UKRAINE

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

Spent fuel is generated in Ukraine at operating NPPs and research reactors. Ukrainian NPPs currently operate WWER-1000 (13 units) and WWER-440 (2 units) reactors. Their spent fuel management systems include handling equipment for loading and unloading the reactors and transport casks and spent fuel cooling ponds. Ukraine has no facilities for spent fuel reprocessing. Solid waste is collected in the NPP sites of their formation, sorted into groups (by gamma dose rate) and transported to solid radwaste storage facilities. Low-level waste is treated at some NPPs prior to placement for interim storage: preliminary compaction and incineration.

Ukraine deals with uranium ore mining and processing resulting in uranium ore waste stored in tailing pits. Radioactive waste originating from RS use in medicine, industry, science and other nonnuclear fields is managed by six State Interregional Specialized Plants for Radioactive Waste Management (run by Ukrainian State Association Radon): Kyiv, Donetsk, Odessa, Kharkiv, Dnipropetrovsk and Lviv. There are radwaste disposal facilities on these sites (except the Donetsk SISP dealing only with radwaste transport) that were constructed according to standard designs in the 1960- 1970s. The radwaste disposal facilities represent reinforced concrete disposal modules. Some part of the modules had been completely filled and preserved before a decision was made to transfer to radwaste collection and temporary storage technology (1996). The preserved modules are monitored and maintained. These enterprises continue measures on re-equipment and conversion from the disposal technology to collection and container storage of radwaste and radiation sources. For this purpose, new types of special containers were and still have to be installed at the facilities. There are also borehole facilities on these sites for spent radiation sources. They represent deep stainless steel tanks with a wavy reception tube for lowering of capsules. According to a regulatory decision, spent radiation sources are no longer placed into the borehole facilities.

According to the Law of Ukraine "On Radioactive Waste Management", the major principles of state policy for radioactive waste management are as follows:

- priority to the life and health of personnel and the public and protection of the environment against the impact of radioactive waste in compliance with state radiation safety standards;
- separation of state control functions in the area of radioactive waste management;
- implementation of state policy for radioactive waste management through the long-term National Target Ecological Program for Radioactive Waste Management;
- minimization of radioactive waste generation as can be practically achieved;
- prevention of uncontrolled accumulation of radioactive waste;
- state supervision of radioactive waste management;

- involvement of members of the public, public associations, local executive bodies and governments into decision-making process regarding siting of new radioactive waste storage facilities;
- reliable isolation of radioactive waste from the environment and safety justification of radioactive waste storage facilities;
- radioactive waste storage by waste generators for a limited period of time and subsequent waste transfer to specialized radioactive waste management enterprises;
- responsibility of radioactive waste generators for the safety of radioactive waste management during transfer to specialized radioactive waste management enterprises;
- prohibition of radioactive waste disposal by legal entities and individuals that generate radioactive waste and deliver and use radioactive material or nuclear installations;
- research & development and international cooperation for radioactive waste management.

The Strategy for Radioactive Waste Management in Ukraine identifies major areas and tasks for development of the radwaste management system for a 50-year period in Ukraine. The current strategic option for developing the radwaste management system in Ukraine provides for:

- radwaste treatment on NPP sites to the state acceptable for disposal or long-term storage;
- collection, conditioning, interim storage and transport of radwaste generated in medicine, science and industry at UkrDO Radon interregional specialized enterprises for radwaste management;
- centralized disposal of low- and intermediate-level short-lived waste and long-term storage of long-lived and high-level waste from all Ukrainian generators in facilities on the Vector site;
- disposal of long-lived and high-level waste in a geological repository;
- development of a national organization for radwaste management, including long-term storage and disposal;
- sustainable and adequate funding of radwaste management measures;
- development of the regulatory and legal framework and international cooperation.

b) National legal and regulatory framework

Nuclear safety requirements and regulations in Ukraine are established by laws, resolutions of the Cabinet of Ministers and regulatory documents of central executive authorities. Regulatory requirements are developed by the State Nuclear Regulatory Inspectorate of Ukraine on a systematic basis through analysis of the existing regulatory framework, taking into account IAEA safety standards, EC legislation, recommendations of the West European Nuclear Regulators' Association and regulatory experience of other member states. The major legal and organizational aspects of the licensing system are set forth in the Law of Ukraine "On Authorizing Activity in the Field of Nuclear Energy". There is also Law on Use of Nuclear Energy and Radiation Safety.

The State Nuclear Regulatory Committee of Ukraine was established according to Presidential Decree No. 1303 of 5 December 2000. Following the reform in the system of central executive authorities according to Presidential Decree No. 1085 of 9 December 2010 "On Optimizing the System of Central Executive Authorities", the State Nuclear Regulatory Committee of Ukraine with its territorial bodies was renamed the State Nuclear Regulatory Inspectorate of Ukraine (SNRIU). Competence and functions of SNRIU are the same as defined previously. Since 2006 there have been eight territorial bodies in the SNRIU structure.

The Ministry of Health participates in state radiation safety supervision, and its competence includes the development and implementation of radiation safety standards, authorization of practices involving radioactive material and other radiation sources and state supervision under health and epidemiological legislation. The Ministry of Environment participates in the regulation of environmental radiation protection.

c) Radioactive waste management, decommissioning and spent fuel strategy

According to the Strategy for Radioactive Waste Management in Ukraine, operator (NNEGC Energoatom) is developing at all NPPs complexes for treatment of solid radwaste to be accepted for disposal or long-term storage in centralized facilities at the Vector site. A substantial part of equipment for radwaste treatment has been delivered to the Zaporizhzhya and Rivne NPPs, and complex treatment lines are to be commissioned in 2014-2015. The Khmelnitsky and South Ukraine NPPs have started inspection of buildings for future installation of the complexes and preparation of documentation for the relevant tendering procedures. Since the product of liquid radwaste treatment at NPPs, salt fusion cake, cannot be transferred for long-term storage/disposal without additional treatment, the operating organization is looking for safe technologies to immobilize the salt fusion cake produced by deep evaporation facilities in a solid matrix. At the safe time, modernization of the liquid radwaste treatment process at NPPs is under consideration to exclude the formation of salt fusion cake.

The Energy Strategy of Ukraine till 2030 identifies the following strategic areas for spent fuel management at Ukrainian nuclear power plants:

- temporary storage of spent fuel in reactor ponds to ensure its safe transport and further storage in interim spent fuel storage facilities on the territory of Ukraine;
- safe operation of the dry spent fuel storage facility at the Zaporizhzhya NPP (Zaporizhzhya ISF);
- construction, commissioning and safe operation of the centralized spent fuel storage facility for the Rivne, Khmelnitsky and South Ukraine NPPs (Centralized ISF).
- transport of spent fuel from the Rivne, Khmelnitsky and South Ukraine NPPs to the Russian Federation for temporary storage and subsequent reprocessing (until Centralized ISF is commissioned);

- construction, commissioning and safe operation of the facility for long-term storage of high-level radwaste to be returned from the Russian Federation after spent fuel reprocessing;
- completion, commissioning and safe operation of ChNPP ISF-2 intended for storage of all spent fuel from this plant.

The state policy for radioactive waste management is implemented in compliance with the Strategy for Radioactive Waste Management in Ukraine, National Target Ecological Program for Radioactive Waste Management, National Program for Chornobyl NPP Decommissioning and Shelter Transformation into an Environmentally Safe System. The current strategic option for developing the radwaste management system in Ukraine provides for:

- radwaste treatment on NPP sites to the state acceptable for disposal or long-term storage;
- collection, conditioning, interim storage and transport of radwaste generated in medicine, science and industry at UkrDO Radon interregional specialized enterprises for radwaste management;
- centralized disposal of low- and intermediate-level short-lived waste and long-term storage of long-lived and high-level waste from all Ukrainian generators in facilities on the Vector site;
- disposal of long-lived and high-level waste in a geological repository;
- development of a national organization for radwaste management, including long-term storage and disposal;
- sustainable and adequate funding of radwaste management measures;
- development of the regulatory and legal framework and international cooperation.

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	1122517	1122517	5	0	0	0	0	95	0	
All Classes	Yes	5694	5694	100	0	0	0	0	0	0	
High-active	No	870	870	35	0	0	0	0	65	0	
Low-active	No	34603	34603	96	0	0	0	0	4	0	
Low-active	Yes	3634	3634	100	0	0	0	0	0	0	
Mid-active	No	1087044	1087044	2	0	0	0	0	98	0	
Mid-active	Yes	2060	2060	100	0	0	0	0	0	0	

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	No	695849	0	0	0	0	0	100	0	
All Classes	Yes	2	0	0	0	0	0	100	0	
High-Active	No	3960	0	0	0	0	0	100	0	
Mid-Active	No	691889	0	0	0	0	0	100	0	
Mid-Active	Yes	2	0	0	0	0	0	100	0	

Table 3 Spent fuel in Storage (MTHM)

Type	Current Amount (NPP)	Current Amount (Research

		Reactors)
Total Spent Fuel Storage	5059.824	0,0476
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	LILW-SL	LILW-LL	HLW
Mid-Active	99	1	0
Low-Active	99	1	0
High-Active	0	0	100

Table 6 Waste management facilities

Type	Planned	Construct.	Commiss.	In Operation	Shutdown	Decomm.	Other	Total
Spent Fuel Storage		1		19		3		23
Spent Fuel Reprocessing and Recycling								
Spent Fuel Conditioning								
Spent Fuel disposal								
Waste processing				12				
Waste storage				18				
Waste disposal				16				

Table 7 Summary of major sources of waste

Type	Planned	Construct	Commiss.	In Operation	Shutdown	Decomm.	Other	Total
Research reactors	1	1		3				5
Nuclear Power reactors		2		15	4			21
Spent Fuel Reprocessing and Recycling								
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							
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							
Waste disposal							