Regulatory experiences from implementation of SNF disposal programme from site selection to construction of disposal facility

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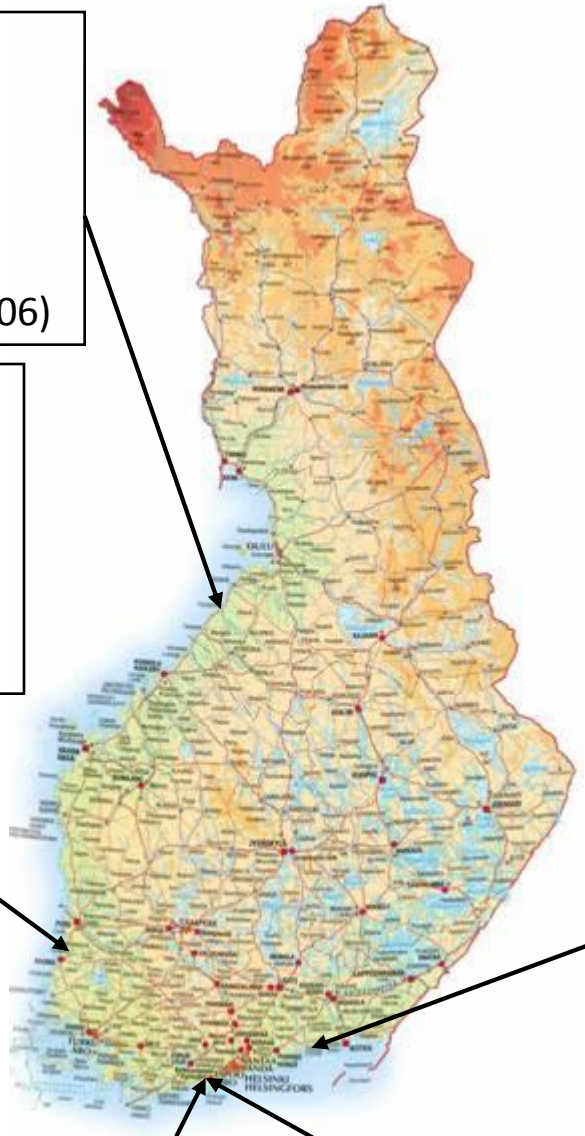
Nuclear facilities in Finland

Fennovoima Ltd
- New utility, no operating reactors
- Decision in Principle (DiP) for FH1 (Hanhikivi Site), SF storage , LILW repository
- Planned reactor type VVER (AES-2006)

Olkiluoto NPP (TVO)
- 2 operating units - ABB BWRs
- OL3 (EPR) under construction
- Interim Spent Fuel Storage
- LILW repository
- Posiva SF repository site “Onkalo”



Loviisa NPP (Fortum)
- 2 operating units – VVERs
- Interim Spent Fuel Storage
- LILW repository

FiR research reactor

STUK

STUK

Spent fuel management policy and strategy

- Spent fuel is defined as nuclear waste (once-through option)
- Nuclear waste producers are responsible for waste management and disposal – no joint national programme
  - Government decision on waste management principles in 1978 (responsibility of waste producer, funding, regulation of R&D work)
- Government's Decision 1983 set time schedule for disposal of spent nuclear fuel and radioactive waste
  - Development of LILW disposal facilities
  - Search for international solutions for spent fuel management but also preparation of domestic solution (Disposal site selection 2000 and operation 2020)
- Government has required Fennovoima to submit at latest June 2016
  - An agreement of spent fuel disposal to Olkiluoto repository **OR**
  - A programme for environmental impact assessment for its own repository.
- Spent fuel from the research reactor is planned to be repatriated to USA

Nuclear waste management and disposal in Finland

Teollisuuden Voima Oyj

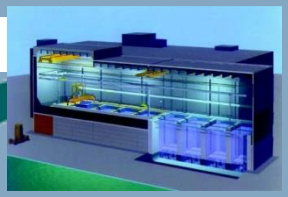
Olkiluoto power plant

Interim storage of spent nuclear fuel

Operating waste repository

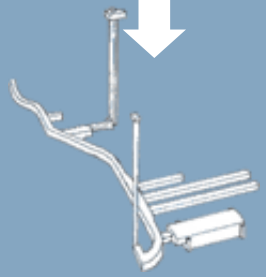
In future

Fortum Power and Heat Oy



Interim storage of spent nuclear fuel

Loviisa power plant



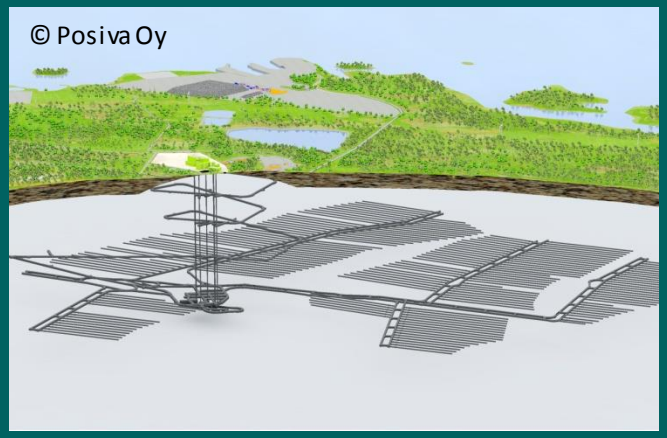
Operating waste repository

Fennovoima Oy

In NPP site:

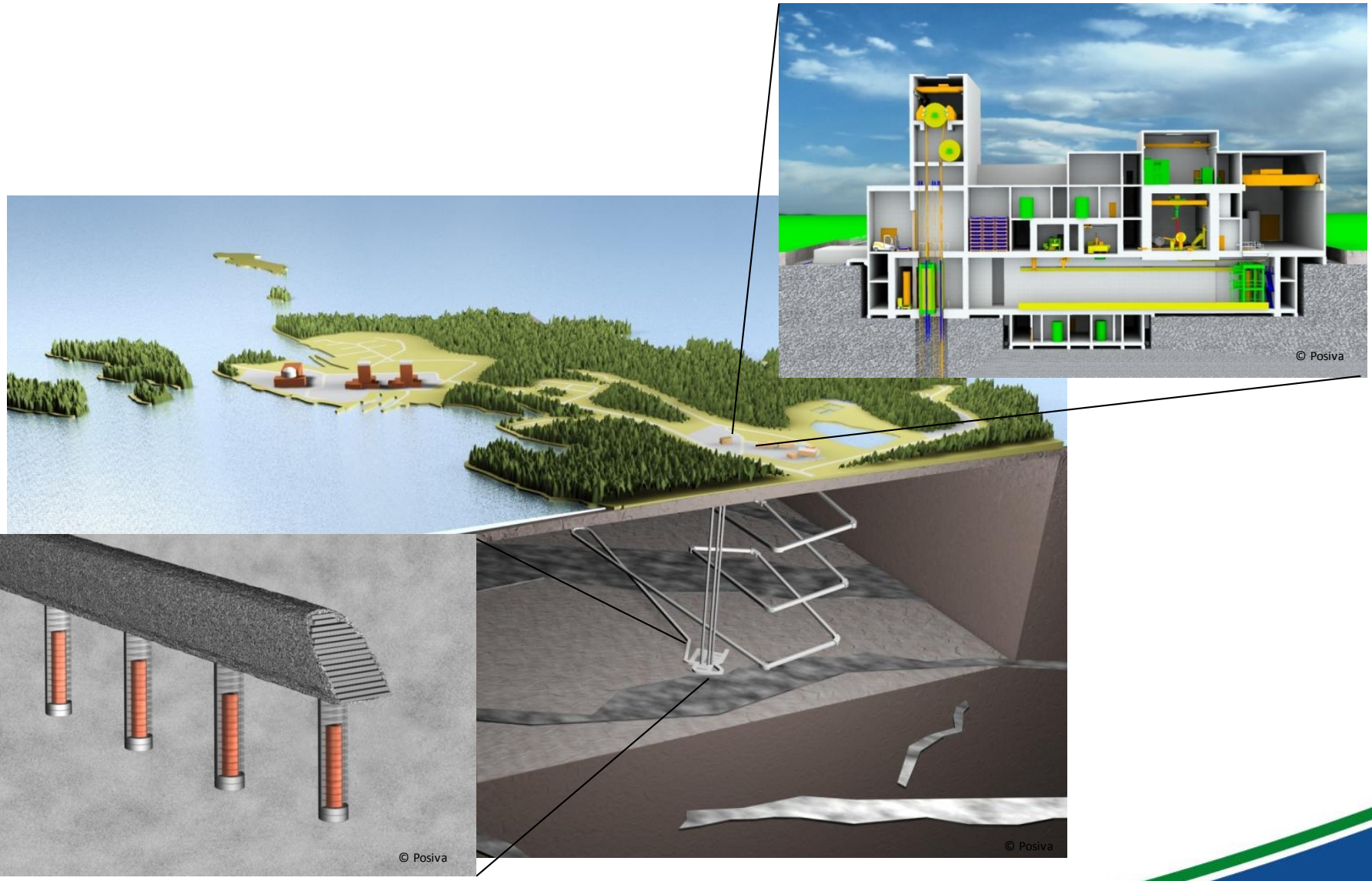
- Interim storage of spent nuclear fuel
- Operating waste Repository

Posiva Oy



Final disposal of spent nuclear fuel

Spent fuel geological disposal in Olkiluoto – KBS-3



Steps in licensing of spent fuel repository

- 2000/2001 **Decision-in-Principle** was made. Political and societal acceptance of the Olkiluoto Repository
  - STUK's Preliminary Safety evaluation followed by municipal acceptance, Government Approval and Parliament's ratification,
  - The Finnish regulation requires that the bedrock shall be characterized from disposal depth before submitting construction licence application
  - Authorization to construct underground rock characterization facility (Onkalo URCF)

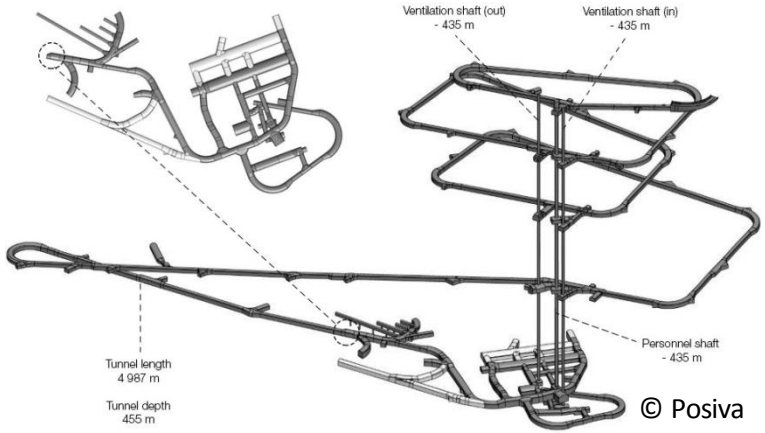
- 2012-2015 **Construction License**
  - Posiva submitted construction licence application (CLA) 28th December 2012
  - Authorization to construct encapsulation plant and underground disposal rooms and operational systems
  - No nuclear waste to be introduced into repository

- 2020 -2022 **Operating License**
  - Authorization to introduce nuclear waste into encapsulation and repository

- 2022- 2120 **Operating phase**
  - Fixed period with full safety review at 15 y intervals (or as specified in license)
  - Authorization of disposal facility step-wise construction

STUK's step-wise oversight

- After Decision-in-Principle STUK reviewed step-wise developed safety case parts prepared by Posiva
- STUK has implemented regulatory oversight for Onkalo construction in the same manner as for other nuclear facilities
- Draft construction license documentation required by Ministry in 2009 was important step for STUK
- R&D-plans submitted every three years, has been an important tool for guiding the disposal project



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	2009	2010	2011	2012
Description of the Disposal System report				
Final version				
Process report*				
Final version				
Formulation of Scenarios report				
Final version				
Models and Data report				
First version				
Final version				
Analysis of scenarios report**				
First version				
Final version				
Complementary Considerations report*				
Final version				
Summary report				
First version				
Final version				

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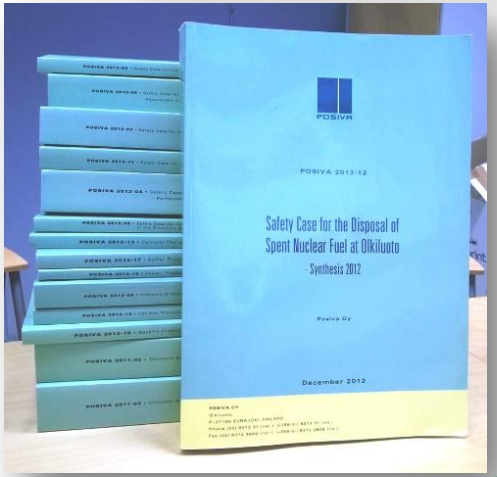
* First version of the report has already been published

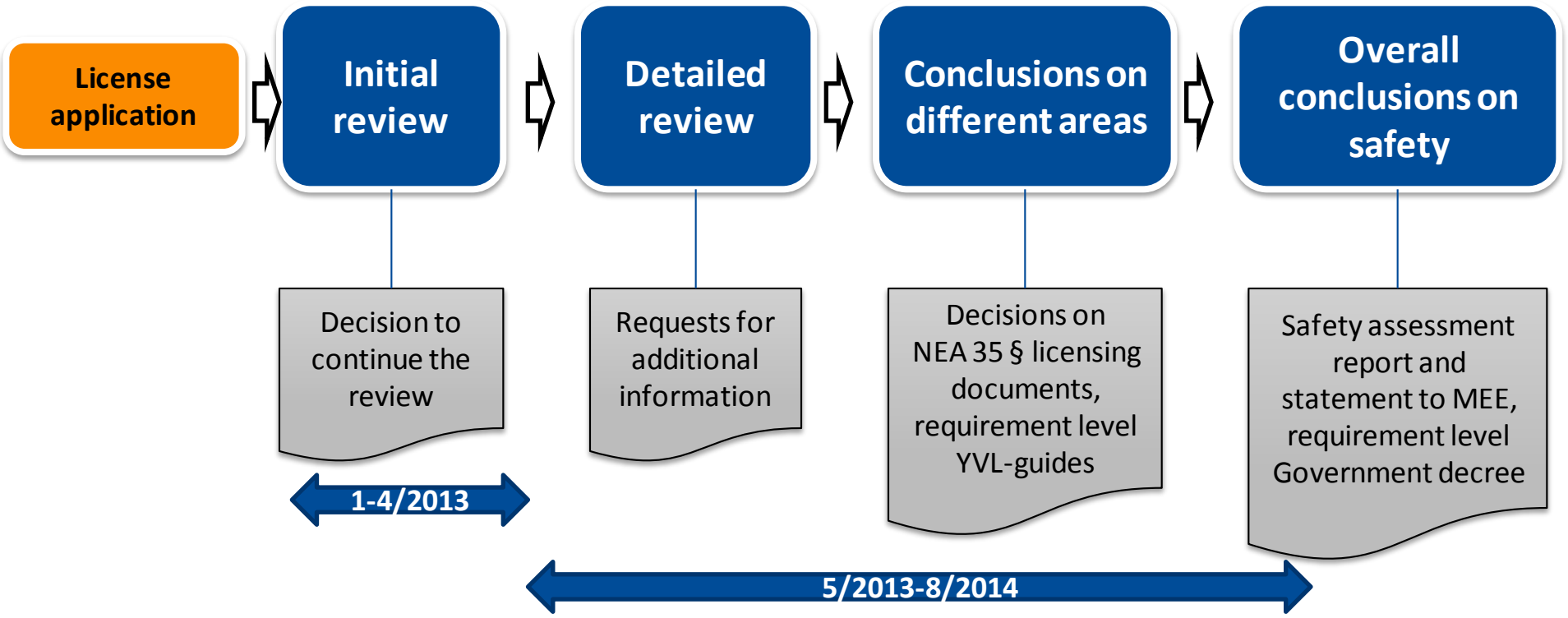
** KBS-3V Safety Analysis report (Nykyri et al. 2008) has been published in 2009 and the Biosphere Analysis report will be published in 2009.

Construction license application for spent fuel repository

- Posiva submitted construction license application (CLA) to Ministry of Employment and Economy (MEE) in the end of 2012
- CLA covers both encapsulation facility and underground disposal facility
- Amount of SNF 9000 tU (NPPs OL 1-4 and LO 1-2)
- License application was supported with comprehensive operational and post-closure safety demonstration (integrated safety case)



STUK's review stages and time schedule



Active review period 2 years

Number of experts involved ~70

Workload ~20 man years

Supporting activities for CLA review and assessment

Inspection program during review of construction license application

- STUK has assessed Posiva's readiness to start the construction of encapsulation and disposal facility
  - Focus on Posiva's management system, organization and work processes
- In total 17 inspections during two year review period
- Topics: Quality assurance, Sub-contractor management, design process, Requirement management, Readiness for construction phase, …

Analysis and modeling work supporting STUK's review

- Scenario process, radionuclide transport, THMC-modeling, Fracture zone model evaluations

Co-operation with Swedish Radiation Safety Authority (SSM)

- Mutual understanding of key safety issues

STUK conclusions of Posiva's construction license application

- STUK gave statement and safety assessment report to Ministry of Employment and Economy 11th February 2015
- Main conclusion: **Encapsulation plant and disposal facility can be built to be safe**
- STUK emphasized in its statement to the Government that:
  - Level of safety and facility design is satisfactory for the construction license stage
  - Further work needed in facility detailed design, tunnel location criteria and selection process, demonstration of engineered barrier component installation and performance and post-closure safety case for Operating license application.
- Translations are also available in English and Swedish at STUK website (www.stuk.fi/ajankohtaista/tiedotteet/en_GB/news_941/?t=2015-3-15-18-6)

Summary

Key elements supporting the concrete progress in spent fuel disposal

Early establishment of **national framework**

- Well defined liabilities and roles
- Early on established funding system
- National policy and strategy (Government decision 1983)
- Long term political commitment to resolve the nuclear waste issue

Clear **licensing process**

- Stepwise licensing and implementation including veto-right for the local community regarding hosting the repository
- Timely and focused communication to public

Active **regulatory work**

- Development of regulatory approach parallel with R&D and in analogy with nuclear plant safety regulations
- Regular regulatory follow-up of progress in spent fuel disposal program