

## RADIOACTIVE WASTE MANAGEMENT PROGRAMMES IN OECD/NEA MEMBER COUNTRIES

### FINLAND

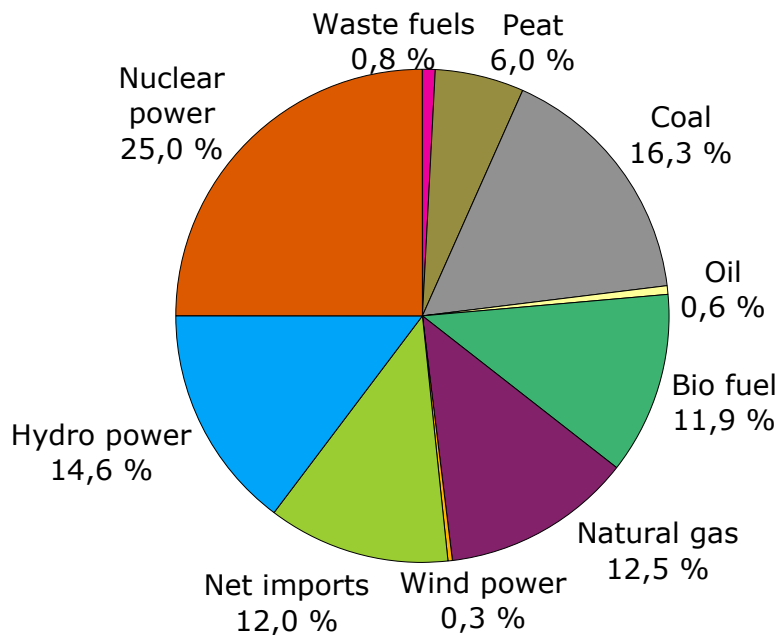
#### NATIONAL NUCLEAR ENERGY CONTEXT

Commercial utilisation of nuclear power in Finland started in 1977 and there are 4 nuclear power units connected to the electricity grid. In 2010 they generated about 22.0 TWh of electricity, 25 % of the total domestic power production in that year.

The construction of a 1600 MWe EPR unit was started in 2005 and it is expected to be operational in 2013. In 2010, the Parliament ratified decisions in principle for the construction of two more NPP units.

In 2001, the Parliament accepted a decision in principle for the disposal of spent nuclear fuel in the bedrock at Olkiluoto, near the site of the existing nuclear power plant operated by Teollisuuden Voima Oyj (TVO).

**Electricity Supply by Energy Sources 2010\* (87.5 TWh)** (Source: : Finnish Energy Industries, 2010)



## SOURCES, TYPES AND QUANTITIES OF WASTE

Nuclear waste in Finland arises from the two nuclear power plants at Olkiluoto and Loviisa, together comprising four units, and from a small research reactor (FiR 1) operated by the Technical Research Centre of Finland (VTT). Other radioactive wastes, so called small user waste, arise from a number of facilities using radioisotopes in medical, research and industrial applications. No major decommissioning projects, giving rise to waste, are underway or foreseen in near future.

Waste is classified in Finland according to its disposal route. Spent nuclear fuel contains very high activity inventory and is destined for disposal in a geological repository, to be constructed at the Olkiluoto site. Low and intermediate level waste (LILW) is of much lower activity and is destined for disposal in rock caverns at intermediate depth, located at the NPP sites. The small user waste generally falls within the latter category. Some very low-level waste can be released without further radiological control for disposal into landfill or recycling in metal industry. The quantities of radioactive waste in storage or disposed of at the end of 2010 are shown in the table below.

### Radioactive waste in Finland at the end of 2010

Waste type	Facility	Quantity (Activity)
Spent fuel from NPPs	Loviisa NPP	500 tonnes HM
	Olkiluoto NPP	1320 tonnes HM
	<b>Total</b>	<b>1820 tonnes HM</b>
LILW from NPPs (excluding activated metal waste)	Loviisa NPP	3430 m <sup>3</sup> (17 TBq)
	Olkiluoto NPP	6540 m <sup>3</sup> (64 TBq)
	<b>Total</b>	<b>9970 m<sup>3</sup> (81 TBq)</b>
Small user waste	Central storage	54 m <sup>3</sup> (25 TBq, mostly tritium)

## **RADIOACTIVE WASTE MANAGEMENT POLICIES AND PROGRAMMES**

### **Waste management policies**

Nuclear waste is defined as radioactive waste in the form of spent nuclear fuel or some other form generated in connection with or as a result of the use of nuclear energy. Producers of nuclear waste are responsible for all nuclear waste management activities and their associated costs.

The Nuclear Energy Act states that the nuclear waste generated in Finland shall be handled, stored and permanently disposed of in Finland (exemption for e.g. spent fuel from the research reactor). Respectively, nuclear waste generated elsewhere than in Finland shall not be handled, stored or permanently disposed of in Finland. The Ministry of Employment and the Economy (MEE) has issued a long-term schedule for the implementation of nuclear waste management.

Each user of radioactive substances is required to take all the measures needed to render harmless the radioactive waste arising from its operations. Highly active disused sealed sources shall preferably be returned to the supplier or manufacturer.

In any situation where a producer of nuclear or other radioactive waste is incapable of fulfilling its waste management obligations, the responsibility for doing so will fall to the State.

### **Spent nuclear fuel management**

Spent fuel will be stored in water pools for some decades and thereafter encapsulated and transferred to an underground repository at a depth of about 500 m in crystalline bedrock. There has been good progress in complying with the milestones set originally in the 1983 Government policy decision on spent nuclear fuel management. An underground rock characterization facility, intended to become a part of the disposal facility, has been constructed to the final depth and the construction licence application for the facility is scheduled to be submitted at the end of 2012.

As regards interim storage, the capacity for spent fuel storage at the Loviisa NPP is adequate until the planned start of disposal. At the Olkiluoto NPP, additional interim storage capacity is needed by 2014.

## **Low and intermediate level waste management**

Low and intermediate level wastes from reactor operations are disposed of in the bedrock of the power plant sites. The repositories at the Olkiluoto and Loviisa NPP sites were commissioned in 1992 and 1998, respectively. Facilities for the conditioning of the waste are nowadays available and about 70 % of the generated waste has been disposed of.

## **Small user waste management**

Such disused sealed sources or other small-user waste that cannot be cleared from regulatory control or shipped abroad, may be handed over to STUK upon compensation that covers the storage and disposal costs. STUK operates a rock cavern interim storage located in the premises of the Olkiluoto LILW repository.

## **Programmes and projects**

The most important waste management development project is the spent fuel disposal programme, being implemented by Posiva, a company owned by the two NPP utilities. The main achievements and targets of the programme, in line with the decision by the Ministry of Employment and Economy, are the following:

- Disposal site selection in 2000 (the Olkiluoto site was proposed in the Decision-in-principle application of 1999 which was approved by the host municipality in January 2000, the decision was made by the Government in December 2000 and ratified by the Parliament in May 2001)
- Start of construction of an underground rock characterisation facility at Olkiluoto in 2004 (reached the final depth of 420 m in 2010)
- Construction licence application for the disposal facility by the end of 2012; the construction licence will be issued by the Government
- Operating licence application in 2018 and start of operation of the disposal facility in 2020; the operating licence will be issued by the Government.

## **RESEARCH AND DEVELOPMENT**

The producers of nuclear waste carry out research and development work for the safe management of their wastes. The total budget for this work is in excess of 30 million euros annually. The programme is focused on Posiva's spent fuel disposal project. Extensive geological investigations as well as development of the disposal technology and performance assessment modelling and databases have been carried out for more than 20 years. At depth investigations in the Olkiluoto rock characterisation facility are ongoing. The R&D programmes and results are reported in three-year periods for the review by the regulatory authorities.

Posiva has extensive collaboration with the Swedish SKB and has also bilateral co-operation agreements with ANDRA (France), DBE (Germany), NAGRA (Switzerland), RAWRA (Czech Republic), JAEA, NUMO and RWMC (Japan) and NWMO (Canada).

Posiva also participates in European Commission's projects.

There is also a Public Sector's Research Programme aimed at supporting the regulatory activities and maintaining expertise in national research institutes. Its volume is about 1,7 million euros per year and the financing of the programme is mainly coming from a specific fund for which the money is collected annually from the licence holders. Several national research institutes participate in this programme, which is focused on some specific issues related to spent fuel disposal.

## **DECOMMISSIONING POLICIES AND PLANS**

The nuclear power utilities must update their NPP decommissioning plans for regulatory review every five years, last update was in 2008. The plan for the Loviisa NPP is based on immediate decommissioning while for the Olkiluoto NPP, a safe storage period of about 30 years prior to dismantling is envisaged.

According to the plans, decommissioning wastes will be disposed of in underground repositories co-located with those for operational wastes at the power plant sites. Activated metal components accumulated during the operation of the reactors would also be disposed of in those repositories. The engineered barriers will be selected taking account of the radiological and other safety related characteristics of each waste type. A special feature of the decommissioning plans is the emplacement of large components, such as pressure vessels and steam generators, into the disposal shafts or vaults as such, without cutting them into smaller pieces.

## **REGULATORY AND IMPLEMENTING ORGANISATIONS**

### **Regulation and Licensing**

The key organisations involved in regulation of radioactive waste management, and their roles, are as follows:

**The Government** grants licenses for nuclear facilities and issues general safety regulations.

**The Ministry of Employment and Economy (MEE)** oversees implementation of waste management and related R&D to ensure that it complies with national policy and, together with the State Nuclear Waste Management Fund, that the financial provisions for future waste management are adequate.

**The Radiation and Nuclear Safety Authority (STUK)** is responsible for the control of radiation and nuclear safety, for issuing detailed safety regulations and for the technical

and safety-related review of license applications and other important documents.

## Operators

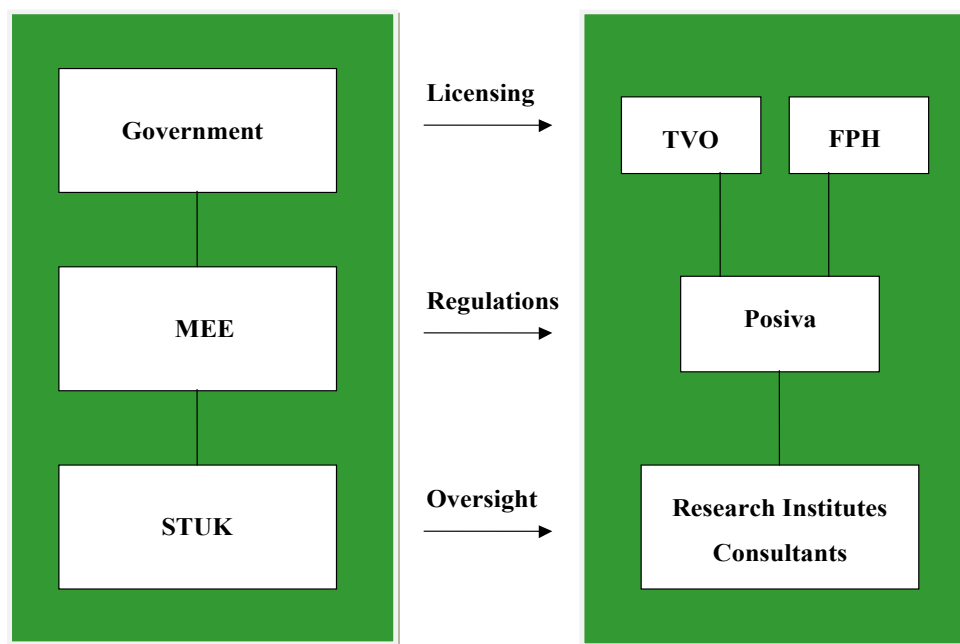
The key bodies responsible for carrying out the activities associated with radioactive waste management are as follows:

**Fortum Power and Heat Oy (FPH) and Teollisuuden Voima Oyj (TVO)** are the utilities responsible for operation of the Loviisa NPP and the Olkiluoto NPP respectively. They are responsible for interim storage of spent fuel, for the conditioning and disposal of operating LILW, and for planning of the decommissioning of their NPPs.

**Posiva Oy** is a company owned jointly by FPH and TVO and is responsible for the preparations for, and subsequent implementation of, spent fuel disposal.

As well as being a regulatory body, **the Radiation and Nuclear Safety Authority (STUK)** also has administrative control of a central interim storage facility for small user radioactive waste.

All of these bodies, in the discharge of their responsibilities, call on the services of relevant research institutes, universities and consultants.



**Regulatory and implementing organisations**

## FINANCING

The operators of nuclear facilities are responsible for financing the management of the wastes that they generate. In order to ensure that their financial liability is covered, they must present estimates of the costs for their future waste management commitments. The current (2010) estimate, including costs for management of existing wastes and those expected to arise from decommissioning of NPPs, amount to about 2 100 million euros, without discounting. The utilities are obliged to set aside the required amount of money each year to the State Nuclear Waste Management Fund. The funded amount to about 1900 million euros at the end of 2010.

## MORE INFORMATION

### Government

Radiation and Nuclear Safety Authority: Website: <http://www.stuk.fi> E-mail: [stuk@stuk.fi](mailto:stuk@stuk.fi)

Ministry of Employment and Economy: Website: <http://www.tem.fi> E-mail: [kirjaamo@tem.fi](mailto:kirjaamo@tem.fi)

### Research

Technical Research Centre of Finland (VTT): Website: <http://www.vtt.fi/nuclear>  
E-mail: [kirjaamo@vtt.fi](mailto:kirjaamo@vtt.fi)

### Industry

Posiva Oy: Website: <http://www.posiva.fi>

Teollisuuden Voima Oy (TVO): Website: <http://www.tvo.fi>

Fortum Power and Heat Oy (FPH): Website: <http://www.fortum.com>