LTO License Application Project
NPP Borssele

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Geography
Background LTO

- 2-loop PWR designed and built by Siemens Kraftwerk Union (German company, now part of AREVA-NP)
- Commercial operation since 1973 (40 y design life: 2013)
- 1994: political agreement closing NPP Borssele in 2003
- 1994-2006: lawsuits and political discussions about closing date of NPP Borssele, no end of license date
- 2004: feasibility study on ageing mgt investments for 60 years: scope of investments no threat for LTO!
- 16 June 2006: The Borssele Agreement 2034!
- From 30 to 40 to 60 years perspective in only a few years
Background LTO

Covenant on June 16th 2006:
- Long Term Operation to 2034

LTO Conditions:
- Safe operation demonstration
  - Borssele should be among the 25% safest Western light-water reactors
- License change for operation after 2013
Regulatory Framework LTO

- Nuclear Energy Act (Kernenergie wet)
  - Nuclear Safety Rules (NVR), based on IAEA Safety Standard Series
  - NVRs provide no guidance on LTO

- PSR every 10 years
- Unlimited license (but agreement to shutdown before 2034)
- Safety Report: design life 40 years (TLAAs)

- Basis by IAEA LTO guidelines
  - IAEA Safety Report No. 57 (Safe Long Term Operation of Nuclear Power Plants)

- Review for Dutch regulator (KFD)
  - IAEA SALTO peer reviews
  - GRS: review of all LTO reports
Additional Requirements:

Dutch regulator KFD:

- IAEA limited scope SALTO peer review 2009:
  - Verification of preconditions
  - Active Components

- Include in LTO license change application:
  - PSR Safety Factor 10 (Organisation and Administration)
  - PSR Safety Factor 12 (Human Factor)
LTO project overview

LTO "bewijsvoering" KCB

Feasibility (3.1)
Verification of preconditions (3.2)

IAEA Safety report Nr 57 Safe Long Term Operation of Nuclear Power Plants
IAEA guidelines

Scoping (4.1)
Screening (4.2)

IAEA NS-G-2.12 (ch 6) Ageing Management for Nuclear Power Plants

Regulatory framework

Check of existing plant programmes

Mechanical A (barrier concept) Mechanical B Electrical Civil / structural

Documentation of basis for LTO

Active
Mechanical
Civil / structural
Electrical

Passive

AMR (5)

TLAAs (6)

RPV Fatigue LBB EQDBA

VROM Regulatory Oversight

Phase LTO assessment (SR57, fig1)

Phase LTO approval & implementation (SR57, fig1)
LTO project overview

• KCB project LTO “bewijsvoering” based on IAEA Safety Report 57:
• Feasibility and verification of preconditions;
• Scoping, screening and Ageing Management Reviews;
• Revalidation of the following TLAAs:
  - Reactor Pressure Vessel (RPV);
  - Fatigue;
  - Leak Before Break;
  - Qualification of Design Base Accident resistant electrical Equipment.
• Assessment of active components;
• Documentation for LTO basis;
• Regulatory oversight and the KCB implementation of plant commitments.
• The outcome of the project LTO “bewijsvoering” will be submitted to the Dutch regulator KFD for a license change procedure for long term operation of KCB until 2034.
LTO Assessment

Scoping (4.1)
Screening (4.2)

AMR (5) Passive
Mechanical A (barrier concept)
Mechanical B
Electrical
Civil / structural

TLAAs (6)

RPV
Fatigue
LBB
EQDBA

Non technical requirements
IAEA Draft Safety Guide No. 426
Periodic Safety Review of Nuclear Power Plants
SF 10 & 12
Civil / structural
VROM
Regulatory Oversight

Phase LTO assessment (SR57, fig1)
Phase LTO approval & implementation (SR57, fig1)

Documentation of basis for LTO
Scoping & Screening

- Identification of systems, structures and components that are:
  - important to safety
  - not important to safety, but whose failure may impact SSCs important to safety
- Scoping: system level
- Screening: further detailing on structure/component (SC) or commodity level

Two groups:
1. Passive: AMR
2. Active: check existing programmes

For AMR 4 groups:
- Mechanical A (barrier concept)
- Mechanical B (rest of scope)
- Electrical and I&C
- Civil/structural
LTO Assessment: AMR

Ageing Management Review
- Process description, from SR57
- Discipline based approach
- EPZ/AREVA/NRG project
LTO Assessment: AMR

- 17 Ageing Management Review reports (3 disciplines)
- A catalog of relevant aging mechanisms (3 disciplines)
- Recommendations were made to improve KCB programs
- The effects of ageing on in-scope SCs is adequately managed
- Reports currently reviewed by Dutch nuclear regulatory authority
**Active components**

- **LTO "bewijsvoering"**
- **KCB**
- **Feasibility (3.1)**
- **Verification of preconditions (3.2)**
- **Scoping (4.1)**
- **Screening (4.2)**

**Check of existing plant programmes**

- **TLAAs**
- **RPV**
- **EQDBA**
- **LBB**
- **Fatigue**

**Documentation of basis for LTO**

**IAEA Safety report Nr 57**

- **Safe Long Term Operation of Nuclear Power Plants**
- **IAEA NS-2.12 (ch.6)**

**Ageing Management for Nuclear Power Plants**

- **Mechanical A** (barrier concept)
- **Electrical**
- **Civil/structural**
- **Mechanical B**

**Implementation of plant commitments for LTO**

**Active AMR (5)**

**Passive**

**Regulatory framework**

- **IAEA guidelines**

**Phase prior to LTO assessment**

- **(SR 57, fig 1)**

**Phase LTO assessment**

- **(SR 57, fig 1)**

**Phase LTO approval & implementation**

- **(SR 57, fig 1)**

**Non technical requirements**

- **IAEA Draft Safety Guide No. 426**

**Periodic Safety Review of Nuclear Power Plants**

- **SF 10 & 12**

**Civil/structural**

**VROM**

**Regulatory Oversight**

**NRG**
LTO Assessment: TLAAs

Time Limited Ageing Analyses (TLAAs)

- Reactor Pressure Vessel (RPV)
- Fatigue
- Leak Before Break (LBB)
- Qualification of Design Base Accident resistant electrical Equipment (EQDBA)
RT_{NDTj} = 18°C (55 full power years)

RT_{T0j} = 3°C
TLAA Fatigue

- Determination of TLAA fatigue scope
- Implementation FAMOS 2010
- Fatigue demonstration (LTO license) based on conservatism in loads and number of loads
- Environmental fatigue issue, new KTA rule awareness thresholds used in preliminary proof
- Fatigue programme carried out in coming years, taking into account new measurement data and environmental fatigue
TLAA Leak Before Break

The goal of the review is the answer to the question:

- Is the concept Break Preclusion (Bruchausschluß) as entered in 1997 still valid in case of plant life extension to 2034?

- Scope:
  - Primary Piping
  - Main steam and Feedwater Lines within the secondary containment

- The time dependent assumptions in LBB TLAAs are not restricting operation for 60 years
TLAA EQDBA

Qualification of Design Base Accident resistant electrical Equipment (EQDBBA)

Monitoring program environmental conditions (2007-2009)

AUREST
Automated Residual Lifetime Estimation (1st phase finished in 2009)

- Components with insufficient data:
  - Requalification program
  - Replacement program
Summary

- LTO demonstration project based on IAEA Safety Report 57
- Main parts are:
  - Scoping and screening
  - Ageing Management Review
  - Revalidation of TLAAs (RPV, fatigue, LBB and EQDBA)
- Project results are currently reviewed by the authorities
- Two IAEA SALTO peer reviews are carried out
- Licensing application project in progress, based on results of LTO demonstration project