FINLAND

a) National framework for management of spent fuel and radioactive waste

As spent nuclear fuel is defined in the Finnish legislation as radioactive waste, the nuclear power plants at Loviisa and Olkiluoto are the main generators of radioactive waste. There is also a research reactor. Other radioactive waste, so-called small user waste, arises from a number of facilities using radioisotopes in medical, research and industrial applications.

The main regulations in the field of spent nuclear fuel management as well as nuclear and other radioactive waste management are the Nuclear Energy Act and Decree, the Radiation Act and Decree, the Government Decrees on nuclear safety and on the safety of disposal of nuclear waste and the regulatory guides issued by the Radiation and Nuclear Safety Authority (STUK). The Nuclear Energy Act states that waste from NPPs generated in Finland shall be handled, stored and permanently disposed of in Finland; there are some exceptions e.g. for research reactor spent fuel. Radioactive waste generated elsewhere than in Finland, shall not be handled, stored or permanently disposed of in Finland. Small user waste that cannot be cleared, including spent sealed sources that cannot be returned to the manufacturer, must be handed over to an installation licensed to receive, condition and transfer radioactive waste to a central storage operated by STUK.

In Finland it is recognized that the producer of radioactive waste is responsible for its management and, in the case of nuclear power plants, their decommissioning, including related planning, research and development work. The waste producer is also responsible for financing the costs of the future management of his waste and of decommissioning of his facility. The State is responsible for nuclear waste after its approved disposal and has the secondary responsibility in the event that a producer of nuclear waste is incapable of fulfilling his management obligation.

b) National legal and regulatory framework

According to the Nuclear Energy Act, the overall authority in the field of nuclear energy is the Ministry of Employment and the Economy which has the responsibility of formulating the national energy policy. The Act states that the Ministry shall decide, having consulted, when necessary, the Ministry of the Environment in the matter, the principles on the basis of which the waste management obligation is to be implemented. The Ministry prepares matters concerning nuclear energy, including the nuclear waste management, for the Government for decision-making. As stipulated in the Radiation Act, which covers radioactive, non-nuclear waste management, the Ministry of Social Affairs and Health is the supreme authority on the supervision of practices involving exposure to radiation.

The Nuclear Energy Act and the Radiation Act define the enforcement system and rules for suspension, modification or revocation of a licence. The enforcement system includes provisions for executive assistance if needed and for sanctions in case the law is violated. The licences are prepared by the Ministry of Employment and the Economy and granted by the Government. On the basis of the Nuclear Energy Act, minor licences for spent fuel and nuclear waste management activities (export, import, transfer and transport licence and licences for operations) are granted by STUK. The use of radiation requires a safety licence, which can be granted by STUK upon application. A safety licence can be subject to extra conditions needed to ensure safety. The Ministry of Employment and Economy (MEE) oversees the implementation of nuclear waste management and related research and development to ensure that it complies with national policy. It also oversees the state Nuclear Waste Management Fund to ensure that the financial provisions for future nuclear waste management are adequate.

STUK is an independent governmental organisation for the regulatory control of radiation and nuclear safety. STUK's responsibilities and rights include the following main regulatory activities: authorization, review and assessment, inspection and enforcement, development of regulations and guides, national registers and inventories, information and public communication. STUK does not grant construction or operating licences for nuclear facilities. However, no such licence can de facto be issued without STUK's safety review and statement on the fulfilment of the safety regulations. As well as being a regulatory body, STUK also has administrative control of a central interim storage facility for small user radioactive waste.

c) **Radioactive waste management, decommissioning and spent fuel strategy**

The Finnish waste classification system includes two main categories: nuclear waste, and radioactive waste not originating from the use of nuclear energy and the associated nuclear fuel cycle.

Spent nuclear fuel management: The Nuclear Energy Act defines spent fuel from the operation of nuclear reactors as nuclear waste, destined for disposal in a permanent manner. Due to its high activity and heat generation, spent fuel is regarded as high-level waste. 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. 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 will be needed by 2014. The operator of Olkiluoto NPP - TVO started the construction works for enlarging the Olkiluoto interim storage in autumn 2010 and construction and installation works have been finalized in early 2014.

The nuclear power companies have formed a joint company, Posiva Oy, which is responsible for the preparations for and later implementation of their spent fuel disposal. The nuclear energy legislation provides for disposal of nuclear waste into the Finnish bedrock. Posiva is

implementing the spent fuel disposal programme on behalf of its owners in line with the Government Policy Decision of 1983 and a further decision by the Ministry of Trade and Industry in 2003. The construction of the underground rock characterization facility (ONKALO) started in July 2004. Posiva completed the excavation works for access tunnel and technical rooms in 2012.Posiva submitted the construction licence application for Olkiluoto Encapsulation and Disposal Facility by the end of 2012. It is foreseen to have readiness for starting the disposal of spent fuel operations in the early 2020's.

Low and intermediate level waste management: The predisposal management of LILW takes place at the NPPs under their operating licences and other provisions. The wastes are segregated, treated, conditioned, packaged, monitored and stored, as appropriate, before they are transferred to the disposal facilities. The predisposal management of LILW takes place at the NPPs under their operating licences and other provisions. The wastes are segregated, treated, conditioned, packaged, monitored and stored, as appropriate, before they are transferred to the disposal facilities. The construction of the repository at the Olkiluoto site began in 1988 and the operation in 1992. At Loviisa, the construction of the repository was started in 1993 and the operation of the first phase of the disposal facility was started in 1998. Facilities for the conditioning of the waste are available and about 70 % of the generated waste has been disposed of.

LILW generated from the operation of the research reactor is stored at the reactor facility until decommissioning. VTT is negotiating with the Finnish NPP licensees for possible interim storage and future disposal of decommissioning waste.

Small management user waste: Small user waste that cannot be cleared from regulatory control and such disused sealed sources that cannot be returned to the manufacturer, may be handed over to the national long-term storage operated by STUK's Department of Environmental Radiation Surveillance. A private entrepreneur, Suomen Nukliditekniikka, takes care of the conditioning, packaging and transfer of the spent sealed sources and other small user radioactive waste and they are stored in an interim storage cavern attached to the LILW repository at Olkiluoto, under the regulatory control of STUK's Department of Nuclear Waste and Material Regulation. The Department of Environmental Radiation Surveillance of STUK takes care of the waste containing nuclear material and stores it at STUK.

Decommissioning: No major decommissioning projects, giving rise to waste, are underway. There is one research reactor, however, in 2012 VTT decided to start planning of the decommissioning and eventual shut-down of the research reactor, due to economical reasons. VTT submitted the EIA programme for decommissioning and dismantling in autumn 2013. The EIA report will be prepared during 2014 and after that VTT can apply for a licence for the research reactor decommissioning. The first option for spent fuel management is to return the fuel to the United States. Another option is interim storage and later disposal into the Olkiluoto spent fuel disposal facility, but this would require a new Decision-in-Principle and licensing of the Olkiluoto disposal facility for research reactor spent fuel.

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 waste will be disposed of in underground repositories co-located with those for operational waste at the power plant sites. Activated metal components accumulated during the operation of the reactors would also be disposed of in these repositories.

Table 1 Radioactive Waste In Storage (including spent fuel that is considered waste)

Route Waste Class	Processed (type)/Unprocessed	Total Current Volume (m3)	Estimated Disposal Volume (m3)	Distribution (%)							Planned Disposal Route (if known)
				RO	FFE	RP	NA	DF	DC/RE	ND	
All Classes	No	2112	2112								
Reactor waste	No	2050	2050								
LILW	No	6	6								
Small user waste	No	56	56								

NEWMDB waste origin type codes:
RO – reactor operations
FFE – fuel fabrication & enrichment
RP – fuel reprocessing
NA – nuclear applications
DF - defence
DC/RE - decommissioning & remediation
ND - Not Determined

Table 2 Radioactive Waste Disposed (as disposed volume)

Waste Class	Processed (not)	Total Volume (m3)	Distribution (%)							Disposal Route Used
			RO	FFE	RP	NA	DF	DC/RE	ND	
Total of all Classes	Yes	6997	6997	0	0	0	0	0	0	
Reactor waste	Yes	6997	6997	0	0	0	0	0	0	

Table 3 Spent fuel in Storage (MTHM)

Type	Current Amount (NPP)	Current Amount (Research Reactors)
Total Spent Fuel Storage	1747 tonnes HM	4.45 kgU (24 elements)
Wet storage (AR)		
Wet storage (AFR)		
Dry storage (AR)		
Dry storage (AFR)		X
Total spent fuel held in storage for other countries (amounts also included above)		

Table 4 Spent fuel sent for reprocessing (in the country or sent to another country) (MTHM)

Type	Current Amount (NPP)	Current Amount (Research Reactors)
Total amount Spent Fuel sent to Reprocessing (in your country)		
Total amount Spent Fuel sent to Reprocessing (in another country)	0	0
Total amount of Spent Fuel received from another country for reprocessing and recycling		
Total amount of Spent Fuel (MTHM) or radioactive waste (cubic metres) returned to country of origin for storage/disposal		

Table 5 Example of a translation matrix (from NEWMDB) that can be used for transition from a national classification system to IAEA classification

National Waste Classification Name	VLLW	LILW-SL	LILW-LL	HLW
Reactor waste		99%	1%	
Spent fuel				100%
LILW		100%		
Small user waste		90%	10%	

Table 6 Waste management facilities

Type	Planned	Construct.	Commiss.	In Operation	Shutdown	Decomm.	Other	Total
Spent Fuel Storage				9 (4 at Loviisa NPP, 3 at Olkiluoto NPP and 2 at FiR 1)				9
Spent Fuel Reprocessing and Recycling								
Spent Fuel Conditioning		1						1
Spent Fuel disposal		1						1
Waste processing				4				4
Waste storage				10				10
Waste disposal				3				3

Table 7 Summary of major sources of waste

Type	Planned	Construct	Commiss.	In Operation	Shutdown	Decomm.	Other	Total
Research reactors	0	0	0	1	0	1	0	2
Nuclear Power reactors	2	1	0	4	0	0	0	7
Spent Fuel Reprocessing and Recycling	0	0	0	0	0	0	0	
Other								

Table 8 Future prospects

Type	Current amount	Estimated Current amount when prepared for disposal	Current Disposal Capacity	Total forecast at 2030	Disposal Capacity 2030	Total forecast at 2050	Disposal Capacity 2050
Spent Fuel Storage	6997		16382 tonnes HM		4400 TeHM		6700 TeHM
Wet storage (AR)							
Wet storage (AFR)							
Dry storage (AR)							
Dry storage (AFR)							
Total amount Spent fuel sent to Reprocessing and Recycling							
Total amount Spent fuel disposed							
Waste in storage	2112						
Waste disposal	7567				33000		33000