# FINAL DISPOSAL OF SPENT FUEL IN FINLAND AND KNOWLEDGE MANAGEMENT SYSTEMS

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# FINAL DISPOSAL OF SPENT FUEL IN FINLAND

# GENERAL INFORMATION

# Organising of nuclear waste management

**LICENSES**

**Government**
**Ministry of Employment and Economy**

**SUPERVISION**

**Radiation and Nuclear Safety Authority (STUK)**

**MANAGEMENT OF FUNDING**

**The State Nuclear Waste Management Fund**
**Ministry of Employment and Economy**

**TEOLLISUUDEN VOIMA OYJ**

**FORTUM POWER & HEAT**

**POSIVA OY**

**Consultants, Contractors, Universities, Research Institutes**

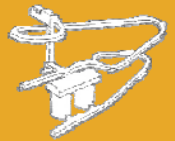


# Implementation of waste management

**Teollisuuden Voima Oyj**

**Olkiluoto power plant**

Interim storage of spent nuclear fuel

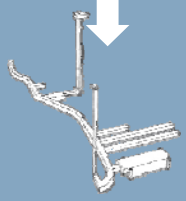


Operating waste repository

**Fortum Power and Heat Oy**

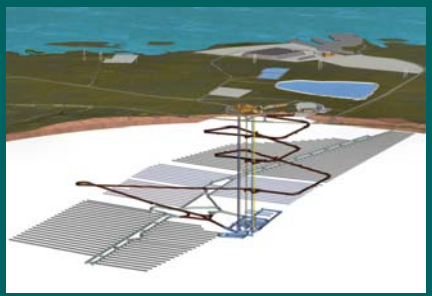
Interim storage of spent nuclear fuel

**Loviis**



Operating waste repository

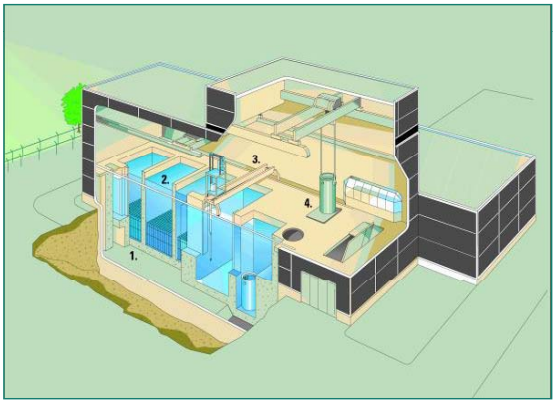
**Posiva Oy**



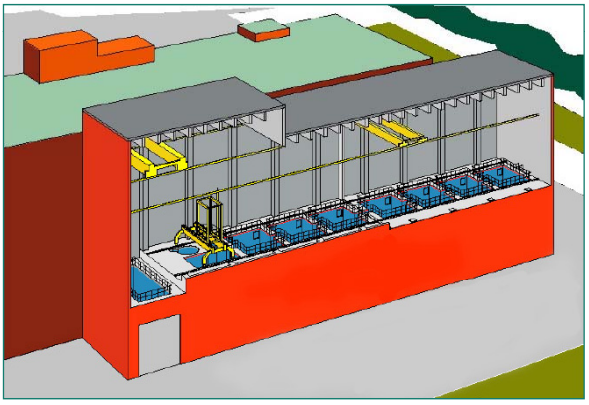
Final disposal of spent nuclear fuel

# Interim storages for spent fuel

**OLKILUOTO, 1987**



**LOVIISA, 1984/2000**

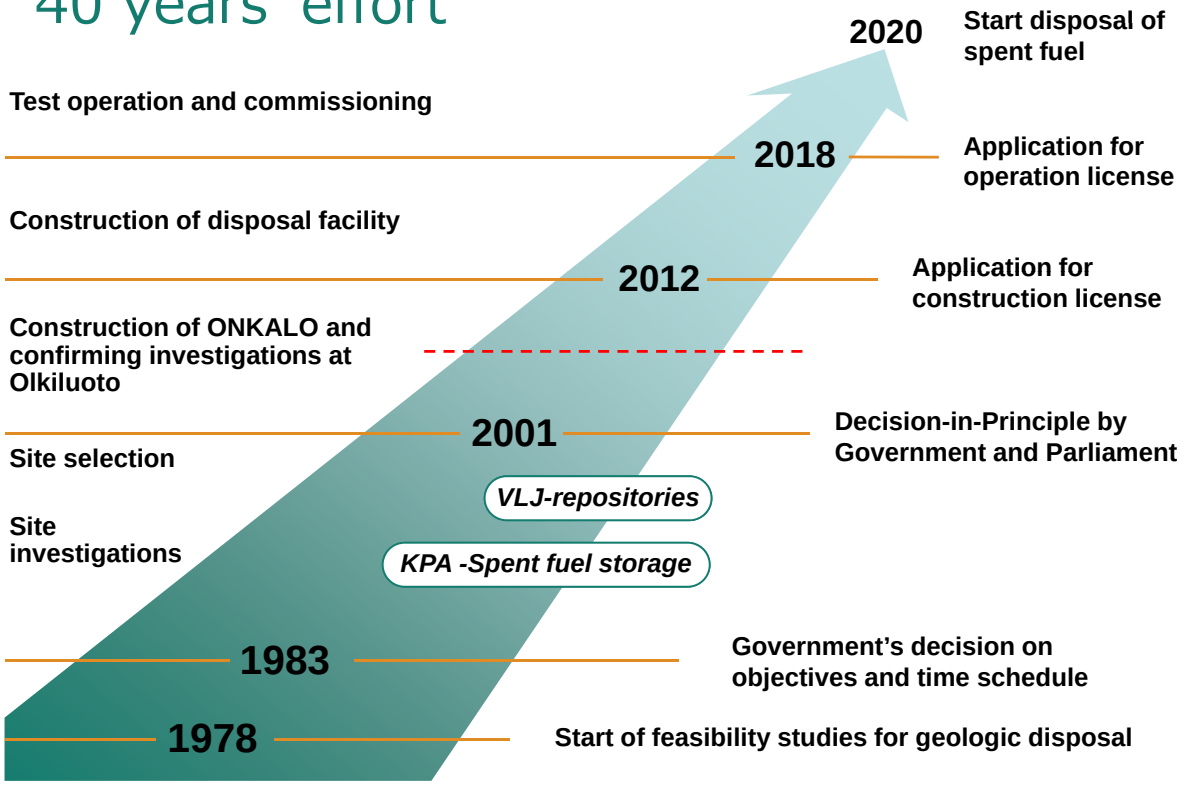




# Posiva Oy

- Company established in 1995
  - Ownership: Teollisuuden Voima Oy 60 %,
    Fortum Power and Heat Oy 40 %
- Mission: Final disposal of spent nuclear fuel of the owners and other tasks of expertise within nuclear waste management
- Gradual change from R&D company to implementing organisation
  - Organisation adjusted according to changing demands
- Steadily developing staff
  - Own and contractors' staff in Olkiluoto about 150 persons
  - Total employment in final disposal more than 300 persons
- Turnover growing
  - Accrued in 2008: EUR 56 million
  - Budgeted for 2009: EUR 60 million

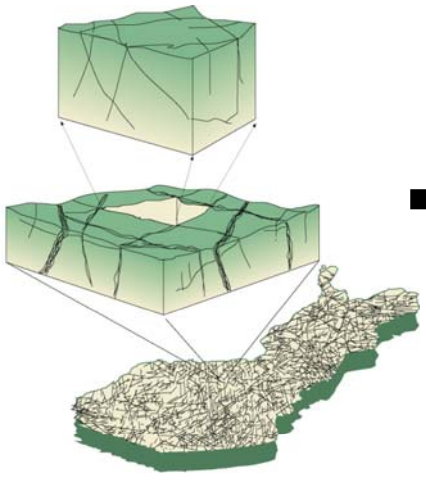
# 40 years' effort






# Site selection research programme 1983 - 2000

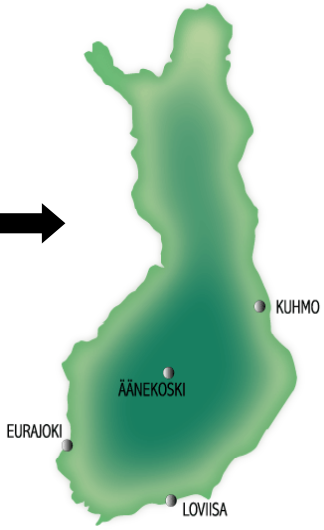
**Site Identification**
**1983 - 1985**



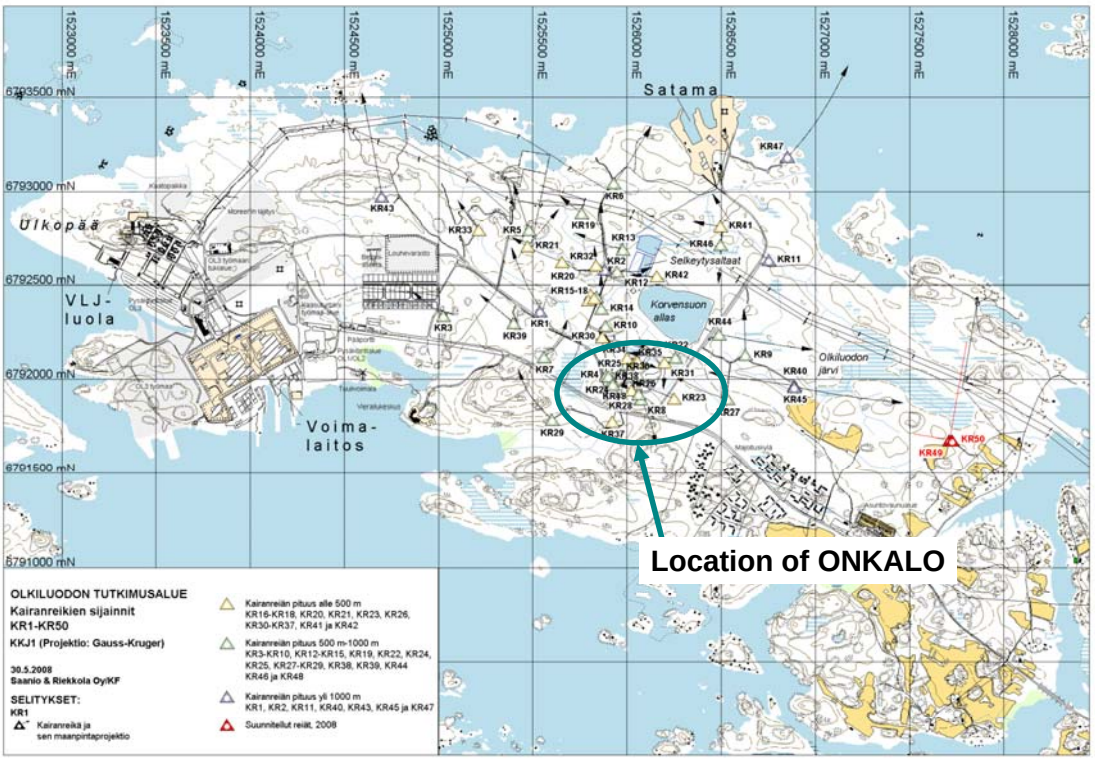
**More than 100 candidate sites were identified**

**Preliminary Site Characterisation 1986 - 1992**


**Detailed Site Characterisation 1993 - 2000**



# Site investigations focused in Olkiluoto



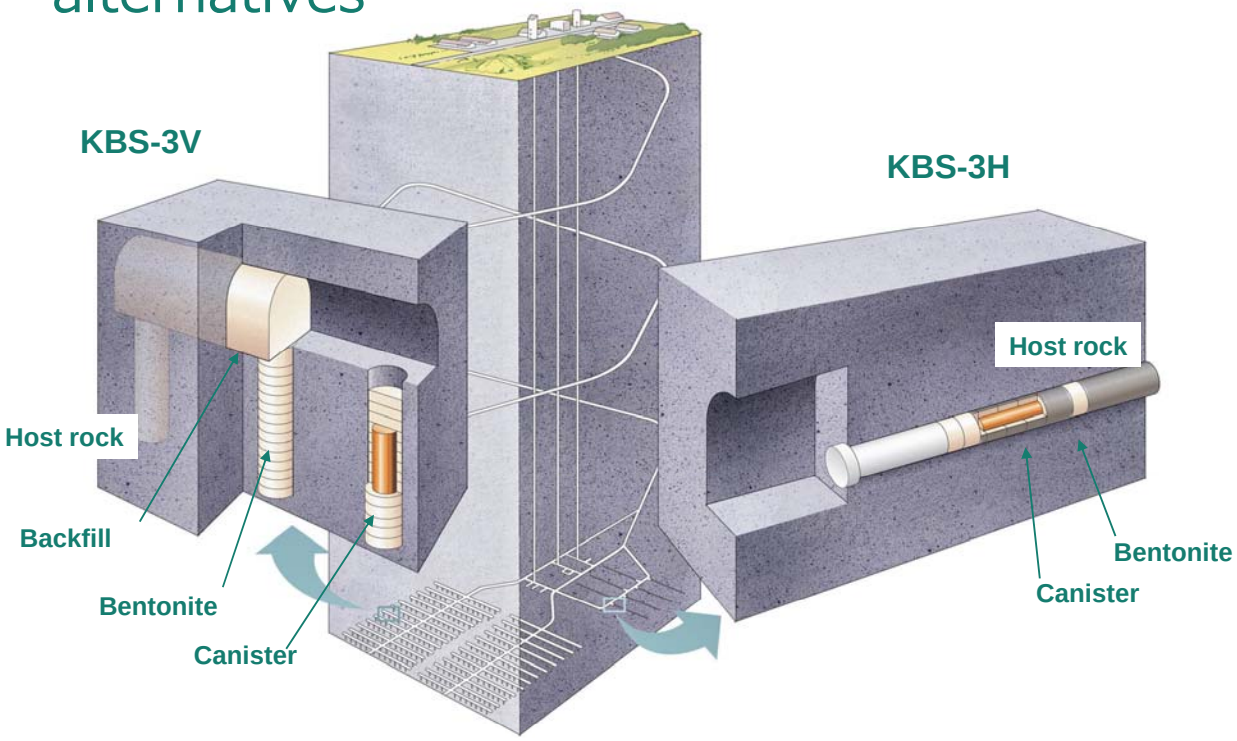



# Olkiluoto Island

# Olkiluoto site, June 2009



# KBS-3 disposal concept: two alternatives



# Canister design: three versions

- Copper canister
  - Long-term tightness
  - Wall thickness 50 mm
  - Length 3.6 m; 4.7 m; 5.2 m
  - Diameter 1.052 m
- Cast iron insert
  - Mechanical strength
  - Nodular cast iron
  - For 12 / 4 fuel assemblies
- Total number ca. 2800
  - LO ca. 700
  - OL1-2 ca. 1200
  - OL3 ca. 900

LO1-2 OL1-2 OL3



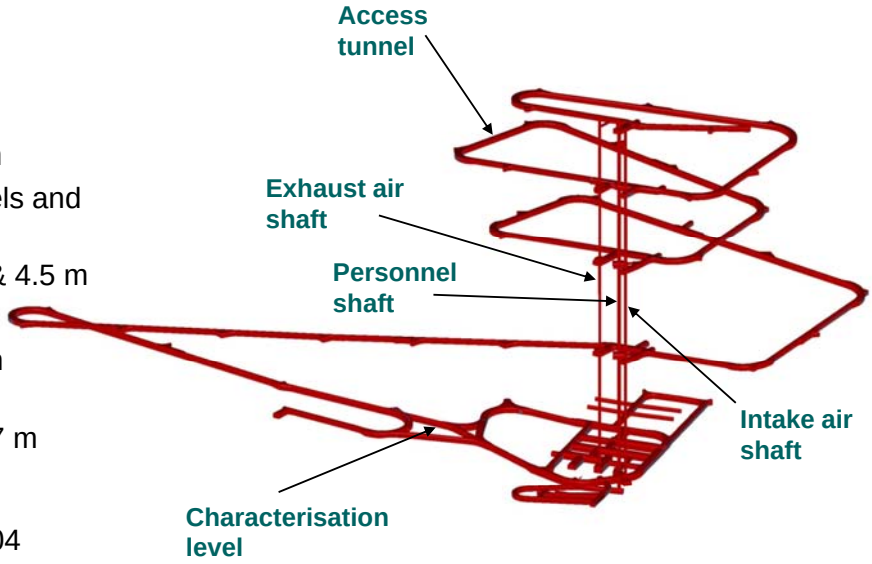
# ONKALO Underground rock characterisation facility

- The suitability of site for final disposal will be verified by means of research made in ONKALO
  - Research at different depths during ONKALO construction
  - Final verification at disposal depth
- Design target: Utilisation of ONKALO during construction and operation of underground repository
  - Design and construction according to requirements set for nuclear facilities
- Provides an opportunity for Posiva to learn repository implementation
  - Disposal technology can be tested in real conditions

# ONKALO lay-out and technical information

**TECHNICAL DATA**

- Excavation volume 340,000 $m^3$
- Access tunnel
  - length 5 km
  - inclination 1:10
  - size 5.5 x 6.3 m
- Total length of tunnels and shafts 9 km
- Shaft diameter 3.5 & 4.5 m
- Depth
  - characterisation level 420 m
  - lowest level 437 m

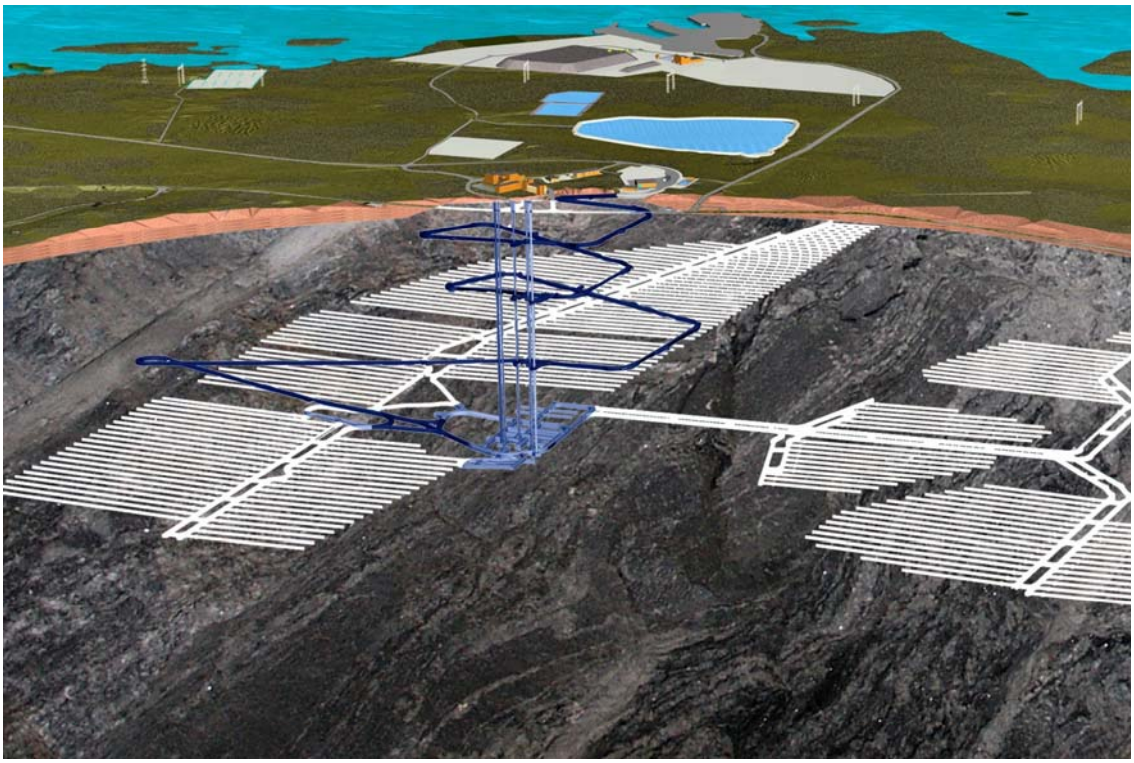



**SCHEDULE**

- Excavation start 2004
- Characterisation level 2010
- Excavation completed 2011



# Disposal facility above and under ground



# ONKALO on ground level



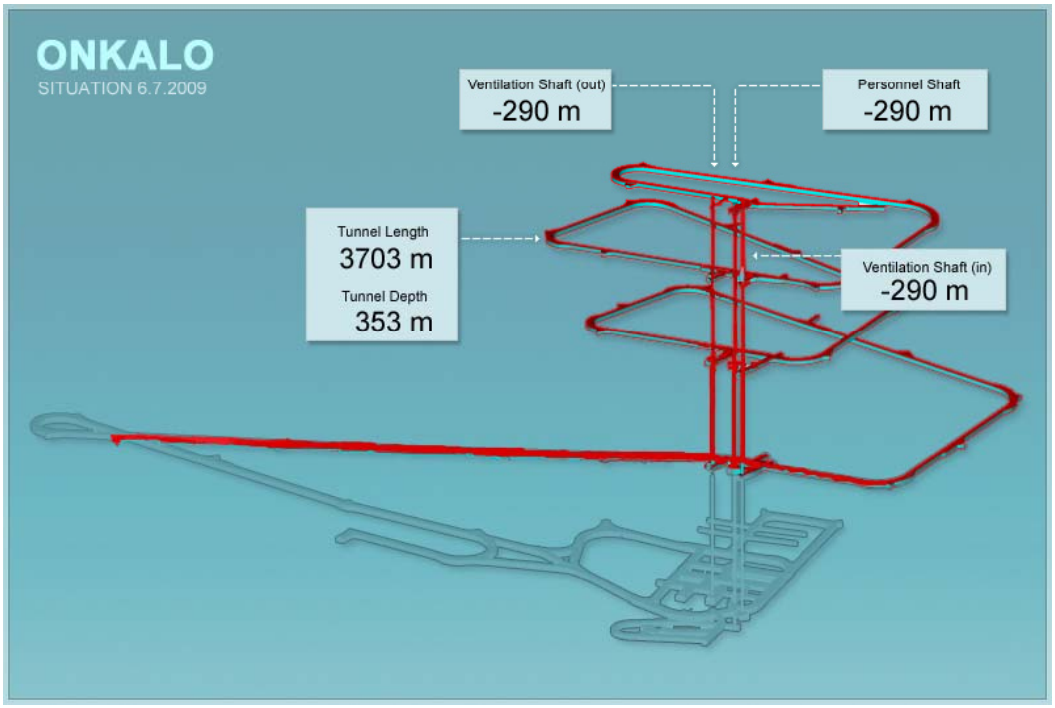

# ONKALO excavation started in summer 2004

# ONKALO site in summer 2008



# Excavated tunnel

# Progress of excavation in July 2009






# General design conditions

**Fortum**

Loviisa 1-2
operation 50 y

1000 tU

**TVO**

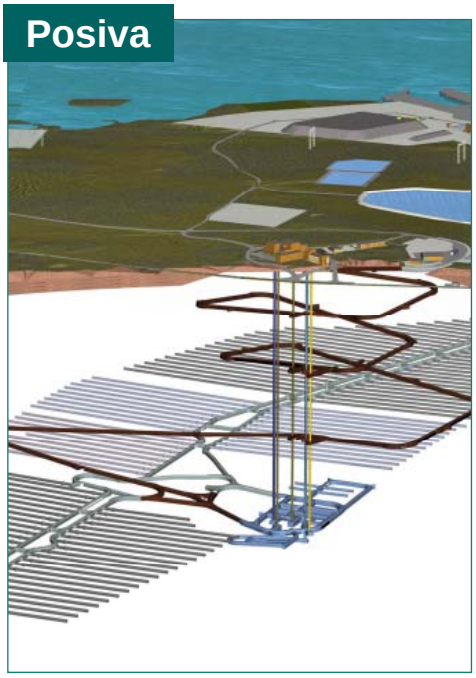
Olkiluoto1-2
operation 60 y

2500 tU

Olkiluoto 3
operation 60 y

2000 tU

**Posiva**

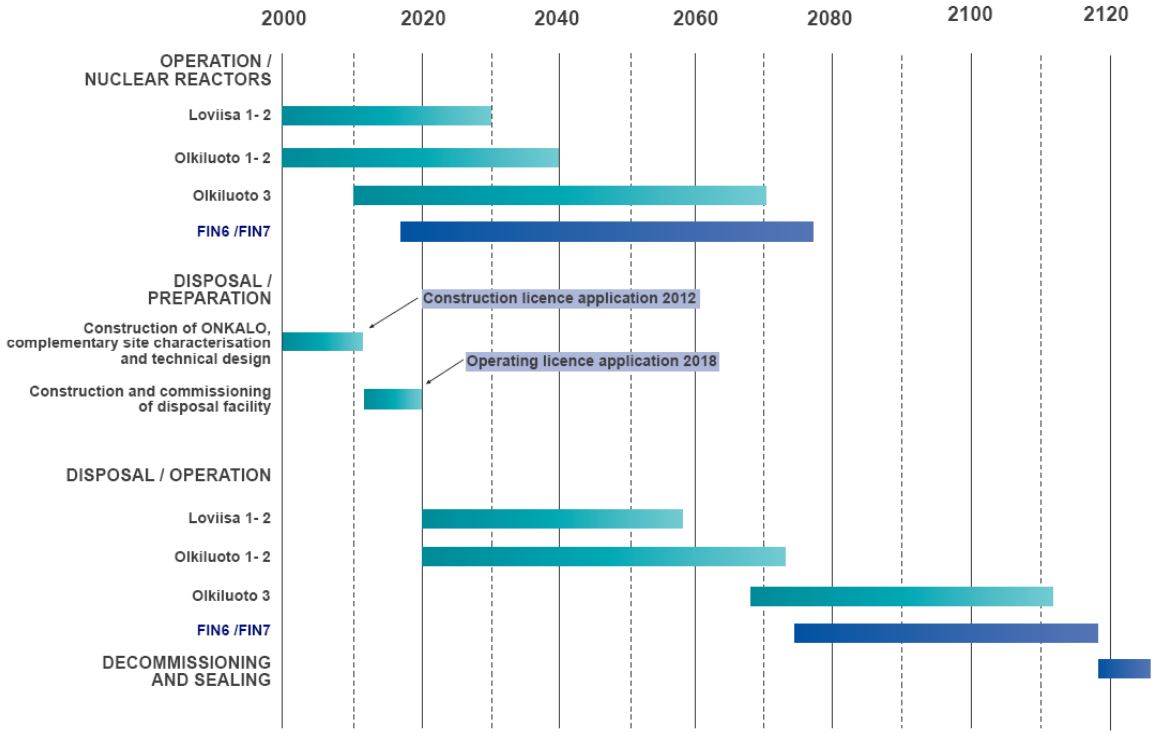


# Costs of final disposal of spent fuel

- Total 3,010 M€
  - Investments 630 M€
  - Operation 2,140 M€ (until year 2120)
  - Decommissioning 240 M€
- Basic assumptions
  - Some 5,500 tonnes of uranium accumulated in spent fuel during 50-60 years of operation in Loviisa and Olkiluoto NPPs
  - All costs calculated in December 2006 level and representing overnight costs at this moment
  - Costs include ONKALO and other investment costs incurred so far but no accrued R&D costs



# Schedule of spent fuel disposal



# KNOWLEDGE MANAGEMENT SYSTEMS



## KMS - Knowledge Management System

- The main goal of the knowledge management system in Posiva is to preserve the basic knowledge of the final disposal activities in next decades and at least the next century while workers and generations will change.

- The threat is that the final disposal activities will be interrupted if any doubt of absence for the long term safety analysis will arise or the fundamentals of the analysis will not be remembered or understood.

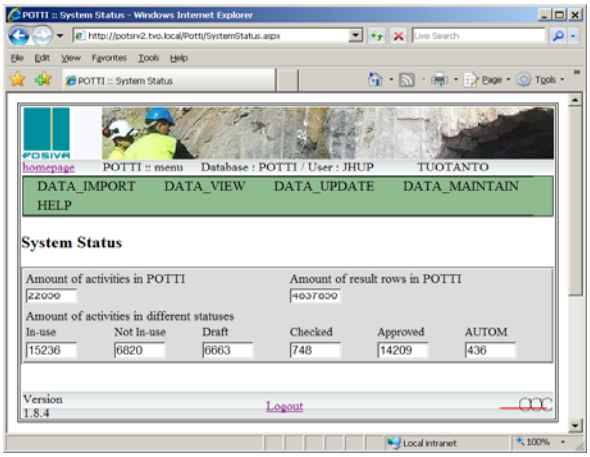
# KMS - Knowledge Management System

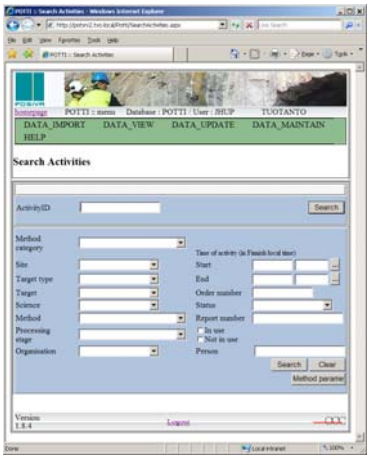
- Posiva is using several information management systems in aim to document the existing data and information.
  - research data systems
  - requirements mgmt system
  - document  mgmt system
  - research report mgmt system



# KMS - Knowledge Management System

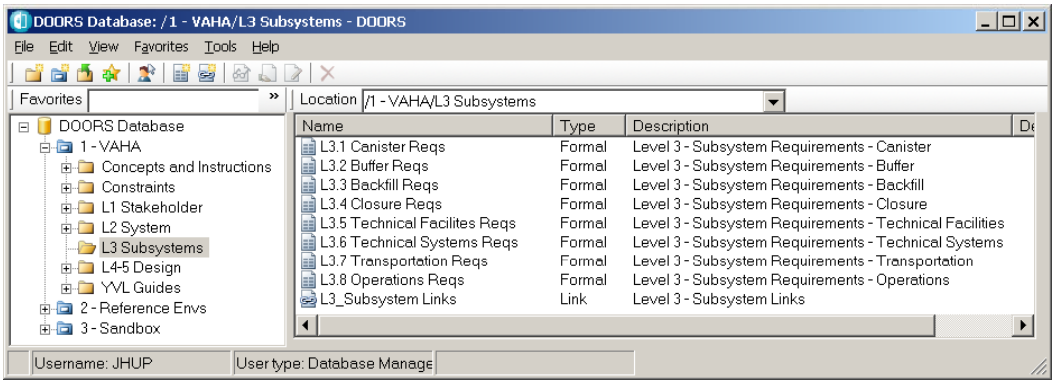
- In the POTTI research data system the data from the site investigation program and constructon work will centralised be stored to be utilised in several aims.
- For both internal and external usage.



# KMS - Knowledge Management System

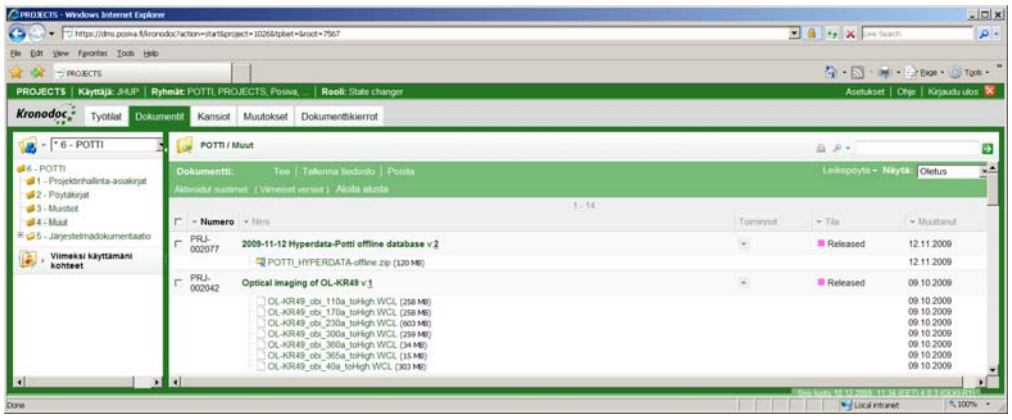
- In VAHA requirements management system the requirements for the final disposal system will be processed and documented.
- For both internal and external usage.






# KMS - Knowledge Management System

- Kronodoc, document management system.
- For both internal and external usage.



# KMS - Knowledge Management System

- The HR related issues will also be connected to the KMS as whole.
- The ultimate challenge in knowledge management is to transfer the undocumented tacit information to be utilised for the organisation while personnel will leave organisation or will retire.



# KMS - Knowledge Management System

- The first step for the KMS in Posiva could be to organise the contents of the research work and reports to be utilised in much more approached form.
- The implementation of the KMS could be realised in semantic web based KMS ontology portal, which combines information from the internal and external information and document systems based on the defined ontology concepts and relations (classes, definitions, relations).

# KMS - Knowledge Management System

- The KMS must be able to search information from
  - the reports published by Posiva
  - the internal DMS and RMS
  - the external law databases
  - the databases published by the atom energy organisations, in case that the databases have support for this functionalilty.
- The KMS can be commercial or custom-made system.



# KMS - Knowledge Management System

- The activities for the KMS at Posiva are planned to be started during 2010.
- In case for further questions, please contact to

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