ESTONIA

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

In Estonia radioactive wastes are arising from the use of radioactive sources in industry, medicine and to a small extent from the use in education and research as well as from decommissioning of facilities used for radiation practice. Estonia has 2 shut-down nuclear submarine reactors of the former Soviet Union in long term storage stage in Paldiski and RADON-type Tammiku waste disposal facility under decommisioning.

The Radiation Act provides that the benefits arising from the use of radiation and practices involving exposure to radiation shall exceed the detriment it causes; that the practice shall be organized in such a way that the resulting exposure to radiation hazardous to health is kept as low as reasonably achievable and that no person`s exposure shall exceed the maximum values prescribed in the Radiation Act. These general safety principles, included in the Radiation Act, apply to the management of radioactive waste, including those arising from decommissioning of a nuclear facility. Estonia is a member state of the European Union from 1st May 2004. Thus, the regulations of the Union are in force in Estonia.

Radioactive waste is regulated in the framework of the Radiation Act. According to the definitions given in the article 3 of the Radiation Act radioactive waste is any material or object which contains or is contaminated by radionuclides, the activity or specific activity of which exceeds the established clearance levels and for which no future use is foreseen. The definition includes also equipment, goods and materials that are contaminated by radioactive materials. Radioactive materials and radiation appliances containing radioactive material whose owner can not be found shall also be regarded as radioactive waste.

Radioactive waste will be categorized by activity or specific activity, by half-life, by type of radiation and by heat generation as a result of radioactive decay. In conditioning and storing of radioactive waste their producer has to take into account, beside their type, also physical, chemical and biological properties of radioactive waste. Radioactive waste categorization is the following:

- cleared waste – includes radioactive waste arising from radiation practice the activity, specific activity or surface-specific activity of which are below the exemption levels;
- NORM waste – includes radioactive waste arising from processing of natural radionuclides the specific activity of which is higher than exemption levels;
- short-lived waste – includes radioactive waste, which contains radionuclides with half-life less than 100 days and which decay within less than 5 years below exemption level;

- low and intermediate activity short-lived waste – includes radioactive waste, which contains β- and γ-sources with half-life less than 30 years and a limited number of long-lived α-sources (no more than 4000 Bq/g for one waste package and no more than 400 Bq/g averaged for total waste package amount)
- low and medium activity long-lived waste – includes radioactive waste, which contains radionuclides with half-life higher than 30 years with the activity concentration higher than that for low and intermediate activity short-lived waste and which will generate less than 2 kW/m3 heat energy during radioactive decay;
- high level waste – includes radioactive waste, which generates more than 2 kW/m3 heat energy during radioactive decay.

According to the Radiation Act, the organization engaged in radiation practice is required to take any measures to render harmless radioactive wastes arising from its operation. Rendering radioactive waste harmless means any measure needed to treat, isolate or dispose of the waste, or to restrict its use so that it does not endanger human health or the environment. The state has the secondary responsibility in case when a producer of radioactive waste is incapable of fulfilling its management obligation. There are two options for the management of such radioactive waste - either to return the sealed source to the supplier/manufacturer or to deliver it to the waste management agency paying a waste management fee. In Estonia, majority of waste generated by practices involving the use of unsealed sources have too low activity concentrations or amounts to justify their storage in the same way that is implemented, e.g., for the spent sealed sources. A common practice is that radionuclide laboratories store their short-lived radioactive waste at their premises until their activity/activity concentration decays below the approved discharge limit.

b) National legal and regulatory framework

The main legal instrument is the Radiation Act. The principles of radiation and nuclear safety as well as the responsibilities of the licence holder are provided by the Radiation Act. Article 2 of the Act specifies that no radiation practice should be started without a radiation practice licence. The Environmental Impact Assessment and Auditing Act states that the environmental impact shall be assessed upon application for or application for amendment and for development consent if the proposed activity which is the basis for application for or amendment of the development consent potentially results in significant environmental impact.

The performance of activities related to the field of radiation safety shall be managed by the Ministry of the Environment within the limits of its competence through the Environmental Inspectorate and the Environmental Board. In 2009 in the course of reorganization, the Estonian Radiation Protection Centre was merged as a department, Radiation Safety Department, with the Environmental Board (est., Keskkonnaamet). The Radiation Act 2009 authorizes the latter to function as a regulatory authority. The other body, the Environmental Inspectorate, is provided to carry out regular inspections of the licenced practices. Both the Environmental Board and the Environmental Inspectorate have their own budget on the annual Fiscal Act.

c) Radioactive waste management, decommissioning and spent fuel strategy

Low-level waste (LLW) and Intermediate-level waste (ILW)

In 1997, an interim storage facility for radioactive waste was established at the main building of the former Paldiski nuclear site. The interim storage was designed for the purpose of containing all radioactive waste that may be created in connection with decommissioning of the Paldiski nuclear site (a training centre for the crews of Soviet nuclear submarines), with the exception of reactors. The radioactive waste arising in the country is stored in the interim storage and there are activities ongoing in finding the suitable disposal options.

High-level waste (HLW)

There is no overall policy for HLW and the spent fuel management in Estonia, as spent fuel from the former U.S.S.R Paldiski Nuclear Submarine Training facility was under the Russian jurisdiction and according to the Estonian-Russian agreement was transported to Russia in 1994. There is possibility that during the dismantling of the submarine reactors some of the arising waste has to be classified as high-level waste.

Decommissioning

A.L.A.R.A. Ltd., operator of both facilities under decommissioning (Tammiku Radioactive Waste Storage and Paldiski Former Nuclear Submarine Training Centre) is state owned and operates under Ministry of Economic Affairs and Communications. The staff and financial arrangements of the A.L.A.R.A. Ltd. are adequate for the long-term safe storage of the reactor compartments at Paldiski, decommissioning of Tammiku and partly of Paldiski facility.

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

Route Waste Class	Processed (type)/Un processed	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	792	3168				1%		99%		
All Classes	Yes	412	412				11 %		89%		
LILW-LL	No	47	188				100 %				
LILW-SL	No	745	2235						100%		
LILW-SL	Yes	412	412				11 %		89%		

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	
All Classes										
LILW-LL										
LILW-SL										

Table 3 Spent fuel in Storage (MTHM)

Type	Current Amount (NPP)	Current Amount (Research Reactors)
Total Spent Fuel Storage		
Wet storage (AR)		
Wet storage (AFR)		
Dry storage (AR)		
Dry storage (AFR)		
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)		
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**	**ILW**	**HLW**
LILW-SL	0	100	0	0
LILW-LL	0	100	0	0
HLW	0	0	0	100

Table 6 Waste management facilities

Type	**Planned**	**Construct.**	**Commiss.**	**In Operation**	**Shutdown**	**Decomm.**	**Other**	**Total**
Spent Fuel Storage								
Spent Fuel Reprocessing and Recycling								
Spent Fuel Conditioning								
Spent Fuel disposal								
Waste processing				1				

Waste storage				1				
Waste disposal								

Table 7 Summary of major sources of waste

Type	Planned	Construct	Commiss.	In Operation	Shutdown	Decomm.	Other	Total
Research reactors								
Nuclear Power reactors								
Spent Fuel Reprocessing and Recycling								
Other						X		

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							
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	1204	4816	-			7000	7000
Waste disposal							