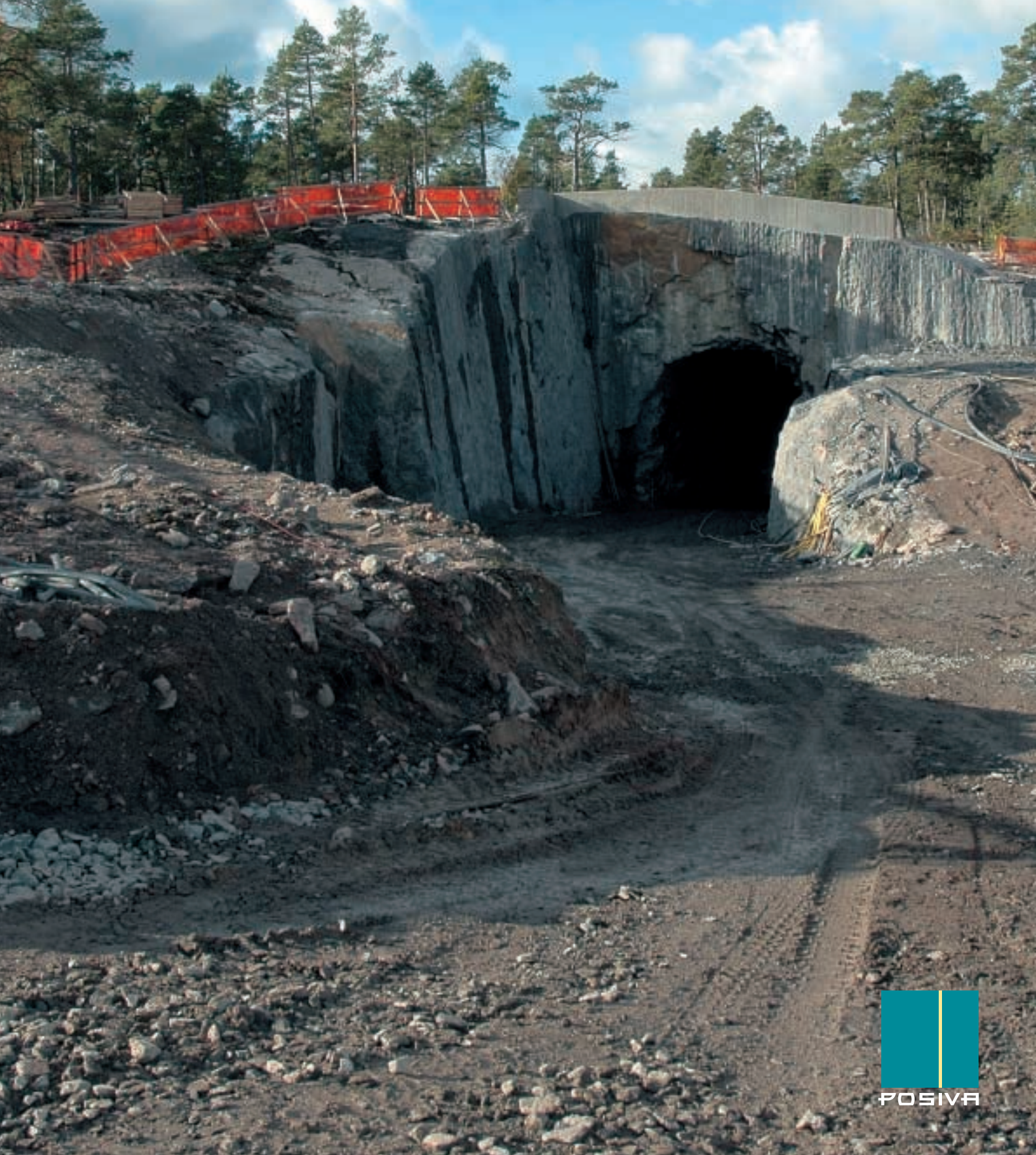


ONKALO

Underground Rock Characterisation Facility at Olkiluoto, Eurajoki, Finland



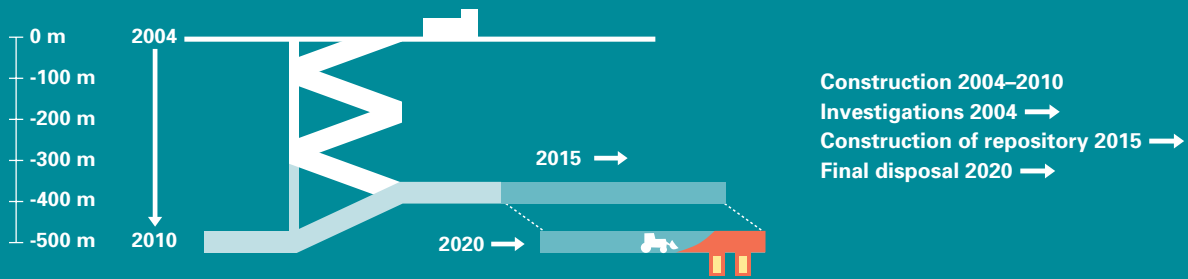
ONKALO – the underground rock characterisation facility

Finland has been preparing for the final disposal of spent nuclear fuel for some 25 years. Based on the screening of investigation areas, detailed site investigations and environmental impact assessment, in 1999, Posiva submitted an application to the Government for a decision in principle to choose Olkiluoto in the municipality of Eurajoki as the site of the final disposal facility for spent nuclear fuel. Since the municipality of Eurajoki had given its consent to locate the disposal facility in the area and the Radiation and Nuclear Safety Authority's (STUK) safety assessment had noted that there were no objections to the decision in principle, in December 2000 the Finnish Government duly issued a decision in principle in favour of the project. The Finnish Parliament approved the decision in principle by 159 votes in favour and 3 against. Since then, planning disposal has progressed to the next stage – constructing an underground characterisation facility, known as ONKALO, at Olkiluoto. Work on the entire final disposal project is progressing so that disposal can commence in 2020.



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The map shows the location of ONKALO at Olkiluoto. Numerous deep boreholes were drilled in the investigation area to obtain further information for planning ONKALO.



Preparation and implementation of the final disposal of spent nuclear fuel

	1980	2000	2020	2040	2060	2080	2100	2120
Nuclear power plant operation: Loviisa 1-2	█							
Olkiluoto 1-2	█							
Olkiluoto 3			█					
Site investigations		█						
Selection of disposal site		▼						
Construction of ONKALO, complementary characterisations and planning		█						
Construction and commissioning of repository			█					
Encapsulation and final disposal: Loviisa 1-2			█					
Olkiluoto 1-2			█					
Olkiluoto 3					█			
Decommissioning and sealing of final disposal facility								█

ONKALO will be used to obtain further information to plan the repository in detail and to assess safety and construction engineering solutions. ONKALO will also enable final disposal technology to be tested under actual conditions.

ONKALO is not intended solely for research premises, but has also been designed to serve as an access route to the repository when constructed.

ONKALO will take 6-7 years to complete. Construction is scheduled for 2004-2010 and investigations will be made from

the start of construction in conjunction with excavation. An application for a building permit for ONKALO was submitted to the municipality of Eurajoki in May 2003 and construction work began in June 2004.

Once ONKALO has been completed, work will start on building the encapsulation plant and final disposal repository in the 2010s. These stages of construction and commissioning of the facility itself are subject to separate permit procedures.



Excavation in June 2004



Blast signifying the start of work on the tunnel in September 2004

ONKALO progresses deep into the bedrock

ONKALO construction and investigations

An access tunnel and ventilation shaft will be excavated to the main characterisation level at a depth of 420 m. Other engineering work including tunnel opening structures, cable ducts, floor structures and pipelines, etc will be carried out at the same time. Excavation will be carried out using drill and blast technology. The access tunnel is being excavated in stretches of about five metres at a time. Charges of explosive are placed in holes drilled into the rock. The charge is then detonated and the blasted rock removed. The rock walls are washed and any loose stones removed.

Pre- and post-grouting and lining structures will be used to seal the rock in places as required. Cemented rock bolts and shotcrete will be used to strengthen the rock. Cast concrete, which serves as both a water insulator and a rock reinforcement, can also be used in the ventilation shaft. Final choice of materials will depend on the findings of preliminary investigations and investigations carried out while work is in progress.

A shaft building, maintenance and control buildings and a civil defence shelter will be built at ground level. Road building, earthworks and electrical work will also be carried out.

Planning and construction investigations will be carried out from the access tunnel in conjunction with excavation. The findings will be drawn on immediately in excavation and construction work. Investigations focusing on rock groundwater conditions and the location of the repository will commence at a depth of 200–300 metres.

Later, excavation of the access tunnel and ventilation shaft will continue to the lower characterisation level at a depth of 520 m. The access tunnel will total 5.5 km in length at an inclination of 1:10. The premises involve the excavation of a total of 330,000 cubic metres.

The lower characterisation level will be used to investigate rock mechanics conditions and factors impacting on the positioning of the repository. This stage also includes disposal demonstrations, which, like other investigations and tests, will also continue during 2010–2020, after ONKALO has been completed.

Map of the tunnel rock surface



Drilling of grout holes



Drilling



Blasting



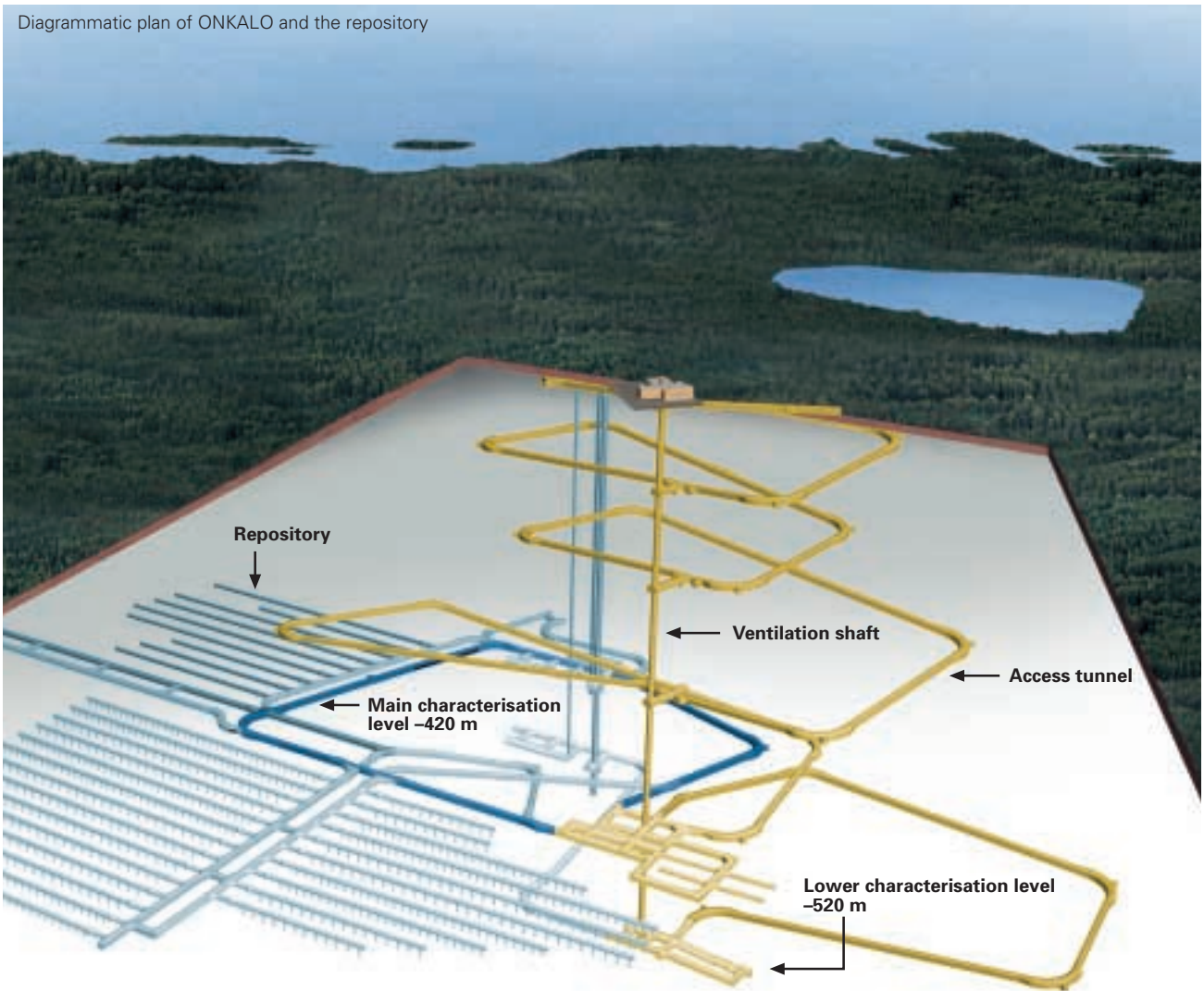
Removal of blasted rock



Grouting and reinforcement



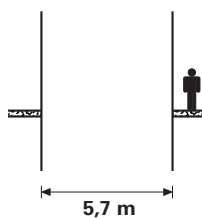
Diagrammatic plan of ONKALO and the repository



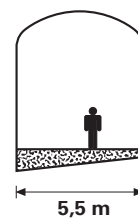
Repository tunnel



Ventilation shaft



Access tunnel

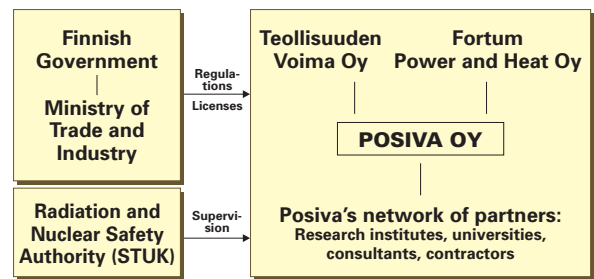


Nuclear waste management in Finland

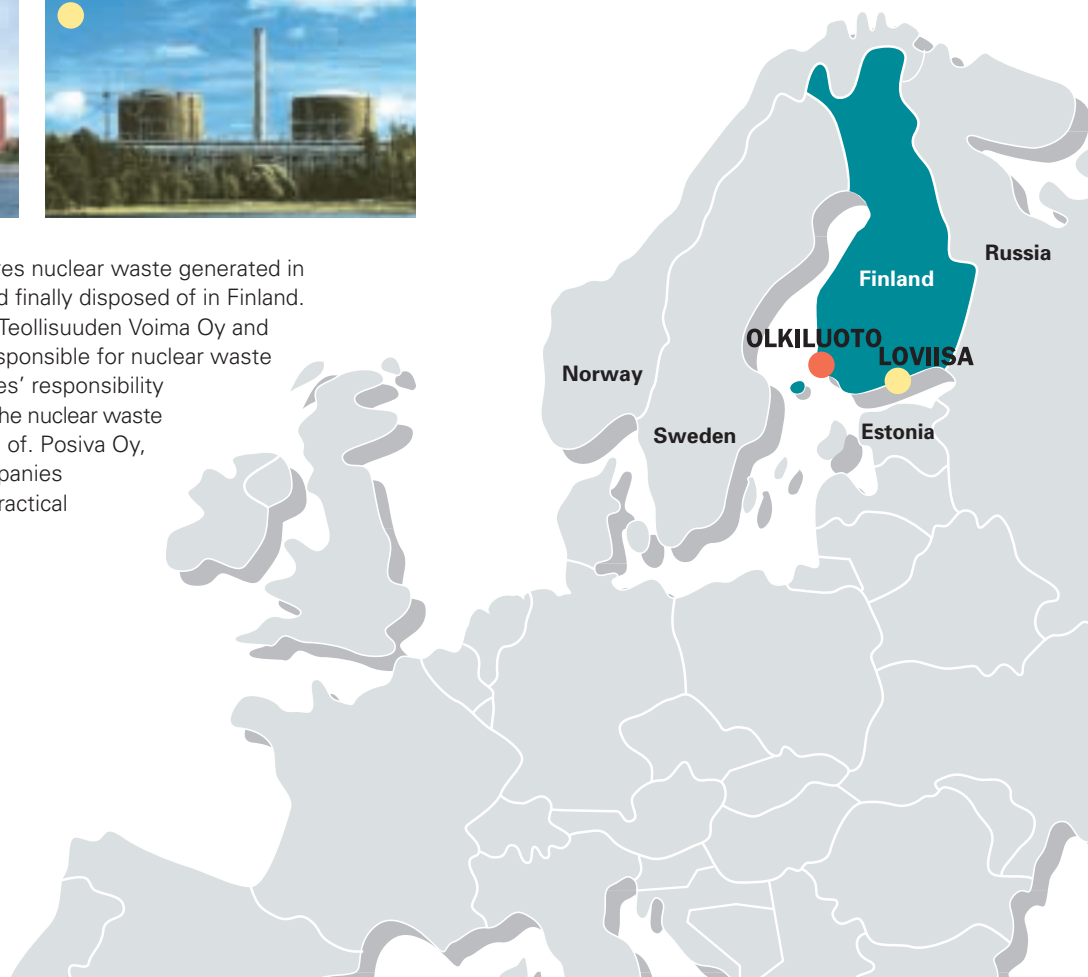
Finland has two nuclear power plants, each with two reactor units. The power plants are at Olkiluoto in Eurajoki, on the Finnish west coast, and at Hästholmen in Loviisa, on the Finnish south coast.

The combined output of the two reactors at Teollisuuden Voima Oy's power plant at Olkiluoto is 1,680 MW and that of the two reactors at Fortum Power and Heat Oy's power plant in Loviisa is 976 MW. Finland made a decision in principle in 2002 to build a fifth reactor unit. The new reactor unit (OL3) being built at Olkiluoto will have an output of 1600 MW.

The Finnish authorities are responsible for the principles governing nuclear waste management, safety criteria and for ensuring that legislation is complied with. The Ministry of Trade and Industry (KTM) is responsible for licenses and legislation and the Radiation and Nuclear Safety Authority (STUK) for supervising safety.

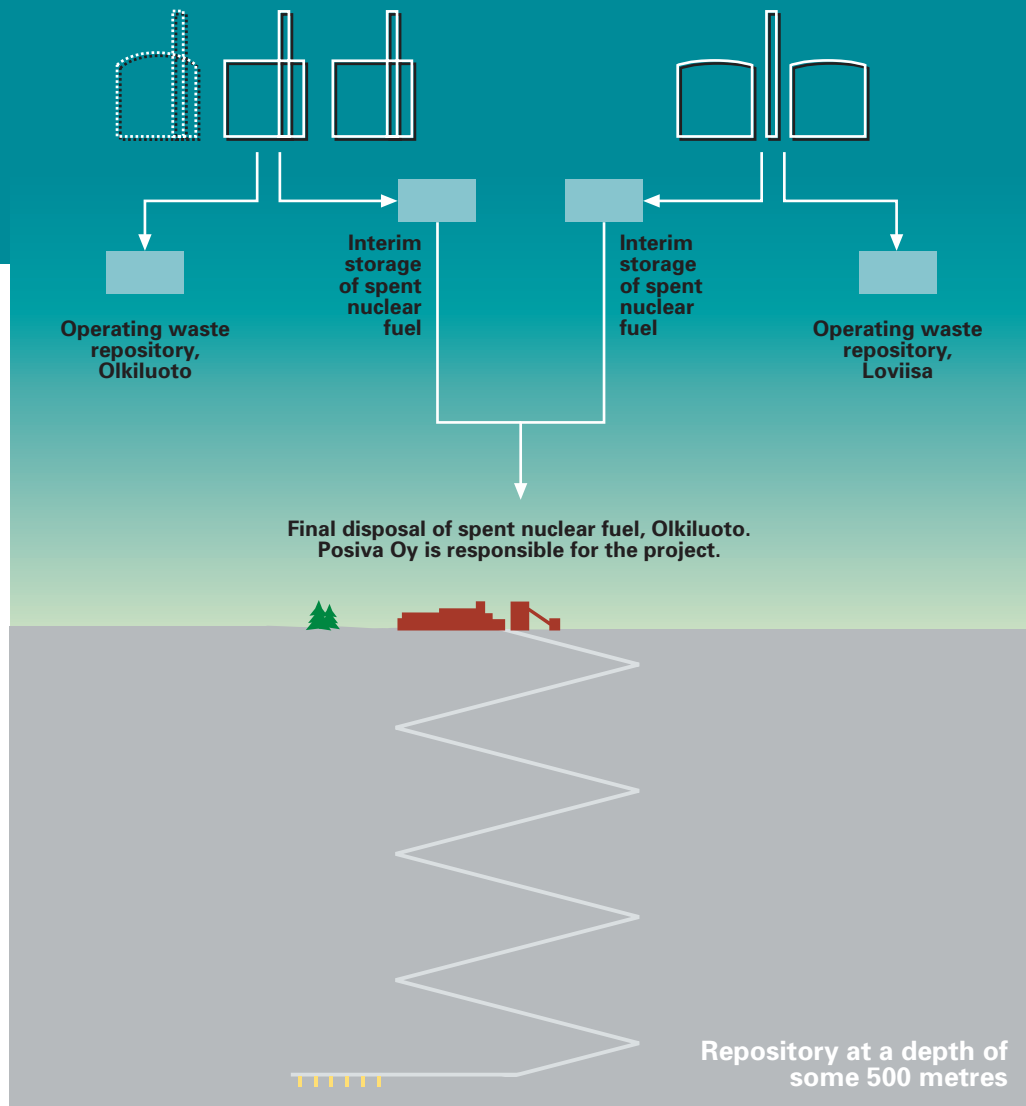


Legislation passed in Finland requires nuclear waste generated in Finland to be processed, stored and finally disposed of in Finland. The power companies concerned, Teollisuuden Voima Oy and Fortum Power and Heat Oy, are responsible for nuclear waste management. The power companies' responsibility covers all actions until such time as the nuclear waste is finally and permanently disposed of. Posiva Oy, which is owned by the power companies concerned, is responsible for the practical implementation of final disposal.



Olkiluoto nuclear power plant

Loviisa nuclear power plant



Processing of nuclear waste in Finland

Under nuclear waste management regulations, radioactive waste is divided into low level, intermediate level and highly radioactive waste. The disposal of low and medium level radioactive waste or so called operating waste is already under way and is being carried out by each power plant on its own site.

At Olkiluoto, the final disposal of operating waste began in 1992 and in Loviisa in 1997. Finland has also made a decision in principle as regards the final disposal site and solution of highly radioactive spent nuclear fuel. It is planned to begin the disposal of spent nuclear fuel at Eurajoki in 2020. Until then, the spent fuel is being temporarily stored in pools built on the power plant sites.

Posiva Oy, established in 1995 and jointly owned by TVO and Fortum Power and Heat, is responsible for practical preparations and research

into and the actual final disposal of nuclear waste. Posiva coordinates research and preparation in the final disposal project and works together with expert organisations in many different specialist fields and with similar nuclear waste management companies and other organisations in different countries.

Under the Nuclear Energy Act, funds for nuclear waste management are collected in advance in the price of nuclear electricity and paid into the State Nuclear Waste Management Fund. In 2005, the Fund stood at some EUR 1400 million, which will also be used to cover the cost of decommissioning of the plants.

Under the Government's decision in principle, the spent nuclear fuel generated by Finland's existing nuclear power plant units and the new unit (OL3) can be finally disposed of at Olkiluoto. A maximum of some 6,500 tonnes of uranium will have accumulated for disposal at Olkiluoto.

Posiva works together with numerous organisations

Implementation of ONKALO represents a decentralised model, where Posiva has outsourced the work to outside researchers, consultants, suppliers and contractors. Posiva is responsible for implementation management and overall administration of the project, which highlights collaboration and compatibility with investigations, design of the disposal facility and the construction of ONKALO.

Posiva's international partners include:

- SKB (Svensk Kärnbränslehantering AB), Sweden
- ANDRA (Agence nationale pour la gestion des déchets radioactifs), France
- NAGRA (Nationale Genossenschaft für die Lagerung radioaktiver Abfälle), Switzerland
- OPG (Ontario Power Generation), Canada
- RAWRA (Radioactive Waste Repository Authority), Czech Republic
- NUMO (Nuclear Waste Management Organisation), Japan
- RWMC (Radioactive Waste Management Funding and Research Center), Japan

Posiva also has a contract to exchange information with the above organisations and regularly cooperates with SKB and ANDRA on research into disposal facility systems and bedrock investigations.



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