Evolving R&D needs at the Loviisa LILW repository

IGD-TP Session 7

OREA Hotel Pyramida Praha, Prague

Wednesday 26 November 2025

Frans Jansson, Fortum, Finland

Fortum is a strong Nordic nuclear operator

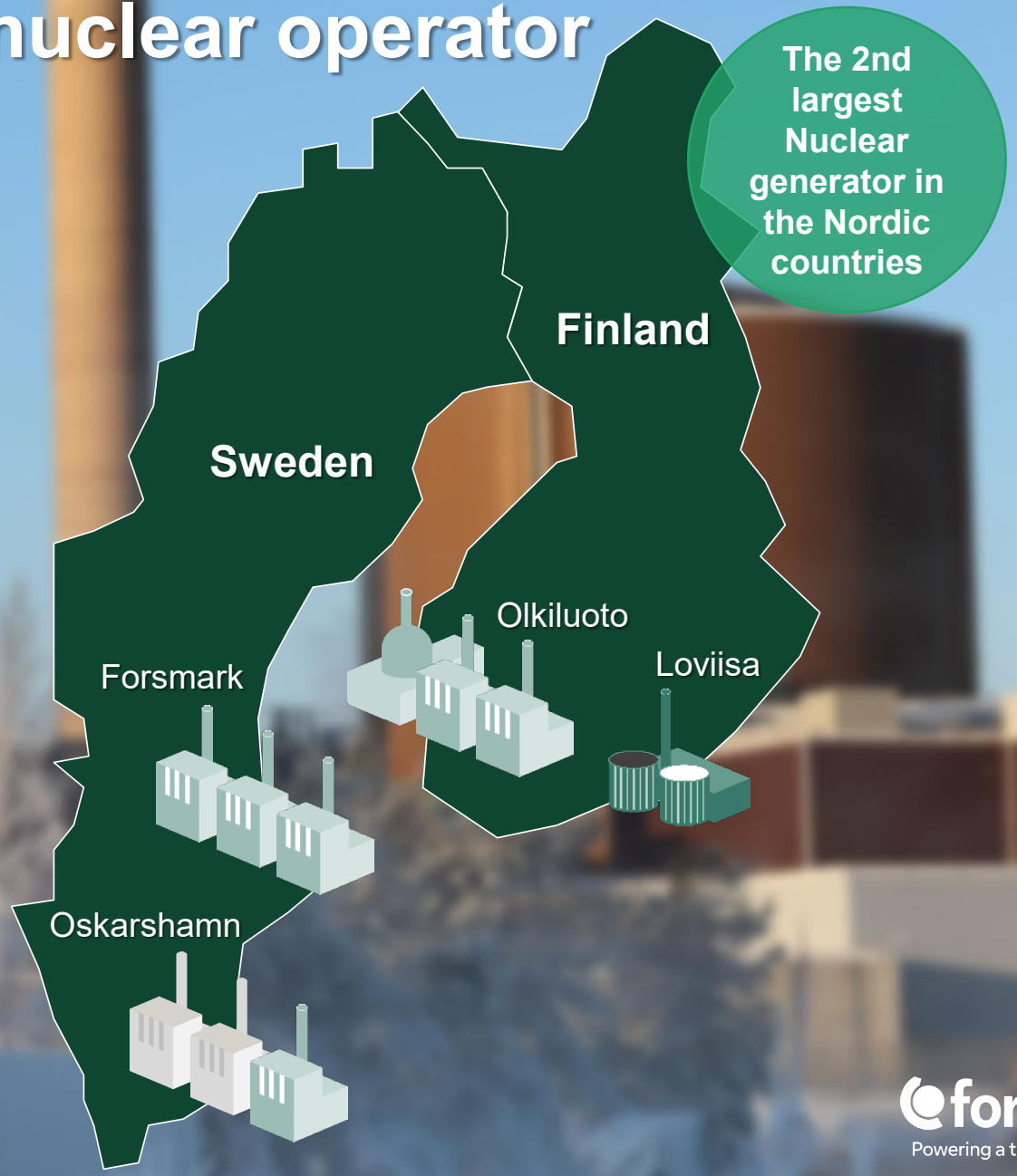
Units fully owned by Fortum

Co-owned units

Units under decommissioning

Final Disposal:
Fortum is a co-owner in spent fuel and waste management companies Posiva (FIN) and SKB (SWE)

Nuclear represents 53% energy generated by Fortum



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Background

- In Finland waste producers are responsible for waste management
- Fortum operates a repository for LILW disposal in southern Finland
  - Commissioned in 1998
  - ~100 meters below sea level
- Waste production, handling, transportation and disposal within a single organisation
  - Proven to be an effective setup for waste management
- Spent fuel will be sent to Posiva

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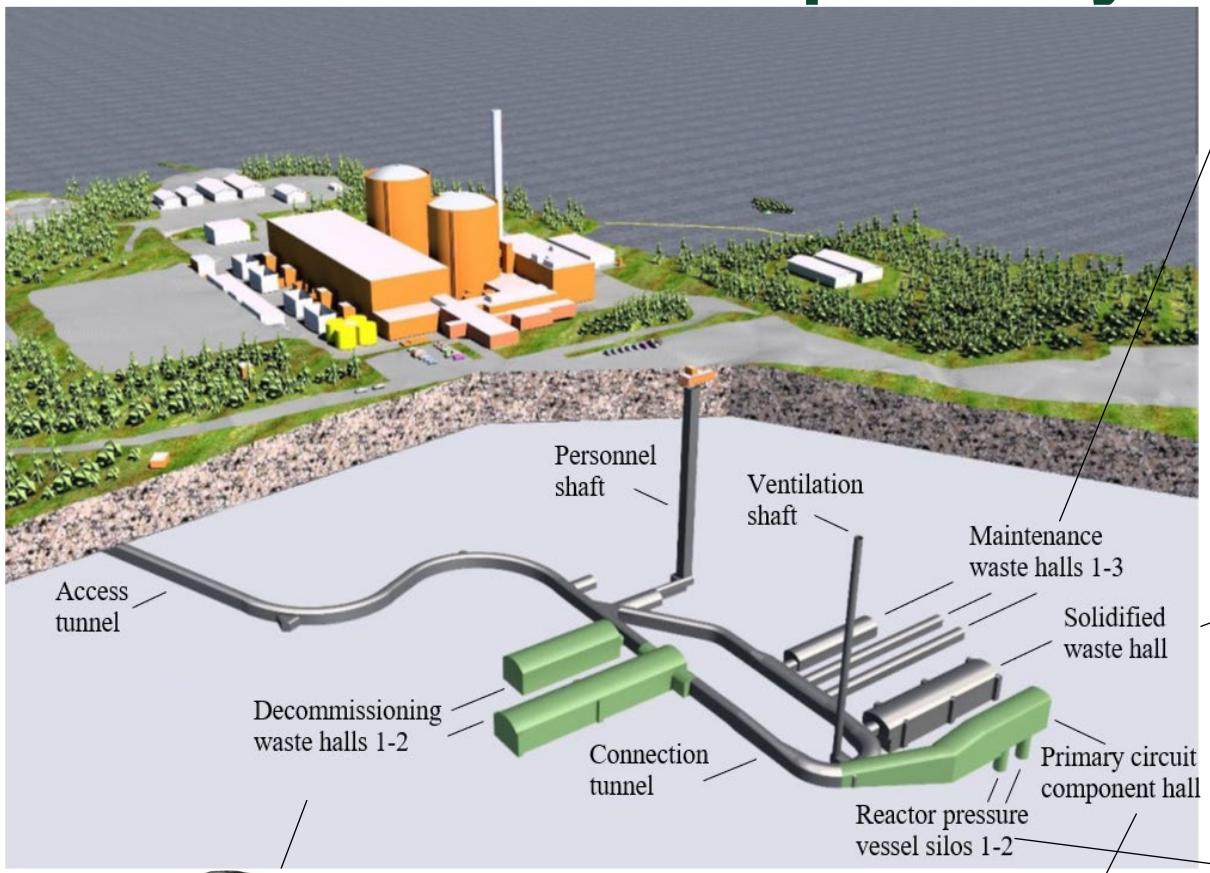
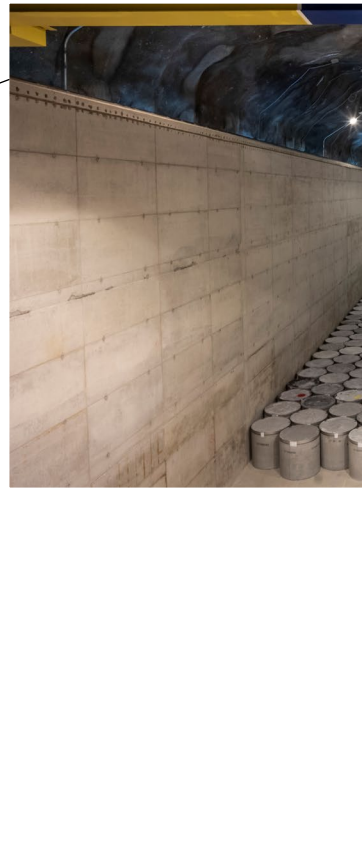
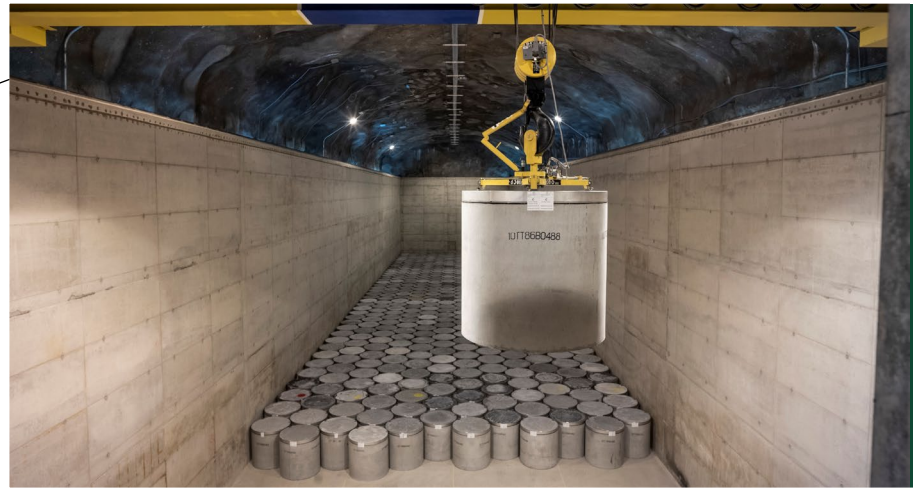
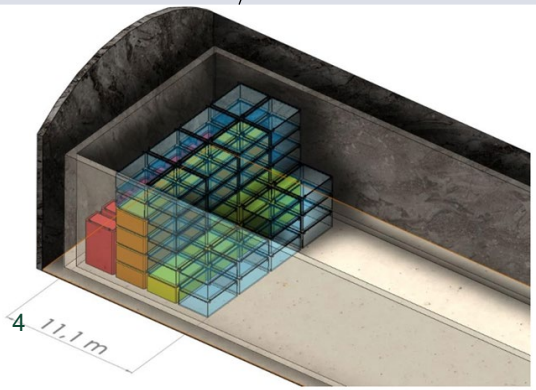
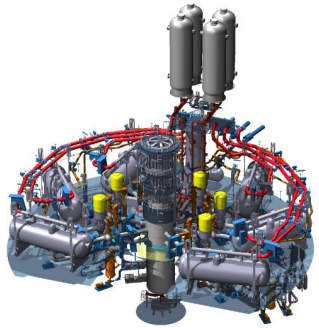
Loviisa LILW repository











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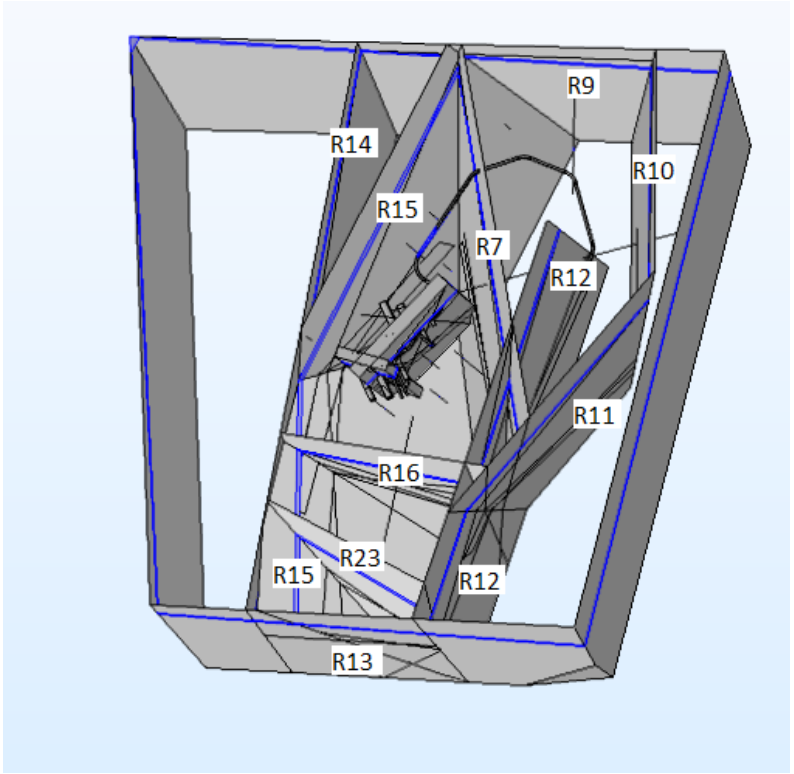
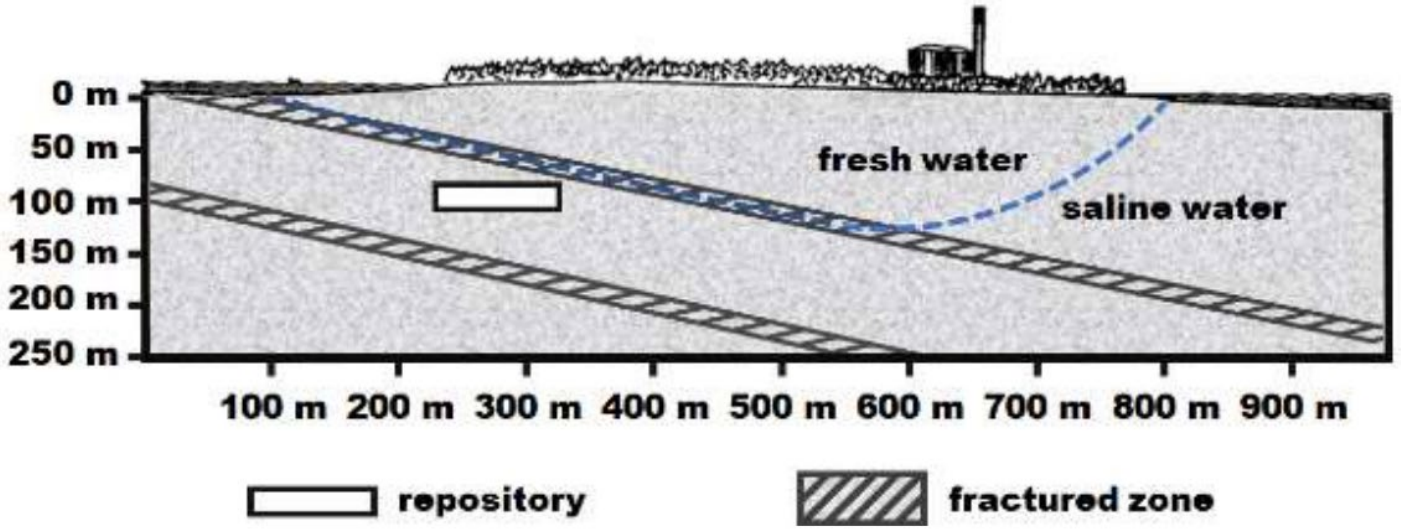
Original site investigations

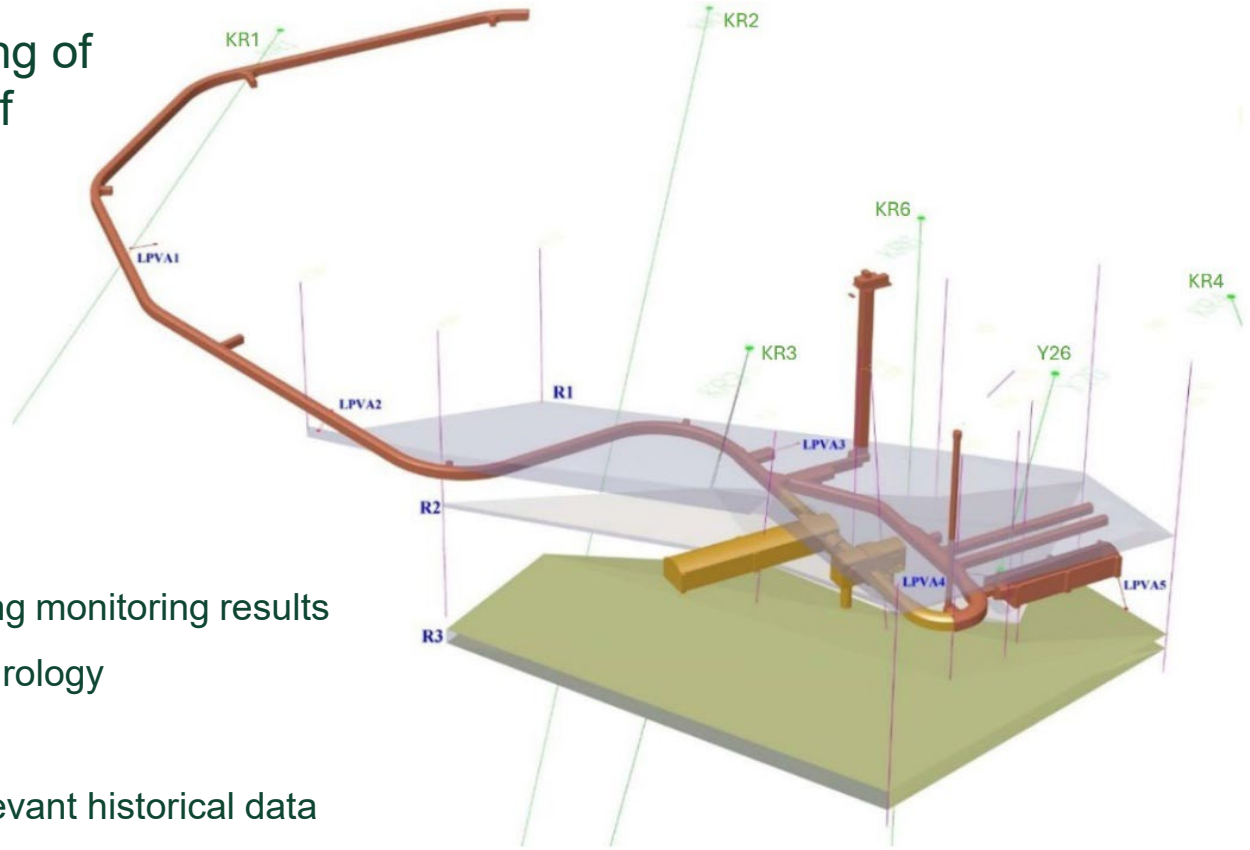
- Mainly focused on drilling investigations, hydrological measurements, groundwater chemistry, stresses in the bedrock etc
- Aim to find the major bedrock fractures and areas with low groundwater flows
- Included preliminary safety assessment (1986)
- Reasons for the specific location
  - On the same island as the power plant – short transport distances and easier for general public to accept
  - No major fracture zones intersect the repository
  - Not below the power plant or possible future power plants
  - Not below the sea – the municipality could not give permits for construction below the sea





Monitoring program

- Monitors groundwater level, composition, flow, leakage into the repository, rock mechanics, aging of repository structures and equipment, condition of waste packages etc
- Currently being reviewed and updated
  - Areas for improvement?
  - Something missing?
  - Unnecessary measurements?
  - Goals:
    - More systematic approach to processing and interpreting monitoring results
    - An improved model of the bedrock and the bedrock hydrology
    - Better coupling with the groundwater flow model
    - Database for the monitoring program, containing all relevant historical data
  - Significant support from Posiva
- Will continue during the whole operational period



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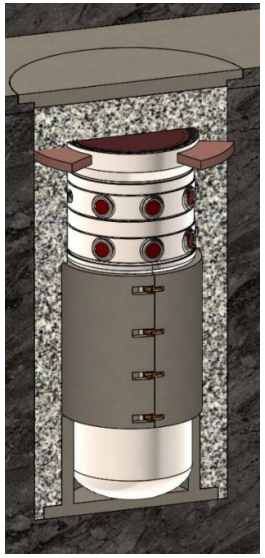
Recent and current research (1)

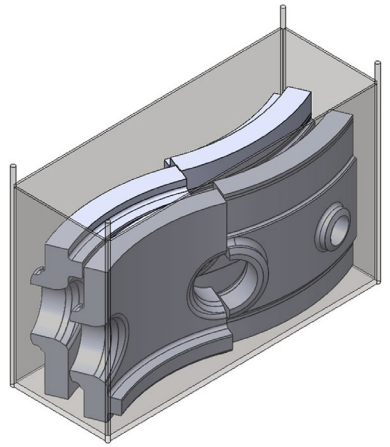
- Driven by uncertainties identified during the latest safety case (2018) and feedback from the regulator (STUK)
- Performance of concrete structures
  - Projects in the SAFER2028 research programme
    - RACEMAT – Radionuclide transport in cementitious materials, Helsinki University and Geological Survey of Finland GTK
    - PERCO2 – Long-term Performance Modelling of Concrete in Final Disposal Repositories of LILW Nuclear Waste, Aalto University
  - Internal development of concrete degradation model
- Performance of plugs for closure
  - Changing concrete plugs for so-called hydraulic plugs (concrete/bentonite plugs)
  - General plug design, improve interface between bedrock and plug
- Host rock stability
  - Numerical simulation of host rock stability for long-term safety, AFRY

https://safer2028.fi/

Recent and current research (2)

- Introduction of new (to the Loviisa repository) waste types produced outside the Loviisa NPP
  - E.g. graphite, Fluental from decommissioning of VTT's TRIGA-type research reactor
- Design changes
  - Backfill materials
  - Possibly updated disposal concept for reactor internals and RPVs
    - Weld integrity and corrosion
    - SAFER2028: MICWEST - Influence of environment and microbes on corrosion behaviour of welded steels in the LILW repositories, VTT
- Miscellaneous R&D projects
  - Release of Cl-36 from activated serpentinite concrete
  - Leaching tests from solidified waste
  - Modelling development: Gas transport, groundwater flow, concrete degradation, radionuclide transport





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Future research

- Focus will be on disposal of decommissioning waste and extending the repository
  - More accurate activity estimations
  - Bedrock analyses for the yet to be excavated waste halls
  - Monitoring program probably needs to be revisited
- Near the end of repository operation, the focus will shift towards repository closure

Thank you!

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