO Mission report and will monitor the commitment of Eskom in implementing actions/safety improvements to resolve the recommendations/suggestions that were raised in the report.

• The IAEA SALTO review objective is to:
  – Provide the licensee with an objective assessment of readiness for LTO
  – Provide the licensee with recommendations and suggestions for improvement.
IAEA SUPPORT FOR LTO

• The NNR requested expert support from the IAEA through a workshop regarding regulatory activities for SALTO.

• The IGALL and SALTO training workshop for NNR was held during the week of 28-30 April 2015 at the NNR office in Centurion.

• Three experts from USA, Sweden and Netherlands were invited to share their knowledge and their countries experiences regarding SALTO and IGALL.

• The workshop included participants from both licensee (Eskom) and the regulator (NNR).
IAEA SUPPORT FOR LTO

- IAEA SALTO Expert Mission was held during the week of 11-13 May 2016 at the NNR office in Centurion.
- The scope of assistance covered the following:
  - IAEA recommendations in the area of LTO and AM
    - IAEA Safety Standards and other documentation related to LTO and ageing management
    - New Safety Guide on ageing management and LTO
    - Utilization of IGALL Safety Report
    - Lessons learned from SALTO peer review service
  - Provide presentations on regulatory approaches to:
    - Regulatory requirements for LTO, AMR, AMPs and TLAAs
    - Licensing procedure for LTO, interaction with plants
    - Lessons learned from licensing process, cooperation with IAEA
  - Perform review of NNR regulatory approach for LTO and ageing management:
    - Regulatory requirements
    - Licensing procedure
    - Interactions with licensee
THANK YOU

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