Ageing Management and Long Term Operation of Nuclear Power Plants

Senior Regulators' Meeting

17 September 2015

Jan BENS

FANC

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AGENDA

- Belgian Nuclear Reactor Sites
- LTO Legal Framework
- LTO Regulatory Framework
- FANC Strategic Note on LTO
- SALTO mission at TIHANGE-1
- LTO for DOEL-1 and DOEL-2
- New development: SALTO for Research Reactors

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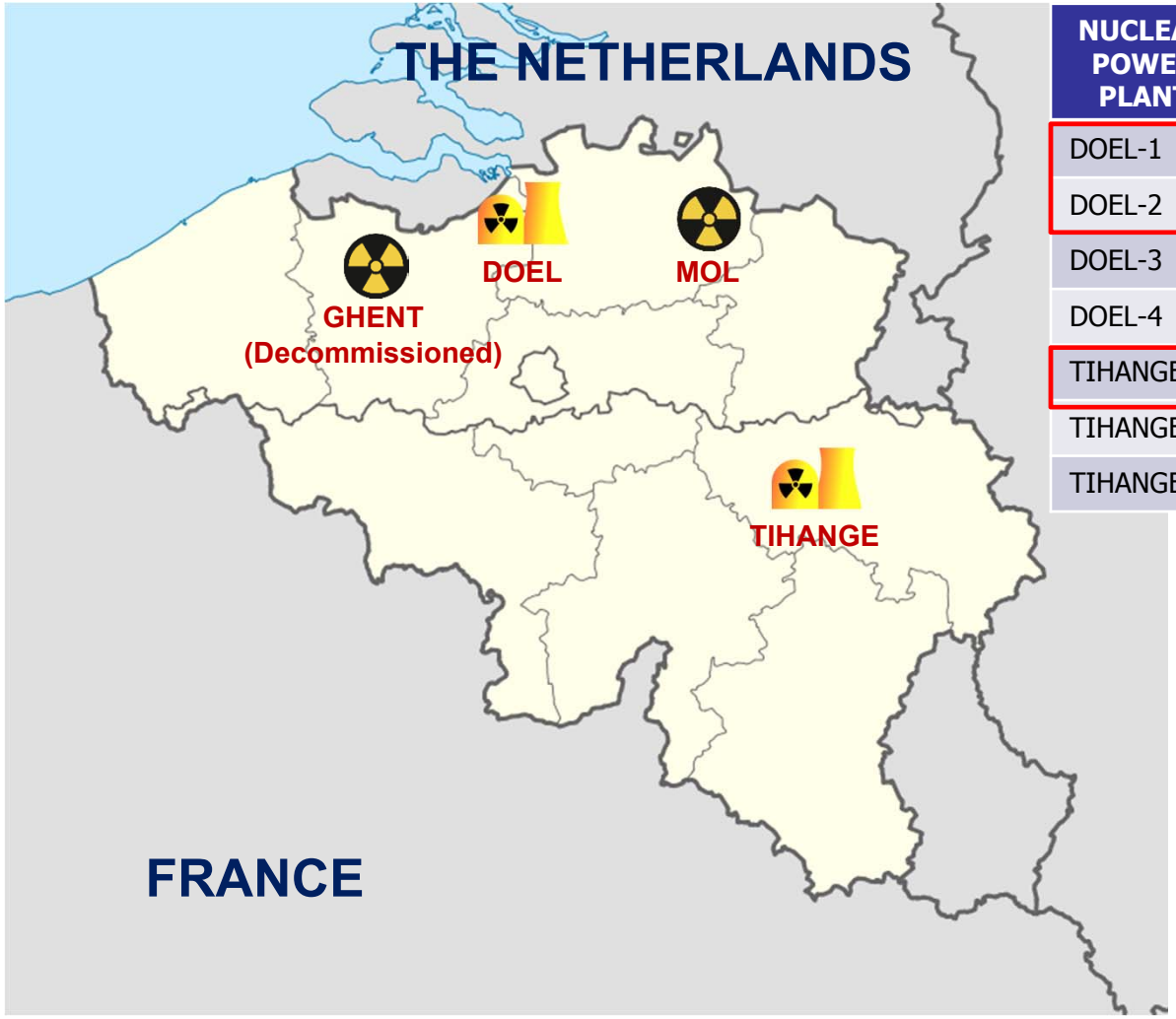
Belgian Nuclear Reactor Sites



NUCLEAR POWER PLANT	POWER OUTPUT (MWe)	Date of first commercial operation	Date of last commercial operation
DOEL-1	433	15/02/1975	~~15/02/2015~~
DOEL-2	433	01/12/1975	~~01/12/2015~~
DOEL-3	1006	01/10/1982	01/10/2022
DOEL-4	1039	01/07/1985	01/07/2025
TIHANGE-1	962	01/10/1975	~~01/10/2015~~
TIHANGE-2	1008	01/02/1983	01/02/2023
TIHANGE-3	1046	01/09/1985	01/09/2025

= NUCLEAR POWER PLANT

= RESEARCH REACTOR

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LTO Legal Framework


BELGISCH STAATSBLAD | MONITEUR BELGE

- **2003 "Law on gradual phase-out of nuclear power"**
  - Art. 4: Existing NPPs must cease operating after 40 years (2015-2025)
  - Art. 9: If electricity supply is threatened, the appropriate measures can be taken
- 2009: New Government announced intention to change phase out law (protocol agreement with GDF-Suez)
  - DOEL-1, DOEL-2 and TIHANGE-1 could operate until 2025 (50 years)
- 2013: Phase Out Law was changed:
  - DOEL-1 and DOEL-2 definitively stopped in 2015
  - LTO for TIHANGE-1: could operate until 2025 (50 years)

LTO Legal Framework (2)


BELGISCH STAATSBLAD | MONITEUR BELGE

- 2014: New Government announced intention to change phase out law once more
  - DOEL-1 and DOEL-2: could operate until 2025 (50 years)
- 2015: Confirmation by Law of Government decisions:
  - LTO for DOEL-1 and DOEL-2: could operate until 2025 (50 years)


DOEL-1 was already shut down when law was approved!

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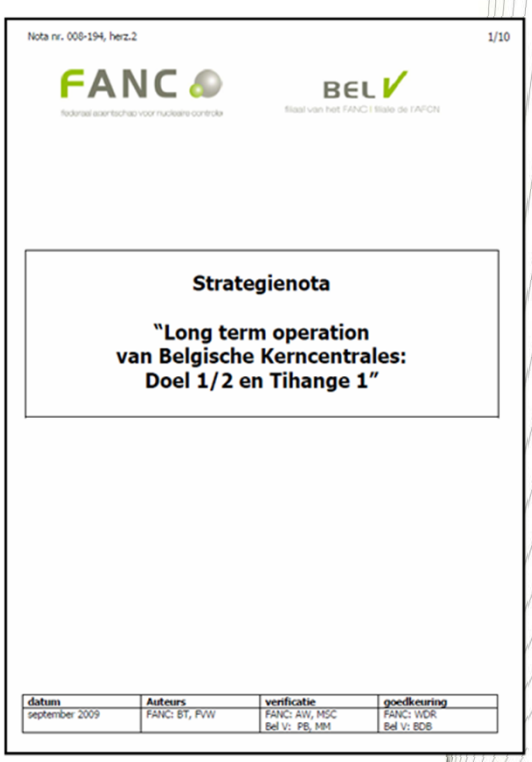
LTO Regulatory Framework (1)

- NPP License conditions in Belgium
  - No time limit in license
  - PSR: Periodic Safety Review (every 10 years)
    - Confirm plant is as safe as originally intended
    - Justify current safety levels by comparing with new standards, codes and identify areas for improvement
    - DOEL-1, DOEL-2, TIHANGE-1: 4th PSR (after 40 years) scheduled in 2015

LTO Regulatory Framework (2)


Nota nr. 000-194, herz.2 1/10

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BEL V

Strategienota

"Long term operation van Belgische Kerncentrales: Doel 1/2 en Tihange 1"

datum	Auteurs	verificatie	goedkeuring
september 2009	FANC: BT, PVW	FANC: AW, MSC Bel V: PB, MM	FANC: WDR Bel V: BDB

2008 - 2009

Development of LTO-policy by FANC-Bel V

- Analysis of relevant international requirements (IAEA, US NRC,…)
- Meetings with other safety authorities (NRC, ASN,…)

Final result:

FANC- Bel V (2009)

« Strategic Note on LTO for Belgian NPP TIHANGE-1 and DOEL-1 and DOEL-2 »

Eventual forthcoming LTO's for Belgian NPPs DOEL-3, DOEL-4, TIHANGE-2 and TIHANGE-3 are not concerned by this strategic note.

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Strategic Note on LTO

SCOPE

- LTO feasibility depends on many factors (safety, socio-economic, financial, …)
- Scope of strategic note **limited to safety aspects** (no security or environmental issues)
- Installations: DOEL-1, DOEL-2 and TIHANGE-1

DOEL-1 and DOEL-2

TIHANGE-1

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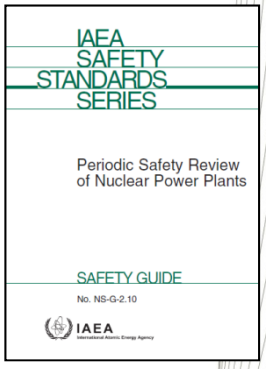
Strategic Note on LTO (2)

GENERAL FRAMEWORK

- **LTO** will be evaluated as part of **4th Periodic Safety Review** for DOEL-1 and DOEL-2 and TIHANGE-1
  - « New » PSR methodology : IAEA NS-G-2.10
  - Global safety evaluation with 14 Safety Factors



- With specific attention to « LTO-aspects »
  - Safety factor Ageing ➔ Ageing Management Program based on American regulations
  - Safety factor Design ➔ Proposal for safety improvements (« Agreed Design Upgrade »)
  - Preconditions for LTO
  - Knowledge and competence management, behaviour

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Strategic Note on LTO (3)

AGEING MANAGEMENT

- *References*:
  - IAEA: Safe LTO of NPPs (SRS 57)
  - NRC: 10 CFR 54 + Standard Review Plan (NUREG 1800)
- *Methodology*
  - Scoping & screening of systems, structures & components (passive + active)
  - Assessment & evaluation of ageing of SSC
  - Review and confirmation of « Time Limited Ageing Analysis »
- *Result*: Ageing Management Program for SSC's of NPP

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Strategic Note on LTO (4)

DESIGN UPGRADE

Licensee must:

1. develop a methodology to identify areas for possible improvements
   - "Comparison with most recent Belgian units"
   - "Comparison with recent PWR-design evolutions" (Generation III)
2. prepare a technical improvement proposal to approach the level of safety of the most recent units"
   - "Compensatory measure if not technically achievable"
   - "Based on deterministic as well as probabilistic considerations"

Result: proposal for «design upgrade » with implementation schedule

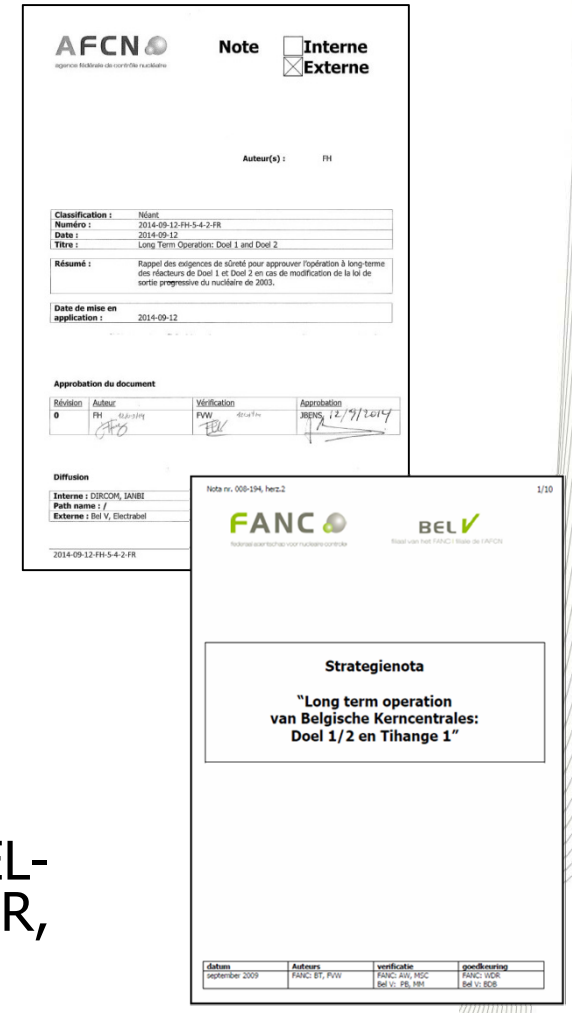
NEW REQUIREMENT: Integrate Fukushima- Stress Test conclusions for DOEL-1, DOEL-2 & TIHANGE-1 in proposal for safety improvements

SALTO mission at TIHANGE-1

- Lessons Learned from SALTO mission performed in **January 2015**:
  - Ensure that during the complete long term operation period of TIHANGE-1 a continuous monitoring and ageing management programme for all components is organized
  - Ensure that the implementation of the developed processes will be completed

LTO for DOEL-1 and DOEL-2

2014-2015: FANC Policy Note
LTO after preparation for decommissioning


AFCN Note ☐ Interne ☒ Externe

Auteur(s) : FH

Classification :	Néant
Numéro :	2014-09-12-FH-5-4-2-FR
Date :	2014-09-12
Titre :	Long Term Operation: Doel 1 and Doel 2
Résumé :	Rappel des exigences de sûreté pour approuver l'opération à long-terme des réacteurs de Doel 1 et Doel 2 en cas de modification de la loi de sortie progressive du nucléaire de 2003.
Date de mise en application :	2014-09-12

Approbation du document

Révision	Auteur	Vérification	Approbation
0	FH	FVW	JBENS 12/9/2014

Diffusion

Interne : DIRCOM, IANBI
Path name : /
Externe : Bel V, Electrabel

2014-09-12-FH-5-4-2-FR

Nota nr. 000-194, herz.2 1/10

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BUT: with a slight shift in time schedule for the implementation of actions

INTEGRATED ACTION PLAN:

Also take into account the specific actions for DOEL-1 and DOEL-2 from past projects: BEST, 4th PSR, Site action plans, Reactor Vessel inspections, …

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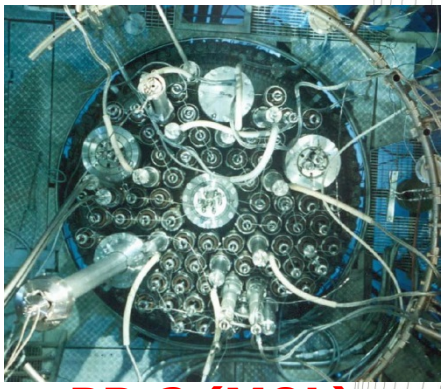
LTO for DOEL-1 and DOEL-2 (2)

- Since 2012:
  - DOEL-1 and DOEL-2 organization was oriented towards decommissioning and prepared a safe transition period
  - 4th PSR that was submitted in 2015 only considered decommissioning
  - A new 4th PSR will be introduced at the end of 2015 to take into account the switch to LTO
- Expert mission in 2016 (⇔ Pre-SALTO)
- SALTO mission in 2017

New development: SALTO for Research Reactors



BR-2 (MOL)

- BR-2: first operation in 1962
- Timeline
  - Pre-SALTO mission (1 or 2 days):
    - Methodology, agenda, scope, timing, team line-up
  - SALTO mission (5 days):
    - 3 to 6 months after pre-SALTO
    - Review documentation, walk-throughs, interviews
    - Report (good practices, recommendations, suggestions)
  - Follow-up mission

Questions?

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