



LTO Track Opening

NRG Ageing Management and LTO Activities

Key words: ageing management, LTO, LTO beyond 60 years

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Ing. Robert Krivanek, Ph.D.

He received his master and doctor degrees in mechanical and nuclear engineering. He has 29 years of experience in nuclear industry. Since 1994 he was with CEZ in the Czech Republic in various positions in operations, engineering and nuclear safety. His main focus was on ageing management and preparation of NPPs for long term operation (LTO).

Since 2012 he served for the International Atomic Energy Agency (IAEA) in Vienna, Austria as an ageing management and LTO programme manager.

Since 2021, he has been working for Nuclear Research and consultancy Group (NRG) in the Netherlands as a manager for international ageing management and LTO activities.





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- LTO Track – objectives, organizational matters
- NRG activities in ageing management and LTO
- ‘LTO Beyond 60 Years’ project



NIC 2024 Programme

- Keynote plenary session 1
- Track 1 – LTO (ageing management and LTO of NPPs)
 - Session 1.1: Regulatory approaches and research
 - Session 1.2: Industry challenges
- Track 2 – New Build
 - Session 2.1: Government
 - Session 2.2: Industry and supply chain
- Track 3 – Advanced Reactors
 - Session 3.1: Reactor developers
 - Session 3.2: Cooperation within the advanced reactor eco-system
- Keynote plenary session 2

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NIC 2024 – LTO track objectives

- Organizational and technical issues connected with ageing management and LTO up to 60 but also beyond 60 years
- Share experience and lessons learned from implementation and improvement of systematic ageing management
- Address activities related to LTO justification and demonstration like PSR, license renewal applications, EIA
- All from operators` and regulators` perspective



LTO Session 1.1: Regulatory approaches and research

13:00-16:30	Track 1 – LTO, Session 1.1: Regulatory approaches and research
13:00-13:30	Track opening: NRG activities in ageing management and LTO, Robert Krivanek (NRG, The Netherlands)
13:30-14:00	Subsequent Licensing Renewal – US fleet perspectives, regulatory and industry challenges, John Wise (NRC, USA)
14:00-14:30	Czech regulator perspective on LTO, Hana <u>Dlouha</u> (SUJB, Czech Rep.)

14:30-15:00	Coffee break
15:00-15:30	French regulatory approach and expectations for LTO, Rachel Vaucher (ASN, France)
15:30-16:00	EPRI Research on LTO to Support Climate Change Goals and Energy Security Needs, Garry Young (EPRI, USA)
16:00-17:00	Panel session moderated by Robert Krivanek (NRG, The Netherlands)



LTO Session 1.2: Industry challenges

9:10-9:40	Koeberg NPP path to demonstrate safe LTO – synergies of SALTO and PSR activities, <u>Bravance Mashele</u> (Koeberg NPP, South Africa)
9:40-10:10	Preparation of LTO of <u>Atucha 1 NPP</u> , <u>Marcelo Liendo</u> (Atucha NPP, Argentina)
10:10-10:40	Subsequent Licensing Renewal— <u>Paks NPP</u> , <u>Pal Weisz</u> (Paks NPP, Hungary)
10:40-11:10	Coffee break
11:10-11:40	Digital Twins for Improving Accuracy of Thermal Fatigue and EQ TLAAs, <u>Miguel Calatayud</u> (Cofrentes NPP, Spain) and <u>David Galbally</u> (Innometrics S.L., Spain)

11:40-12:10	From LTO-project to AM in the long term, <u>Joakim Thulin</u> and <u>Mr. M.Hagglund</u> (Forsmark NPP, Sweden)
12:10-12:40	Ageing management from commissioning to subsequent LTO periods, <u>Kari Makela</u> (OSS, IAEA)
12:40-13:40	Lunch
13:40-14:10	LTOP - <u>Loviisa NPP LTO programme</u> , <u>Atte Moilanen</u> (Loviisa NPP, Finland)
14:10-15:10	Panel session moderated by <u>Robert Krivanek</u> (NRG, The Netherlands)



NIC 2024 – LTO track organization

- Track leader will introduce speaker
- Speakers have 30 min timeslots
- Max 25 min for presentation + 5 min Q&A
- Track leader keeping time (signal after 20 minutes to conclude)
- Sticky notes to be provided to audience to collect questions
- One junior engineer will provide briefing about LTO session topics, discussions and conclusions in plenary session



Useful NIC2024 LTO track related links

- Associated webinars:
www.nuclearinnovationconference.eu/webinars
- Associated workshops:
www.nuclearinnovationconference.eu/workshops
- News and articles:
www.nuclearinnovationconference.eu/news



Ensuring Nuclear
Performance



Advancing
Nuclear Medicine



Advanced reactor
development



Nuclear new build
projects



Operational
support



Long term
operation



Decommissioning
services



NRG provides services in ageing management and LTO under brand name



TULIP LTO covers:

- Ageing management and LTO project management/ overall support
- Methodologies development
- Scope setting
- Ageing management reviews
- Development, implementation and improvement of AMPs
- Identification and revalidation of TLAAs
- PSR preparation and conduct
- Data management
- All in line with IAEA safety standards



NRG ageing management and LTO support



Focus areas:

1. Capacity building in ageing management, LTO and PSR
2. Technical support, calculations, analyses, project management support
3. Preparation of facilities personnel for review missions such as SALTO, OSART
4. Support in resolution of missions findings



NRG ageing management and LTO support

Our clients:

Operators and regulators of NPPs and research reactors:

- In early phase of operation
- Preparing for LTO
- In LTO period improving ageing management to further operate





NRG ageing management and LTO projects and activities



- Borssele NPP, the Netherlands
- Ringhals NPP, Sweden
- Olkiluoto NPP, Finland
- Atucha NPP, Argentina
- Oskarhamn NPP, Sweden
- Trillo NPP, Spain
- Koeberg NPP, South Africa
- Mihama NPP, Japan
- Doel and Tihange NPPs, Belgium
- HFR, the Netherlands
- IAEA SALTO missions
- IAEA IGALL programme
- NRG national R&D program (PIONIER)



‘LTO beyond 60 Years’ project

Objectives:

- Map the status of knowledge regarding LTO of NPPs beyond 60 years and identify potential gaps in knowledge and technology
- Identify possible solutions to disposition the areas that need enhancement

Deliverables: Status report on ‘LTO beyond 60 years’

- The report will focus on technical and safety aspects of safe LTO beyond 60 years for PWRs (including VVERs), but also BWRs and PHWRs (including (CANDUs)



‘LTO beyond 60 Years’ project

- Initiated as a part of NRG PIONIER research project, funded by the Dutch Government, to collect and analyze available information regarding preparation of NPPs for safe LTO beyond 60 years
- Transformed to OECD/NEA project under NRG coordination in two phases:
 1. Direct collaboration with individual experts/ organizations to assemble the draft report
 2. OECD/NEA WGIAGE collaboration project “Status report on LTO Beyond 60 Years” to broaden the expertise and bring new perspectives through a technical questionnaire



‘LTO beyond 60 Years’ project – Phase 1

Phase 1 - Direct collaboration with individual experts

- Q4 2022 - NRG developed the structure of the final report, project planning
- Q1 2023 - NRG drafted initial versions of sections 1-5
- Q2/3 2023 - NRG incorporated inputs of collaborating experts

Contributions received from:

- Canada: CNSC, Atkins-Realis
- Czech Republic: ÚJV Řež, CEZ
- Finland: TVO
- International Atomic Energy Agency (IAEA)
- International Nuclear Utility Obsolescence Group (INUOG)
- The Netherlands: NRG (other teams)
- Sweden: Vattenfall - Ringhals NPPs
- Switzerland: Leibstadt NPP
- USA: EPRI
- World Nuclear Association (WNA)



‘LTO beyond 60 Years’ project – Phase 2

Phase 2 – OECD/NEA WGIAGE ‘LTO beyond 60 Years’ project

- Broaden the level of expertise with new international perspectives
- Balance the content of different subsections to the similar level of detail
- Bring new concerns into perspective based on a technical questionnaire
- All contributors from Phase 1 continued to collaborate
- 16 new collaborators from a very diverse spectra joined:
 - regulatory authorities
 - international organizations
 - research institutes
 - utilities



‘LTO beyond 60 Years’ project participants

Research institutes:

- Belgium: SCK CEN
- Czech Republic: UJV Rez
- Finland: VTT
- France: IRSN
- Germany: GRS
- Sweden: Studsvik Nuclear
- Switzerland: PSI
- USA: EPRI

Nuclear regulators:

- Canada: CNSC
- France: ASN
- The Netherlands: ANVS
- Sweden: SSM
- Switzerland: ENSI
- United Kingdom: ONR
- USA: NRC

Utilities:

- Czech Republic: CEZ (Dukovany and Temelin NPPs)
- Belgium: Electrabel (Doel & Tihange NPPs)
- Finland: TVO (Olkiluoto NPP)
- France: EDF
- Netherlands: EPZ (Borssele NPP)
- Sweden: Vattenfall (Ringhals NPP)
- Switzerland: KKL (Leibstadt NPP)

Other organizations:

- Canada: Atkins Realis
- EU JRC
- IAEA
- INUOG
- OECD/NEA: WGIAGE, SDOCB, WGHOFF
- SNETP
- Switzerland: Swissnuclear
- United Kingdom: Westinghouse, WNA



‘LTO beyond 60 Years’ - milestones

2022:

- **NRG project initiation (Oct 2022)**
- **Survey to identify available information sources, agree on cooperation with external contributors (Nov 2022)**
- **Project planning, structure of the project report (Dec 2022)**

2023:

- **The initial version of the project report developed (June 2023)**
- **OECD/NEA project approved (June 2023)**
- **Approval and distribution of the technical questionnaire (Aug 2023)**
- **Collecting answers to the technical questionnaire and additional inputs to the project report (Dec 2023)**



‘LTO beyond 60 Years’ - milestones

2024:

- Project progress meeting in Petten (27-28 Feb 2024)
- NRG to present the interim report to WGIAGE (March 2024)
- **Task Team to review sections 2-5 (Feb-April 2024)**
- **NRG to finalize sections 2-5 (April-May 2024)**
- **Task Team to draft conclusions in section 6 (June-July 2024)**
- Task Team to review conclusions (July-Aug 2024)
- NRG to compile conclusions and finalize section 6 (Sep 2024)
- **Task Team to develop proposals for gaps dispositioning (Sep 2024)**
- NRG to compile gaps dispositioning (Oct 2024)
- **Task Team to review proposals for gaps dispositioning (Nov 2024)**
- **NRG to finalize Section 7 (Dec 2024)**



‘LTO beyond 60 Years’ - milestones

2025:

- NRG to present the results of the activity to WGIAGE annual meeting (March 2025)
- OECD/NEA CSNI to approve the final report (June 2025)
- OECD/NEA and NRG to share the findings and the recommendations with all the participants of the project, to disseminate the results internationally via workshops, OECD/NEA and IAEA WG/ SC meetings (Q3+Q4 2025)



Project report structure

1. Introduction

2. LTO perspective and regulatory background

3. Non-technical challenges for safe LTO of NPPs

4. Technical challenges important for LTO beyond 60

5. Safety requirements important for LTO beyond 60

6. Conclusions for NPP operation beyond 60 years

6.1. Areas properly addressed

6.2. Identified areas for enhancement

7. Proposed dispositioning of identified areas for enhancement



Project report structure

Section 4. Technical challenges important for LTO beyond 60

4.1. General considerations

4.2. Reactor pressure vessel

4.2.1 Description of RPV

4.2.2 Physical ageing

4.2.3 Inspection and diagnostic methods

4.2.4 Repair, refurbishment, replacement solutions

4.2.5 Potential gaps for LTO beyond 60

4.3. RPV internals

4.4. Steam generators

4.5. Class 1 piping

4.6. Buried and underground piping

4.7. Concrete containment and other civil structures

4.8. Electrical cable systems

4.9. I&C safety systems and transition to digital



Current status (as of June 2024)

- General sections 1, 2, 3 are completed
- Main sections 4 and 5 are compiled but can be still improved
- Section 6 Conclusions in development
 - 6.1. Areas properly addressed
 - 6.2. Identified areas for enhancement
- Section 7 “Proposed dispositioning of areas for enhancement” shall determine for areas for enhancement following types of actions:
 - Further R&D work needed (test, assess, predict behavior)
 - Development/ revision of codes, standards, regulations,
 - Enhanced testing, monitoring, inspection, diagnostics
 - New repair / replacement methods
 - Other soft solutions (more training on ageing management and LTO, improved operating/ maintenance/ chemistry procedures)



Conclusions

- OECD/NEA 'LTO beyond 60 Years' project is in a key year to achieve high quality results
- We are open to accept additional experts/ organizations to contribute to development conclusions on individual topics (section 6) as well as proposals for dispositioning of identified gaps (section 7)
- Project report will be approved and available in Q2 2025
- Results disseminated in Q3/Q4 2025



Thank you for your attention!

Any questions?



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