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
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 \textbf{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

Fortum Power and Heat Oy
- In future
- Interim storage of spent nuclear fuel
- Operating waste repository

Posiva Oy
- Operating waste repository
- Final disposal of spent nuclear fuel

Fennovoima Oy
- In NPP site:
  - Interim storage of spent nuclear fuel
  - Operating waste repository

© Posiva Oy
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
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

**License application**
- Initial review
  - Decision to continue the review
    - 1-4/2013
- Detailed review
  - Requests for additional information
- Conclusions on different areas
  - Decisions on NEA 35 § licensing documents, requirement level YVL-guides
- Overall conclusions on safety
  - Safety assessment report and statement to MEE, requirement level Government decree

**Active review period** 2 years

**Number of experts involved** ~70

**Workload** ~20 man years

**Timeline**
- 5/2013-8/2014
- 10/2013-2/2015
- 6/2014-2/2015
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.

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