ANNEX A: Croatia - National Profile

a. National Framework for management of radioactive waste and spent fuel

The Republic of Croatia shares ownership of the Krško NPP with the Republic of Slovenia. Therefore Croatia owns half of spent fuel that was generated so far and that will be generated up to expiration of the Krško NPP lifetime. The Bilateral Agreement favors development of a common solution for spent fuel management and the solution was developed by both parties on generic way in 2004 - assuming construction of a spent fuel dry storage facility on-site or near-by and construction of a spent fuel disposal facility afterwards at generic site in Croatia or at generic site in Slovenia. However in the meantime there has been no significant improvements of such generic solution. The spent fuel generated in the Krško NPP has been currently managed safely onsite by the operator and it will remain there at least up to expiration of the plant lifetime.

The aim of the updated Governmental Strategy on Radioactive Waste and Spent Fuel Management is to set out goals and general guidelines for development of national framework on radioactive waste and disused sources management, naturally occurring radioactive materials management as well as development of national framework on radioactive waste and spent fuel management from Krško NPP. A detailed set of strategic objectives and guidelines will be elaborated within the National Programme which is currently in the process of development. Among others the new Strategy stands out an important need for development, construction and operation of the Central National Storage Facility (CNSF) for radioactive waste and disused sources generated in the country.

The origins of radioactive waste in Croatia are legacy waste and radioactive waste and disused sources from medicine, industry, science, education and the past public use. The radioactive waste and disused sources from medicine, industry, science, education and the past public use are stored in two storage facilities and both of them are closed nowadays. The project on development, construction and operation of the Central National Storage Facility has been launched recently. Basic design of the facility and preliminary safety assessment is under way presently.

Radioactive waste categorization

- Exempt and cleared radioactive waste – activity concentrations or total radioactive waste activity at or below prescribed exemption or clearance levels

- Low level short lived radioactive waste – radioactive waste containing radionuclides with half-life less than 100 days which will decay below clearance levels within 3 years
- Low and intermediate level radioactive waste – radioactive waste containing radionuclides with half-life less than 30 years and activity concentration or total activity which will remain above prescribed exemption or clearance levels 3 years after their creation, and having a heat generation rate below 2 kW/m3
    - Short lived waste – low and intermediate level radioactive waste containing radionuclides with half-life less than 30 years (limitation of long lived alpha emitting radionuclides to 4000 Bq/g in individual waste packages and to an overall average of 400 Bq/g in the total waste volume)
    - Long lived waste – low and intermediate level radioactive waste activity concentrations exceeding the limits for short lived waste
- High level radioactive waste – radioactive waste thermal power above 2 kW/m3 and activity concentrations exceeding limits for short lived waste.

b. National legal and regulatory framework

In Croatia the issues related to the safety of spent fuel and radioactive waste management are almost entirely covered by the Act on Radiological and Nuclear Safety. The Act establishes measures for radiological safety, measures for physical protection and measures for non-proliferation of nuclear weapons in performing nuclear operations and operations involving sources of ionizing radiation. The goal is to ensure adequate protection of individuals, society and the environment against harmful effects of ionizing radiation, as well as to ensure safe performance of operations involving ionizing radiation sources, nuclear operations, radioactive waste management and physical protection of ionizing radiation sources and nuclear installations.

State Office for Radiological and Nuclear Safety (SORNS) is the regulatory body entrusted with the implementation of the legislative and regulatory framework. The SORNS, as the state administration body, is the competent authority for all activities pertaining to radiological and nuclear safety, as well as for the activities pertaining to storage of radioactive waste and disused sources of domestic origin in the central national storage.

c. Radioactive waste management, decommissioning and spent fuel strategy and current practices & technologies

There are two radioactive storages:

- Radioactive waste storage facility at the Institute for Medical Research and Occupation Health (IMROH) and
- Radioactive waste storage facility within the premises of the Institute Ruđer Bošković (IRB).

Both storage facilities are located in Zagreb (the capital) and contain the waste from medicine, industry, science, education and the past public use. The storage at the IMROH was operational in the period from 1959 till 2000. Radioactive waste storage facility at the IRB was formed in 1967 to allow for safe storage of the waste produced within this scientific institution. In 1987 the facility was enlarged so that the waste produced elsewhere can be accepted as well. Until 2013 this facility was authorized for the collection, processing and storage of all types of solid and liquid radioactive waste generated in Croatia. In 2009 the Governmental Decision was issued according to which the storage at the IRB was supposed to be upgraded to become central national storage for the radioactive waste. However, Decision has never been implemented due to the technical issues raised by the IRB and because of the public concern. In September 2013 the facility was put out of operation. In July and August 2015, during the *"Waste Re-Disposal Program for the Facility Used as a Temporary Radioactive Waste Storage at Rudjer Boskovic Institute in Zagreb"*, radioactive waste at the IRB was characterized and repackaged.

According to Article 51 of Act on Radiological and Nuclear Safety the Fund for Financing the Decommissioning of the Krsko Nuclear Power Plant and the Disposal of Radioactive Waste and Spent Nuclear Fuel, as legal person, will establish and operate the Central National Storage Facility. The Fund will be financed from the designated fund established by the Act on the Fund for Financing the Decommissioning of the Krsko Nuclear Power Plant and the Disposal of Radioactive Waste and Spent Nuclear Fuel and from disposal fees paid by the radioactive waste generators.

d. Radioactive waste classification, waste and spent fuel quantities (inventory) (including disused sources that are declared radioactive waste)

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

Route Waste Class	Processed (type)/ Unprocessed)	Total Current Volume (m^3)	Estimated Disposal Volume (m^3)	Distribution (%)							Planned Disposal Route (if known)
				RO	FFE	RP	NA	DF	DC / RE	ND	
Total of all Classes	No	12.5	/	0	0	0	100	0	0	0	
LILW-SL	No	9.5	/	0	0	0	100	0	0	0	
LILW-LL	No	3	/	0	0	0	100	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 (m^3)	Distribution (%)							
			RO	FFE	RP	NA	DF	DC / RE	ND	Disposal Route Used
Total of All Classes		0	/	/	/	/	/	/	/	/

(Note: Abbreviations as in Table 1)

Table 3 Spent fuel in Storage (MTHM)

Type	Current Amount (NPP)	Current Amount (Research Reactors)
Total Spent Fuel Storage	0	0
Wet storage (AR)	0	0
Wet storage (AFR)	0	0
Dry storage (AR)	0	0
Dry storage (AFR)	0	0
Total spent fuel held in storage for other countries (amounts also included above)	0	0

Table 4 Spent fuel sent for reprocessing (in the country or sent to another country)[1] (MTHM)

Type	Current Amount (NPP)	Current Amount (Research Reactors)
Total amount Spent Fuel sent to Reprocessing (in your country)	0	0

[1] All years

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	0	0
Total amount of Spent Fuel (MTHM) or radioactive waste (cubic metres) returned to country of origin for storage/disposal	0	0

AR = "at reactor site", including fuel pools at NPP

AFR = "away from reactor site"

In the case of disused sources not included in volumes according to the relevant national waste classes, please include a similar table for disused sources declared as numbers of items stored and disposed.

Table 5 below shows a translation matrix from national classification system to IAEA classes.

Table showing conversion factors from stored waste volumes to disposed waste volume for forecasts, if required.

Table 5 Example of a translation matrix (from NEWMDB) that can be used for transition from a national classification system to IAEA classification (see Section 3)

National Waste Classification Name	**VLLW**	**LLW**	**ILW**	**HLW**
LL-SL	100%			
LILW-SL				
LILW-LL				
HLW				100%
…				

a. Tabulation of processing, storage and disposal facilities for waste and spent fuel, including their capacities and status

Tabular information of spent fuel facilities Total number of Fuel cycle facilities (by type and status) from INFCIS types "Spent Fuel Storage"; "Spent Fuel Reprocessing and Recycling" and "Spent Fuel Conditioning" Total number of waste management facilities (by type and status) from NEWMDB

Table 6 Waste management facilities

Type	Planned	Construction	Commissioning	In Operation	Shutdown	Decomm.	Other	Total
Spent Fuel Storage	0	0	0	0	0	0	0	0
Spent Fuel Reprocessing and Recycling	0	0	0	0	0	0	0	0
Spent Fuel Conditioning	0	0	0	0	0	0	0	0
Spent Fuel disposal	0	0	0	0	0	0	0	0
Waste processing	0	0	0	0	0	0	0	0
Waste storage:	1	0	0	0	2	0	0	3
Waste disposal:	0	0	0	0	0	0	0	0

Table 7 Summary of major sources of waste (from IAEA PRIS, INFCIS & RRDB databases)

Type	Planned	Construction	Commissioning	In Operation	Shutdown	Decomm.	Other	Total
Research reactors*	0	0	0	0	0	0	0	0
Nuclear Power reactors	0	0	0	0	0	0	0	0
Spent Fuel Reprocessing and Recycling	0	0	0	0	0	0	0	0
Other (define)**	0	0	0	0	0	0	0	0

* Note: research reactors with medium or high power from RRDB

Note: "Planned" means it has been identified in a national report, strategy, or formal plan. It includes: Planned, Under Study-Assessment, Siting-Design phases

** if applicable, where included in national inventory, e.g. decommissioning of contaminated facilities, cleanup of accident related sites

Table 8 Trends and future prospects (estimation of volumes of waste and spent fuel arising, waste and spent fuel management facilities)

Type	Current amount	Estimated Current amount when prepared for disposal*	Current Disposal Capacity	Total forecast at 2030		Total forecast at 2050	
Spent Fuel Storage	0			0		MTHM	
Wet storage (AR)	0			0		MTHM	
Wet storage (AFR)	0			0		MTHM	
Dry storage (AR)	0			0		MTHM	
Dry storage (AFR)	0			0		MTHM	
Total amount Spent Fuel sent to Reprocessing and Recycling	0			0		MTHM	
Total amount Spent fuel disposed	0		MTHM	0		MTHM	
Waste in storage:	12,5	/		1497,5		1785,5	
LILW-SL	9,5	/		1493,5		1780,5	
LILW-LL	3	/		4		5	
HLW	0			0		0	
Waste disposal:	0		0	0	0	0	

AR = “at reactor site”

AFR = “away from reactor site”

* calculated equivalent amount when waste has been conditioned and packaged for disposal as per table of conversion factors given.

date of profile preparation 02.03.2016.