THE FINAL DISPOSAL OF SPENT NUCLEAR FUEL IN FINLAND

Eero Patrakka
Chair of ENEF Subgroup “Waste Management”
Former President, Posiva Oy, Finland

ITRE Public Hearing, 1 December 2010, Brussels
Implementation of waste management

Teollisuuden Voima Oyj

- Olkiluoto power plant
- Operating waste repository
  → Interim storage of spent nuclear fuel

Fortum Power and Heat Oy

- Loviisa power plant
  ← Interim storage of spent nuclear fuel

Posiva Oy

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

- Company established in 1995
  - Ownership: Teollisuuden Voima Oy 60 %, Fortum Power and Heat Oy 40 %
- Mission: Development, licencing and implementation of safe disposal of the owners’ spent nuclear fuel
- Present focus: Submission of construction licence application in 2012
  - Site characterisation underground (ONKALO)
  - Design of facilities
  - Research and assessment of long-term safety
- Developing competencies and capabilities for implementation
  - Own and contractors' staff in Olkiluoto about 150 persons
  - Total employment in final disposal more than 300 persons
- Annual expenses about EUR 60 million
Olkiluoto in summer 2009
40 years’ effort

1978: Start of feasibility studies for geologic disposal

1983: Site investigations


2012: Site selection

2018: Application for construction licence

2020: Application for operation licence

2020: Start disposal of spent fuel

Test operation and commissioning

Construction of disposal facility

Construction of ONKALO and confirming investigations at Olkiluoto

Government’s decision on objectives and time schedule

VLJ-repositories

KPA -Spent fuel storage
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
KBS-3 disposal concept: two alternatives

KBS-3V

KBS-3H

Host rock

Backfill

Bentonite

Canister

Host rock

Bentonite

Canister
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
Progress of excavation in November 2010

ONKALO
SITUATION 17.11.2010

VENTILATION SHAFT (OUT)
-290 m

PERSONNEL SHAFT
-290 m

TUNNEL LENGTH
4511 m

TUNNEL DEPTH
426 m

VENTILATION SHAFT (IN)
-290 m
ONKALO entrance
Excavated tunnel
Raise bored shaft
Disposal facility above and under ground
Cost estimate for spent fuel disposal

<table>
<thead>
<tr>
<th></th>
<th>M€</th>
<th>Cost estimate (2009)</th>
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<tbody>
<tr>
<td>Investment above ground</td>
<td>160</td>
<td></td>
</tr>
<tr>
<td>Investment underground</td>
<td>550</td>
<td></td>
</tr>
<tr>
<td>Operation cost above ground</td>
<td>1 800</td>
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<tr>
<td>Operation cost underground</td>
<td>540</td>
<td></td>
</tr>
<tr>
<td>Decommissioning and closure</td>
<td>280</td>
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<td><strong>TOTAL</strong></td>
<td><strong>3 330</strong></td>
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1.12.2010 Eero Patrakka
Schedule of nuclear waste management

NUCLEAR REACTORS / OPERATION
- LOVIISA 1-2
- OLKILUOTO 1-2
- OLKILUOTO 3

NUCLEAR REACTORS / DECOMMISIONING
- LOVIISA 1-2
- OLKILUOTO 1-2
- OLKILUOTO 3

LLW/ILW DISPOSAL / OPERATION AND DECOMMISIONING
- LOVIISA
- OLKILUOTO

SPENT FUEL STORAGE / OPERATION AND DECOMMISIONING
- LOVIISA
- OLKILUOTO

SPENT FUEL DISPOSAL / OPERATION, DECOMMISIONING AND CLOSURE
- LOVIISA 1-2
- OLKILUOTO 1-2
- OLKILUOTO 3
- DECOMMISSIONING AND CLOSURE
Summary

- Studies on different options for spent fuel management were started parallel to the commissioning of Loviisa 1&2 and Olkiluoto 1&2 in 1970s
- The Government committed to long-term programme for spent fuel management in 1983
  - Shipping spent fuel abroad was considered as best solution – this was the case for Loviisa
  - In case of Olkiluoto, the programme aimed at starting disposal in Finland in 2020
- Geological disposal in Finland was required by legislation in 1994 for all nuclear waste
- Decision in Principle 2001 stipulated that "disposal at Olkiluoto is in line with the overall good of the society"
- Posiva has reached the disposal depth in ONKALO
- The long-term programme is still followed aiming at start in 2020
- Should this happen, Posiva will start disposal of spent fuel first in the world
Roadmap to Successful Implementation of Geological Disposal in the EU

ITRE Public Hearing
1 December 2010, Brussels

Eero Patrakka
Chair of ENEF Subgroup “Waste Management”
ENEF Subgroup “Waste Management”

- To work with the objective set by ENEF Bratislava meeting in 2007, the Subgroup "Waste Management“ was created in the context of ENEF Working Group "Risks“.
- The objective of the Subgroup is to foster in the EU Member States the management of radioactive waste and spent fuel.
- To this end it is providing guidance for the successful disposal of such waste while recognising that the current status in waste management varies notably between MS and that different routes for successful waste management are available.
- The SWG will also aim at providing views on legislative initiatives of the EC in the area of waste management.
- As an outcome, the "Roadmap to Successful Implementation of Geological Disposal in the EU" was issued in December 2009.
Aim and Basis of the Roadmap

- The aim of the Roadmap is to provide guidance to EU Member States that are starting out or are at an early stage on the decades-long process leading towards the implementation of geological repositories for high level radioactive wastes or spent nuclear fuel.
- The guidance is based to a large extent on the positive progress that has been made in a number of MS.
- The Roadmap is intended to be generic enough to be applicable to all MS, independently of their current position.
  - The national roadmaps to be developed should be compatible with this, but will differ in the specifics of approach and of timing.
Conclusions and Recommendations (1)

- Political decisions have to be taken to ensure that geological disposal is implemented without undue delay.  
  » This is independent of any consideration on the further use of nuclear energy.
- Considering the long time spans involved in waste management, sustained political commitment is essential.
- Plans for new reactors should not be put forward without a comprehensive and credible programme for spent fuel and radioactive waste management.
- The political decisions have to be transposed into clear implementation provisions in the national waste management policy.
- This policy should be empowered through a legal, regulatory and organisational framework in a timely manner.
Conclusions and Recommendations (2)

- Since it is the only technically feasible way for the safe long-term management of high level waste and spent fuel, if regarded as waste, deep geological disposal should be the endpoint in a national waste management programme for such waste.
- For each individual site, the long-term safety has to be demonstrated in a step-wise process with early public involvement, accompanied by international peer reviews and independent expertise as appropriate.
- The implementation of deep geological disposal has to be performed following internationally accepted safety principles, requirements and methodologies, given the extremely long time spans for which safety has to be demonstrated.
Conclusions and Recommendations (3)

- International cooperation is essential to build, exchange and disseminate expertise, identify good practices and optimise the cost of implementation.
  - Joint RD&D programmes will play an important role in this respect.
- Shared repositories could be an option based on a voluntary agreement between the MS concerned.
- The EU can provide an added value in the interest of the European citizens, e.g., by proposing instruments to ensure that each MS establishes, within given deadlines, concrete national programmes for the safe long-term management of spent fuel and all types of radioactive waste, with clearly defined milestones and disposal routes, including deep geological disposal for high level waste.
Thank you for your attention!