

**REPUBLIC OF CROATIA**

## **NATIONAL REPORT**

AS REQUIRED UNDER ARTICLE 14.1 OF  
**COUNCIL DIRECTIVE 2011/70/EURATOM**  
OF 19 JULY 2011 ESTABLISHING A COMMUNITY FRAMEWORK FOR  
THE RESPONSIBLE AND SAFE MANAGEMENT OF SPENT FUEL AND  
RADIOACTIVE WASTE

**2<sup>nd</sup> report**

August 2018

## Table of Contents

A. INTRODUCTION.....	3
B. RECENT DEVELOPMENTS .....	5
C. SCOPE AND INVENTORY (ARTICLE 2, ARTICLE 12.1 (C), ARTICLE 14.2 (B)) .....	6
D. GENERAL PRINCIPLES AND POLICIES (ARTICLE 4).....	10
E. NATIONAL FRAMEWORK (ARTICLE 5) .....	13
F. COMPETENT REGULATORY AUTHORITY (ARTICLE 6) .....	18
G. LICENCE HOLDERS (ARTICLE 7) .....	21
H. EXPERTISE AND SKILLS (ARTICLE 8) .....	23
I. FINANCIAL RESOURCES (ARTICLE 9).....	25
J. TRANSPARENCY (ARTICLE 10).....	27
K. IMPLEMENTATION OF THE NATIONAL PROGRAMME (ARTICLES 11 AND 12).....	31
L. PEER REVIEWS AND SELF-ASSESSMENTS (ARTICLE 14.3).....	34
M. FUTURE PLANS TO IMPROVE SAFE AND RESPONSIBLE MANAGEMENT OF SPENT FUEL AND RADIOACTIVE WASTE.....	35
N. ANNEXES.....	36

## A. INTRODUCTION

After decades of use of ionising radiation sources in medicine, industry, science, education and the past public use, current quantity of radioactive waste (RW) accumulated in Croatia is around 11,34 m<sup>3</sup> with total activity of around  $3,33 \times 10^{12}$  Bq. Today this waste is temporarily stored in two storages that have been closed. Also, according to the Bilateral Agreement with Republic of Slovenia, Croatia is obliged to take over and manage one-half of the radioactive waste and spent nuclear fuel (SNF) now stored at Nuclear Power Plant Krško and other that will be generated in the future, including waste raised from decommissioning. This currently amounts 1145 m<sup>3</sup> of operational radioactive waste with activity of around  $8,5 \times 10^{12}$  Bq and 604 spent fuel elements. Croatia has also the obligation to remediate sites where naturally-occurring radioactive materials have been disposed of.

Independent state administration body competent for activities pertaining to radiological and nuclear safety is the State Office for Radiological and Nuclear Safety. Its obligations cover, among other, licensing and inspection of all activities regarding radioactive waste and spent nuclear fuel management. Implementing agency for these activities as of April 2015 is the Fund for financing the decommissioning of the Krško Nuclear Power Plant and the disposal of NEK radioactive waste and spent nuclear fuel (hereinafter referred to as the Fund) which has the obligation to establish the Radioactive Waste Management Centre as its part.

Croatian national policy is defined in the Strategy for the Management of Radioactive Waste, Disused Sources and Spent Nuclear Fuel (hereinafter referred to as the Strategy) adopted by Parliament of the Republic of Croatia in October 2014. The Strategy prescribes systematic and long-term approach to resolving relevant issues, in compliance with the Act on Radiological and Nuclear Safety (hereinafter referred to as the Act), Directive 2011/70/Euratom (SL L 199, 2.8.2011), Bilateral Agreement between the Government of the Republic of Croatia and the Government of the Republic of Slovenia on the settlement of status and other legal relations with respect to investments, utilization of and decommissioning of the Krško nuclear power plant (NPP) (hereinafter referred to as the Bilateral Agreement), the international regulations, binding guidelines of the International Atomic Energy Agency and the best international practices in this area. The Strategy defines short-term, mid-term and long-term goals related to the management of radioactive waste, disused sources, spent nuclear fuel and remediation of NORM locations in Croatia. The goals set out in the Strategy include establishment of a long-term storage and then repository for institutional radioactive waste (IRW), disused sources (DS) and low and intermediate level radioactive waste (LILW) from Krško NPP; remediation of locations with naturally occurring radioactive material (NORM) in Croatia; establishment of a dry storage for spent nuclear fuel at Krško NPP location, and then disposal of spent nuclear fuel high level waste (HLW) in deep geological formation at a location in the Republic of Croatia or the Republic of Slovenia (or in an eventual international repository in the EU); and a programme for informing and educating public on the management of radioactive waste, spent sources and spent nuclear fuel. In order to fulfil the goals mentioned above the Strategy sets up general guidelines regarding the legislative framework, responsibilities, funding, human resources and public participation.

After the adoption of the Strategy, the National Programme for the Implementation of the Strategy (hereinafter referred to as the National Programme) was developed and will be adopted on the next Government session.

The National Programme sets out how the following Strategy goals will be implemented in the period up to year 2025:

- Establishment of the Central National Storage Facility (CNSF) for institutional radioactive waste and disused sources,
- Construction and commissioning of storage facility for LILW from Krško NPP and

- Remediation of sites with NORM<sup>1</sup>

As the long-term storage for LILW is foreseen, the establishment of repository for LILW and also for IRW and DS is not required before year 2058. The planned duration of long-term storage is 40 years. Meanwhile, spent nuclear fuel generated in the Krško NPP is currently stored in wet storage. Since the wet storage capacity is not adequate, from both safety and operational capacity points of view, from the plant's lifetime extension until 2043, it was decided to construct a dry storage. The long-term dry storage of SNF at NPP Krško location should be constructed by 2019 with an operating lifetime of 60 years. Approximately in year 2050, the site selection process for the disposal of SNF and HLW, which will arise from Krško NPP decommissioning, in deep geological formation will begin. Location selection will be carried out in the Republic of Croatia or the Republic of Slovenia. In parallel, Croatia is also considering all options for participation in regional/international deep geological disposal projects. As a long-term management policy for disused sources (along reuse, repatriation and long-term storage) borehole disposal is also considered.

Bodies involved in preparation of the National Report are State Office for Radiological and Nuclear Safety and Fund for financing the decommissioning of the Krško Nuclear Power Plant and the disposal of NEK radioactive waste and spent nuclear fuel .

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<sup>1</sup> As the Republic of Croatia has not declared any waste that contains only naturally occurring radioactive material as radioactive waste in further text the plans for remediation of NORM sites will not be discussed.



## B. RECENT DEVELOPMENTS

This National Report contains updated information on matters covered in the first report, noting significant changes in applicable national laws, regulations, policies and practices. As for the form, structure and contents, the report aims to follow the most recent version of the Guidelines for Member States reporting on Article 14.1 of Council Directive 2011/70/Euratom issued in January 2018 (ENSREG Working Group 2).

Major developments in Croatia in the period after previous national report were the following ones:

- The National Programme for the Implementation of the Strategy will be adopted on the next Government session..
- Amendment of the Act on Radiological and Nuclear Safety (Official Gazette 130/17)
- Changes within the legislative and regulatory system

After the development of The National Programme for the Implementation of the Strategy in accordance with the requirements given under the Articles 57, 58, 59 and 95 of the Act, with requirements given in the Articles 10 and 11 of the Bilateral Agreement and in accordance with Articles 5, 11, 12 of the Directive 2011/70/Euratom, in 2016 it passed the Strategic Environmental Assessment process including the transboundary assessment. The National Programme was communicated to public and it passed several public hearings, including at the local community where the proposed site for the Radioactive Waste Management Centre is situated. Adoption of the National Programme is the biggest achievement in the implementation of the Directive since the last national report.

In the period covered by this national report, regarding the legislative system, the Act on Radiological and Nuclear Safety was amended in 2017. Among many new definitions the amendment includes definitions of effective dose, equivalent dose, operation involving ionising radiation sources, clearance level, disused source, spent nuclear fuel, orphan source, holder of the approval, treatment, disposal facility, facility for radioactive waste and disused sources management, risk assessment, radioactive waste, remediation, safety culture, spent nuclear fuel management, radioactive waste management. Significant changes within the Act include additional competencies of the State Office for Radiological and Nuclear Safety, new article on *Notice of intent*, changes in articles on *Approval for performance of operations involving ionising radiation sources*, on *Responsibilities of holders of the approval for performance of operations involving ionising radiation sources and holders of the approval for performance of nuclear operations (licence holders)*, on *Dose limits, recommended dose limits and reference levels*, on *Non-Medical exposure*, on *An expert in medical physics*, on *Obligations of the holder of the approval*, on *Person responsible for protection against ionising radiation*, on *Prohibition to use radioactive substances*, on *An expert in the protection against ionising radiation*, on *External exposed workers*, on *Approval for performing operations involving management of radioactive waste and disused sources*, on *Remediation*, on *Remediation of large scale of contamination*, on *Radon Action Plan*, articles on *Nuclear security* and on *Inspectors' rights, obligations and powers* and graded approach (in authorisation: notification or licence).

In addition, 23 new ordinances and one regulation regarding nuclear and radiological safety, nuclear security and management of radioactive waste and disused sources were issued. The Ordinance on the Management of Radioactive Waste and Disused Sources (Official Gazette 12/18) is one of the most important ordinances in the area of interest. It determines the conditions and method of radioactive waste and disused sources management, the obligation to keep records of the same, their content, manner of keeping and deadlines, scope and manner of reporting as well as the list and conditions for performing the activities involving management of radioactive waste and disused sources, activity concentration values for clearance of materials, and a list of documents which, in the process of issuing the approval, prove that it has been complied with the prescribed conditions.

## C. SCOPE AND INVENTORY (ARTICLE 2, ARTICLE 12.1 (C), ARTICLE 14.2 (B))

### **Article 2 – Scope**

1. This Directive shall apply to all stages of:
  - a) spent fuel management when the spent fuel results from civilian activities;
  - b) radioactive waste management, from generation to disposal, when the radioactive waste results from civilian activities.
2. This Directive shall not apply to:
  - (a) waste from extractive industries which may be radioactive and which falls within the scope of Directive 2006/21/EC;
  - (b) authorised releases.
3. Article 4(4) of this Directive shall not apply to:
  - (a) repatriation of disused sealed sources to a supplier or manufacturer;
  - (b) shipment of spent fuel of research reactors to a country where research reactor fuels are supplied or manufactured, taking into account applicable international agreements;
  - (c) the waste and spent fuel of the existing Krško nuclear power plant, when it concerns shipments between Slovenia and Croatia.
4. This Directive shall not affect the right of a Member State or an undertaking in that Member State to return radioactive waste after processing to its country of origin where:
  - (a) the radioactive waste is to be shipped to that Member State or undertaking for processing; or
  - (b) other material is to be shipped to that Member State or undertaking with the purpose of recovering the radioactive waste.

This Directive shall not affect the right of a Member State or an undertaking in that Member State to which spent fuel is to be shipped for treatment or reprocessing to return to its country of origin radioactive waste recovered from the treatment or reprocessing operation, or an agreed equivalent.

### **Article 12 – Contents of national programmes**

1. The national programmes shall set out how the Member States intend to implement their national policies referred to in Article 4 for the responsible and safe management of spent fuel and radioactive waste to secure the aims of this Directive, and shall include all of the following:
  - (...)
  - (c) an inventory of all spent fuel and radioactive waste and estimates for future quantities, including those from decommissioning, clearly indicating the location and amount of the radioactive waste and spent fuel in accordance with appropriate classification of the radioactive waste;

### **Article 14 – Reporting**

- (...)
2. On the basis of the Member States' reports, the Commission shall submit to the European Parliament and the Council the following:
  - (...)
  - (b) an inventory of radioactive waste and spent fuel present in the Community's territory and the future prospects.

Radioactive waste in accordance with Act on Radiological and Nuclear Safety, Official Gazette No. 130 of 27<sup>th</sup> December 2017, is defined as waste matter in gaseous, liquid or solid form for which

no further use is foreseen, containing radioactive substances at activity or activity concentrations above than clearance levels prescribed in the Ordinance issued by the director of the State Office for Radiological and Nuclear Safety (SORNS).

Radioactive waste classification is covered under the Article 4 of the Ordinance on the management of radioactive waste and disused sources, Official Gazette No. 12 of 7<sup>th</sup> February 2018. Given the state of matter, the radioactive waste is categorized into solid, liquid and gaseous. Further classification of radioactive waste due to its typical properties and methods of disposal is described in Table C-1.

Table C-1: Radioactive Waste Classification

Class	Typical Property	Method of Disposal
Exempt (released) radioactive waste (EW)	Waste that meets the criteria for release, from regulatory control	Release from regulatory control. Once released from regulatory control, this material is no longer considered as radioactive waste.
Very short lived radioactive waste (VSLW)	Radioactive waste containing radionuclides with half-life less than 100 days.	Storage in the structure with appropriate characteristics and then release from regulatory control. By storing this radioactive waste for several years, the activity concentration will be reduced to or below the value prescribed in Annex 1 of this Ordinance.
Very low level radioactive waste (VLLW)	Radioactive waste with higher activity concentration than VSLW. Concentrations of long lived radionuclides in VLLW are negligible.	Storage in the structure of appropriate characteristics and then release from regulatory control. By storing this radioactive waste for several dozens of years, the activity concentration will be reduced to or below the value stipulated in Annex 1 of this Regulation.
Low level waste (LLW)	Radioactive waste containing radionuclides with half-life less than 30 years and limited activity concentration of long lived radionuclides (4.000 Bq/g for individual packages, i.e. 400 Bq/g for the total mass of radioactive waste. Heat generation rate in this waste is below 2 kW/m <sup>3</sup> .	Storage in the structure with appropriate characteristics and then disposal in the surface or underground repository.
Intermediate level waste (ILW)	Radioactive waste with higher activity concentration than LLW.	Storage in the structure with appropriate characteristics and then disposal in the underground repository at the depth of several dozens to several hundreds of meters below the surface.



High level waste (HLW)	Radioactive waste with heat generation rate above 2 kW/m <sup>3</sup>	Storage in in the structure with appropriate characteristics and then disposal in the underground repository located in a stable geological formation at the depth of several hundreds of meters below the surface.
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Radioactive waste classification described above is in accordance with Classification of Radioactive Waste, IAEA General Safety Guide No. GSG-1, 2009.

As the Republic of Croatia has not declared any waste that contains only naturally occurring radioactive material as radioactive waste in further text NORM will not be discussed.

In Croatia there are no nuclear fuel cycle facilities in operation or in the process of decommissioning. Furthermore, there are no spent fuel management facilities. There are only two interim storage facilities that contain waste from medicine, industry, science, education and the past public use:

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

Both storage facilities are located in Zagreb (the capital) and are closed. The project on remediation of the facility, meaning segregation, characterization, treatment, conditioning and packing into lead containers was carried out for both storages.

The Republic of Croatia shares ownership of the Krško NPP (PWR, 707 MWe) with the Republic of Slovenia. Therefor Croatia owns half of radioactive waste and spent nuclear fuel that was generated so far and that will be generated up to expiration of the Krško NPP lifetime (and is responsible for its management). SNF is currently stored in wet storage at Krško NPP location.

Inventory of radioactive waste and spent nuclear fuel given in tables are classified based on the recommendations given in Classification of Radioactive Waste, IAEA Safety Guide No. 111-G-1.1, 1994 and Commission Recommendation of 15 September 1999 on a classification system for solid radioactive waste, Official Journal L 265/37 of 13 October 1999. In Table C-2 is given transformation of the classification of radioactive waste based on the Commission Recommendation of 15 September 1999 into classification of radioactive waste in accordance with Classification of Radioactive Waste, IAEA General Safety Guide No. GSG-1, 2009.

Table C-2: Transformation

Radioactive waste categories - IAEA Safety Guide GSG-1	Equivalent EC Recommendation 1999 categories
Very low level waste (VLLW)	Very low level waste (VLLW)
Low level waste (LLW)	Low and Intermediate short-lived waste
Intermediate level waste (ILW)	Low and Intermediate long-lived waste
High-level waste (HLW)	High-level waste



Current inventories and future prospects:

Table C-3: Current and future inventory of radioactive waste generated in Croatia

Radioactive waste type	Current volume (m <sup>3</sup> )	Current activity (Bq)	Expected volume in 2060 (m <sup>3</sup> )	Expected activity in 2060 (Bq)
Short lived	7,53	1,28x10 <sup>12</sup>	100,0	2,4 x10 <sup>13</sup>
Long lived	3,81	2,05x10 <sup>12</sup>		3,0 x10 <sup>12</sup>
Total	11,34	3,33x10 <sup>12</sup>	100,0	2,7 x10 <sup>13</sup>

Data on current future inventory of radioactive waste generated in Croatia are taken from the 6<sup>th</sup> National Report on Implementation of the Obligations Under the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, Zagreb, September 2017 and the future inventory from the National Programme for Implementation of the Strategy for Management of Radioactive Waste, Disused Sources and Spent Nuclear Fuel. Current inventory is conditioned and temporary stored in the interim storages in Croatia.

Table C-4: Current and future inventory of radioactive waste generated in Krško NPP

Radioactive waste type		Current volume (m <sup>3</sup> )	Current activity (Bq)	Expected volume in 2023 (m <sup>3</sup> )	Expected activity in 2023 (Bq)	Expected volume / mass in 2043 (m <sup>3</sup> ) (t)	Expected activity in 2043 (Bq)
Operational RW	LILW	1.142,1	8,3x10 <sup>12</sup>	1.430 m <sup>3</sup>	1,2x10 <sup>13</sup>	1.780 m <sup>3</sup>	1,6x10 <sup>13</sup>
Decommissioning RW	LILW	-	-	-	-	2.660 t	5,5x10 <sup>12</sup>
	HLW	-	-	-	-	41 t	8,0x10 <sup>15</sup>
Total	LILW	1.142,1	8,3x10 <sup>12</sup>	1.430 m <sup>3</sup>	1,2x10 <sup>13</sup>	1.780 m <sup>3</sup> + 2.660 t	2,2x10 <sup>13</sup>
	HLW	-	-	-	-	41 t	8,0x10 <sup>15</sup>

Table C-5: Current and future inventory of spent nuclear fuel generated in Krško NPP

Radioactive waste type	Current number of SFE and mass (t)	Current activity (Bq)	Expected number of SFE and mass (t) in 2023	Expected activity in 2023 (Bq)	Expected number of SFE and mass (t) in 2043	Expected activity in 2043 (Bq)
HLW	604 354 t		749 440 t	2,7x10 <sup>20</sup>	1.142 670 t	4,2x10 <sup>20</sup>

Data on current inventory of radioactive waste and spent nuclear fuel generated in Krško NPP are taken from Technical Report on Management of Radioactive Waste from NPP Krško, Rev.9, NEK ESD-TR-03/97 and Report on the Protection of Ionising Radiation and Nuclear Safety in the Republic of Slovenia in 2017, respectively. Data on future inventory of radioactive waste and spent nuclear fuel that will be generated in Krško NPP are taken from the National Programme for Implementation of the Strategy for Management of Radioactive Waste, Disused Sources and Spent Nuclear Fuel. The given data refer to half of the total amount of radioactive waste and spent nuclear fuel from Krško NPP.

Current LILW inventory from NPP Krško operation is processed/conditioned and temporary stored in the interim storage of solid radioactive waste on NPP site (situated in the Slovenia).

Current SFN elements are stored in the wet storage (pool) at the NPP Krško site (situated in Slovenia).



## D. GENERAL PRINCIPLES AND POLICIES (ARTICLE 4)

### Article 4 – General principles

1. Member States shall establish and maintain national policies on spent fuel and radioactive waste management. Without prejudice to Article 2(3), each Member State shall have ultimate responsibility for management of the spent fuel and radioactive waste generated in it.
2. Where radioactive waste or spent fuel is shipped for processing or reprocessing to a Member State or a third country, the ultimate responsibility for the safe and responsible disposal of those materials, including any waste as a by-product, shall remain with the Member State or third country from which the radioactive material was shipped.
3. National policies shall be based on all of the following principles:
  - a) the generation of radioactive waste shall be kept to the minimum which is reasonably practicable, both in terms of activity and volume, by means of appropriate design measures and of operating and decommissioning practices, including the recycling and reuse of materials;
  - b) the interdependencies between all steps in spent fuel and radioactive waste generation and management shall be taken into account;
  - c) spent fuel and radioactive waste shall be safely managed, including in the long term with passive safety features;
  - d) implementation of measures shall follow a graded approach;
  - e) the costs for the management of spent fuel and radioactive waste shall be borne by those who generated those materials;
  - f) an evidence-based and documented decision-making process shall be applied with regard to all stages of the management of spent fuel and radioactive waste.
4. Radioactive waste shall be disposed of in the Member State in which it was generated, unless at the time of shipment an agreement, taking into account the criteria established by the Commission in accordance with Article 16(2) of Directive 2006/117/Euratom, has entered into force between the Member State concerned and another Member State or a third country to use a disposal facility in one of them.

Prior to a shipment to a third country, the exporting Member State shall inform the Commission of the content of any such agreement and take reasonable measures to be assured that:

  - (a) the country of destination has concluded an agreement with the Community covering spent fuel and radioactive waste management or is a party to the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management ('the Joint Convention');
  - (b) the country of destination has radioactive waste management and disposal programmes with objectives representing a high level of safety equivalent to those established by this Directive; and
  - (c) the disposal facility in the country of destination is authorised for the radioactive waste to be shipped, is operating prior to the shipment, and is managed in accordance with the requirements set down in the radioactive waste management and disposal programme of that country of destination.

The Republic of Croatia has the obligation to manage radioactive waste and disused ionising radiation sources that have been generated through the 60-year use of ionising radiation sources in medicine, industry, science, education, military and the past public use. The two facilities in which this waste was temporarily stored do not accept new waste. There are partially remediated and waiting to be decommissioned and waste to be transferred to a new storage facility. Since both storage facilities are closed the newly generated radioactive waste and disused sources are kept at the owners' facilities. Therefore, it is necessary to establish a central RW storage facility as stipulated in the Act as

soon as possible. Furthermore, the Republic of Croatia has the obligation to remediate localities where there are naturally-occurring radioactive materials, which requires continuous regulatory supervision. Also, in compliance with the Bilateral Agreement), the Republic of Croatia is obliged to physically take over and manage one-half of the RW and spent nuclear fuel currently stored at Krško Nuclear Power Plant (in the case there is no joint solution for waste management).

For the purpose of meeting the above obligations, in October 2014 Parliament of the Republic of Croatia adopted the Strategy for the management of radioactive waste, disused sources and spent nuclear fuel. This Strategy has taken a systematic and long-term approach to resolving the above listed issues, in compliance with the Act, Directive 2011/70/Euratom (SL L 199, 2.8.2011), the international standards and guidelines and the best international practices in this area. Pursuant to the Act and Directive 2011/70/Euratom, after the adoption of the Strategy the National Programme was developed and will be adopted on the next Government session.

According to the Act, RW and SNF generated in the territory of the Republic of Croatia must be disposed in a long-term, sustainable manner in Croatia, except in the cases where bilateral agreements concluded prior to the date of the entry into force of this Act permit disposal of RW and SNF in a territory of another state. Disposal of radioactive waste and spent nuclear fuel in a territory of another state has to guarantee equal or greater safety than that guaranteed under Croatian laws and practice. Producers of RW, DS or SNF must ensure that it is managed in the prescribed manner and transfer of the burden of disposal of RW, DS or SNF to future generations is avoided to the greatest possible extent.

The obligation of the owner or the user of disused sealed source is to ensure that the source is adequately managed and to cover all associated costs. Each disused sealed source firstly has to be offered to those who would use it for other purposes. If such users do not exist, the source has to be transported to storage facility. The dismantling of sources and transport to storage facility can be performed only by authorized technical service and in the prescribed manner. Owners/users are allowed to keep disused sources at their own storages for a maximum of 6 months. In order to minimize waste generation, holder of the approval for performing out specific activity with radioactive source, which imports sealed source containing radionuclide whose activity will, after its intended use, be above the clearance levels referred to in Table 1 of Annex I of Ordinance on the Management of Radioactive Waste and Disused Sources, is obliged to contractually bind the manufacturers to take back each disused sealed source after the end of its use.

For management of the radioactive waste and disused sources the National Programme plans the establishment of the Central National Storage Facility. The preferred location for the CNFS is the location of Čerkezovac, the military logistic complex without perspective for future use by military. The location Čerkezovac is located in Dvor Municipality on the southern slopes of the massif Trgovska gora<sup>2</sup>. According to the National Programme the start of operation of the CNFS is planned for year 2021.

In addition to the radioactive waste produced in the country, the Republic of Croatia has the obligation to take over half of the radioactive waste from Krško NPP. The Bilateral Agreement (Articles 10 and 11) favours development of a common solution for disposal of radioactive waste from Krško NPP. As the Republic of Croatia and the Republic of Slovenia have not achieved a mutually satisfactory common solution, the Republic of Croatia, in line with the objectives of the Strategy, plans with National Programme a series of activities to establish the Long-term storage facility for LILW from Krško NPP. The location Čerkezovac was recognized also as a preferred location for the Long-term storage facility for LILW from Krško NPP. The start of operation of the Long-term storage facility is planned for year 2023 and its duration is 40 years.

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<sup>2</sup> In Croatian National Spatial Plan and in new Spatial Development Strategy of Croatia for Trgovska gora is designated as potential location for LILW repository as a result of site-selection process which included the whole territory of the Republic of Croatia.



The establishment of The Radioactive Waste Management Centre (RWMC) would encompass the Central National Storage Facility and the Long-term storage facility, and also a centre for informing and educating public. The operator of the RWMC will be the Fund for financing the decommissioning of the Krško Nuclear Power Plant and the disposal of NEK radioactive waste and spent nuclear fuel. The process of confirmation of location includes participation of public in decision-making, planning in spatial plans, the environmental impact assessment process including the assessment of transboundary impact.

The site investigation process for the disposal facility for IRW, DS and LILW will start after 2025 and the operation of the repository is not needed before year 2058.

Regarding the financing of the radioactive waste management: financing of management of newly generated radioactive waste and disused sources will be ensured by applying the polluter pay principle and financing of radioactive waste management from Krško NPP will be provided in accordance with the Bilateral Agreement (Article 11). For the financing of legacy waste management, the Government has the subsidiary responsibility.

As the Republic of Croatia shares ownership of the Krško NPP with the Republic of Slovenia, 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 (Articles 10 and 11) favours development of a common solution for spent fuel management. In accordance with aforementioned, the Republic of Croatia and the Republic of Slovenia are planning long-term dry storage of SNF at Krško NPP location and then its disposal in deep geological formation at a suitable location in the Republic of Croatia or the Republic of Slovenia. The Spent Fuel Dry Storage (SFDS) at NPP Krško location should be constructed by 2019 with an operating lifetime of 60 years. The costs of construction, operation and transfer of SNF from the pool to the dry storage, as well as maintenance of SFDS facility will be financed in accordance with Bilateral Agreement (Article 11). Approximately in year 2050, the site selection process for the disposal of SNF and HLW, which will arise from Krško NPP decommissioning, in deep geological formation will begin. Location selection will be carried out in the Republic of Croatia or the Republic of Slovenia. Also, Croatia will actively participate in projects related to the international repository. Meanwhile, the spent fuel generated in the Krško NPP has been managed safely on-site by the operator. Therefore, the spent fuel management has not been practiced in Croatia so far.



## E. NATIONAL FRAMEWORK (ARTICLE 5)

### Article 5 – National framework

1. Member States shall establish and maintain a national legislative, regulatory and organizational framework ('national framework') for spent fuel and radioactive waste management that allocates responsibility and provides for coordination between relevant competent bodies. The national framework shall provide for all of the following:

- a) a national programme for the implementation of spent fuel and radioactive waste management policy;
- (b) national arrangements for the safety of spent fuel and radioactive waste management. The determination of how those arrangements are to be adopted and through which instrument they are to be applied rests within the competence of the Member States;
- (c) a system of licensing of spent fuel and radioactive waste management activities, facilities or both, including the prohibition of spent fuel or radioactive waste management activities, of the operation of a spent fuel or radioactive waste management facility without a licence or both and, if appropriate, prescribing conditions for further management of the activity, facility or both;
- (d) a system of appropriate control, a management system, regulatory inspections, documentation and reporting obligations for radioactive waste and spent fuel management activities, facilities or both, including appropriate measures for the post-closure periods of disposal facilities;
- (e) enforcement actions, including the suspension of activities and the modification, expiration or revocation of a licence together with requirements, if appropriate, for alternative solutions that lead to improved safety;
- (f) the allocation of responsibility to the bodies involved in the different steps of spent fuel and radioactive waste management; in particular, the national framework shall give primary responsibility for the spent fuel and radioactive waste to their generators or, under specific circumstances, to a licence holder to whom this responsibility has been entrusted by competent bodies;
- (g) national requirements for public information and participation;
- (h) the financing scheme(s) for spent fuel and radioactive waste management in accordance with Article 9.

2. Member States shall ensure that the national framework is improved where appropriate, taking into account operating experience, insights gained from the decision-making process referred to in Article 4(3)(f), and the development of relevant technology and research.

### Legislative and regulatory framework

In Croatia the issues related to the safety of spent fuel and radioactive waste management are mostly covered by the Act on Radiological and Nuclear Safety (Official Gazette 141/13, 39/15 and 130/17). The Act establishes measures for radiological and nuclear safety and measures for non-proliferation of nuclear weapons in performing nuclear operations and operations involving sources of ionising radiation. The goal is to ensure adequate protection of individuals, society and the environment against harmful effects of ionising radiation, as well as to ensure safe performance of operations involving ionising radiation sources, nuclear operations, radioactive waste management and physical protection of ionising radiation sources and nuclear installations. Also, some specific issues are regulated by Ordinance on the Management of Radioactive Waste and Disused Sources (Official Gazette 12/18).

The Act provides solid basis for regulation, administrative processes and inspection and covers wide scope of activities. The provisions of the Act are harmonized with EU directives and regulations:

- Council Regulation (Euratom) No 1493/93 of 8 June 1993 on shipments of radioactive substances between Member States,
- Commission Regulation (Euratom) No 302/2005 of 8 February 2005 on the application of Euratom safeguards,
- Commission Regulation (Euratom) No 66/2006 of 16 January 2006 exempting the transfer of small quantities of ores, source materials and special fissile materials from the rules of the chapter on supplies,
- Council Directive No 2006/117/Euratom of 20 November 2006 on the supervision and control of shipments of radioactive waste and spent fuel,
- Council Directive No 2009/71/Euratom of 25 June 2009 establishing a Community framework for the nuclear safety of nuclear installations,
- Council Directive No 2011/70/Euratom of 19 July 2011 establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste,
- Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom
- and Council Directive 2014/87/Euratom of 8 July 2014 amending Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations.

The new by-laws which were issued in the period after the last National Report are as follows:

1. Ordinance on Notification, Registration, Approvals and Transport of Ionising Radiation Sources (Official Gazette 54/18)
2. Ordinance on Conditions and Measures for the Protection Against the Ionising Radiation in Performing the Activities with Ionising Radiation Sources (Official Gazette 53/18)
3. Ordinance on Conditions for Application of Ionising Radiation Sources for the Purpose of Medical and Non-medical Irradiation (Official Gazette 42/18)
4. Ordinance on Education Necessary for Handling Ionising Radiation Sources, Application of Radiological Safety Measures and Managing the Technical Processes in Nuclear Installations (Official Gazette 42/18)
5. Ordinance on the Monitoring State of Radioactivity in the Environment (Official Gazette 40/18)
6. Ordinance on Giving Permissions to the Expert Technical Services to Perform Tasks Related to the Radiological Safety (Official Gazette 40/18)
7. Ordinance on Dose Limits, Recommended Dose Constraints and Assessment of Individual Doses (Official Gazette 38/18)
8. Ordinance on Content and Conditions, Criteria and Approval of the Remediation Plan (Official Gazette 38/18)
9. Ordinance on Nuclear Security (Official Gazette 38/18)
10. Ordinance on Radiation Protection Experts (Official Gazette 36/18)
11. Ordinance on the Management of Radioactive Waste and Disused Sources (Official Gazette 12/18)
12. Ordinance on the Content, Scope and Frequency of the Reports on the Operation of the Nuclear Installation (Official Gazette 94/17)
13. Ordinance on the Periodicity, Content, Scope and Implementation of the Periodic Safety Reviews of the Nuclear Installations (Official Gazette 94/17)
14. Ordinance on the Content of a request for Approval for the Start or End of Operation or Decommissioning of a Nuclear Installation (Official Gazette 47/17)
15. Ordinance on the Validation of a Location for a Nuclear Installation (Official Gazette 38/17)



16. Ordinance on the Required Documents and their Content for Approval of Nuclear Activities (Official Gazette 29/17)
17. Ordinance on Content of the Request for Approval for the Commissioning of Nuclear Installation (Official Gazette 29/17)
18. Ordinance on the Safety Analysis Report for Nuclear Installations (Official Gazette 29/17)
19. Ordinance on Certified Expert Organizations in the Field of Nuclear Safety (Official Gazette 29/17)
20. Ordinance on Establishing Quality Assurance Programme for Management of Nuclear Facilities (Official Gazette 29/17)
21. Ordinance on Nuclear Safety Requirements for Nuclear Installation Construction (Official Gazette 36/16, 79/16)
22. Ordinance on Official ID Card and Badge of Radiological and Nuclear Safety Inspectors (Official Gazette 125/15)
23. Ordinance on the Conditions and Procedure for Issuing and Withdrawing the Approval for Packaging Used for Transport of Radioactive and Nuclear Materials (Official Gazette 19/17)
24. Regulation on Measures for Protection Against Ionising Radiation and Procedures in Case of Emergency (Official Gazette 24/18)

It should be emphasized that the Ordinance on the Management of Radioactive Waste and Disused Sources (Official Gazette 12/18) is the most important by-law in the area of interest. It determines the conditions and method of radioactive waste and disused sources management, the obligation to keep records of the same, their content, manner of keeping and deadlines, scope and manner of reporting as well as the list and conditions for performing the activities involving management of radioactive waste and disused sources, and a list of documents which, in the process of issuing the approval, prove that it has been complied with the prescribed conditions. Annexes includes also Table of activity concentration values and total activities of radionuclides for clearance of materials.

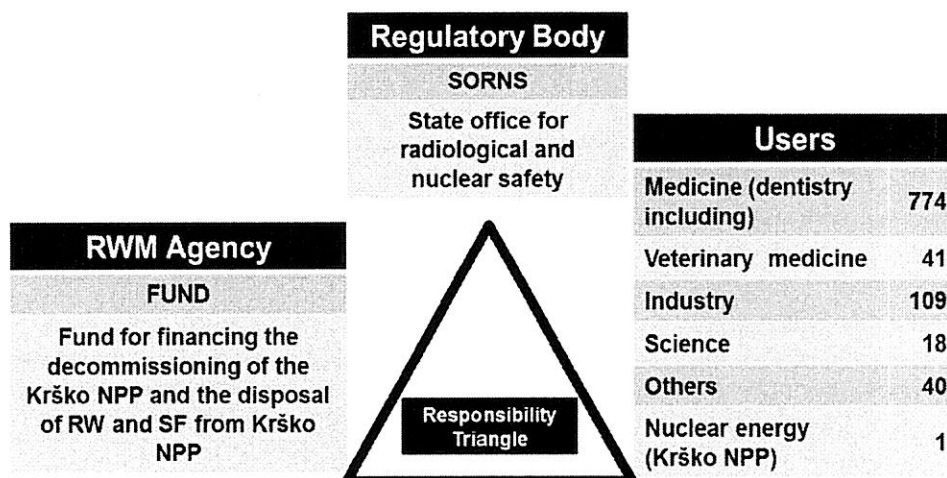
In addition to the basic law and the by-laws, issued in the period after the last National Report, outlined above, a number of other legal acts in the Annex L.1. The list includes acts, regulations, ordinances, strategies, plans, multilateral agreements and bilateral agreements.

The Act prescribes requirements for the preparation of the National programme for the implementation of the Strategy for radioactive waste, disused sources and spent fuel management. After the adoption of the Strategy the National Programme was developed and it passed the Strategic Environmental Assessment process including the transboundary assessment. Last revision of the National Programme was prepared in 2018. and will be adopted on the next Government session.

In 2017 Strategy on Radiological and Nuclear Safety for the period 2017-2025 (Official Gazette 65/17) was adopted by the Government. Strategy describes main principles of nuclear and radiological safety, defines main safety goals and proposes measures for its achievements.

## Division of responsibilities

The following scheme describes responsibility triangle for managing RW and SNF in Croatia:



The current status regarding the division of responsibility in Croatia in the area of management of RW, DS and SNF is given below:

**Croatian Parliament:** (1) Adopts the Strategy for RW, DS and SNF Management (Strategy); (2) Confirms the Decommissioning programme for Krško NPP and the Programme for the disposal of RW and SNF from Krško NPP;

**Government of the Republic of Croatia:** (1) Proposes the Strategy, (2) Adopts the Decommissioning programme for Krško NPP and the Programme for the disposal of RW and SNF from Krško NPP; (3) Adopts regulation on the manner of financing the legal persons for the performance of tasks of managing RW, DS and SNF and the compensation amount and manner of financing of local and regional self-government units in whose territory the Radioactive Waste Management Centre is situated; (4) Adopts the National programme for implementation of the Strategy;

**State Office for Radiological and Nuclear Safety (SORNS):** (1) Establishes the legislative framework in the area of radiological and nuclear safety and nuclear security; (2) Coordinates the drafting of the Strategy; (3) Issues authorisation for performing the tasks of managing RW, DS and SNF; (4) Implements inspection supervision over all facilities and activities of managing RW, DS and SNF; (5) Drafts the National Programme for implementation of the Strategy; (6) Participates in administrative procedures for obtaining permits and authorisations for management facilities included under the Strategy; (7) Reporting and public information on the management of RW, DS and SNF.

**Ministry of Environmental and Energy:** (1) Prescribes the conditions of environmental protection for management facilities covered under the Strategy; (2) Implements the environmental impact assessment for management facilities covered under the Strategy; (3) Participates in administrative procedures for obtaining permits and authorisations for management facilities covered under the Strategy; (4) Notifies the competent body of another state of the draft proposal of the Strategy, plan and programme, if it assesses there is a possibility of a significant influence on the environment and/or human health in that other country, or if so requested by the country that could be exposed to a significant impact; (5) Responsible for the implementation of the Bilateral Agreement.

**Ministry of the Interior:** Approves, after consent of SORNS, Nuclear security plans for management facilities covered under the Strategy.

**Ministry of Health:** Cooperates in the drafting of the legislative framework in the area of radiological and nuclear safety.

**Ministry of the Sea, Transport and Infrastructure:** Competent for the drafting of the part of the legislative framework concerning the area of handling radiological cargo in maritime transport, and



for the implementation and supervision over the Act on the Ratification of the European Agreement on the International Carriage of Dangerous Goods by Inland Navigation.

**Ministry of Construction and Physical Planning:** (1) Responsible for planning of land use and for issuing of permits for management facilities included under the Strategy; (2) Responsible for issuing of site permits and construction permits for buildings of national significance including the buildings for treatment, storage and disposal of radioactive waste.

**Delegation of the Republic of Croatia in the Interstate Committee:** (1) Monitors the implementation of the Bilateral Agreement and informs the Government of the Republic of Croatia thereof; (2) Confirms the Decommissioning programme for the Krško NPP and Disposal programme for RW and SNF from Krško NPP.

**HEP (Croatian Electric Utility):** Makes regular payments to the Fund of financial resources allocated for the decommissioning of Krško NPP and the management of RW and SNF from Krško NPP.

**Owners of the RW or DS:** (1) Safe management of RW, DS and SNF until have been transferred to Radioactive Waste Management Centre; (2) Secure financial resources necessary for management.

**Fund:** (1) Establishes Radioactive Waste Management Centre as its part; (2) Maintains and increases the amount of financial resources paid into the Fund account by HEP; (3) Performs the tasks of coordination, preparation and drafting of the Decommissioning Programme for Krško NPP and the Management programme for RW and SNF from Krško NPP pursuant to the Bilateral Agreement.

**Professional associations (CNS, CRPA):** (1) Increasing knowledge in the field of peace-time application of nuclear science, technology and safety culture; (2) Participate in public information procedures.

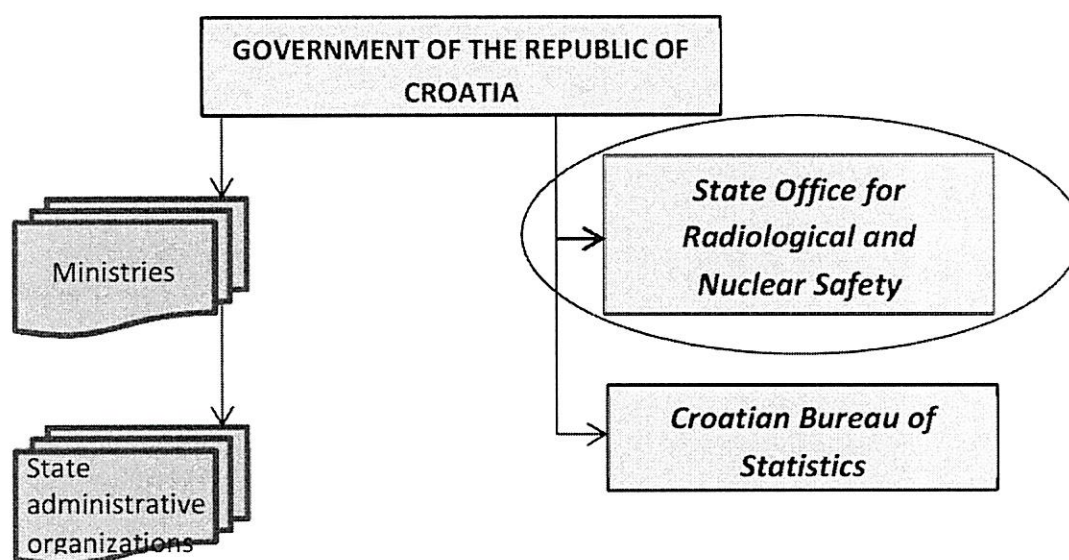
## F. COMPETENT REGULATORY AUTHORITY (ARTICLE 6)

### Article 6 – Competent regulatory authority

1. Each Member State shall establish and maintain a competent regulatory authority in the field of safety of spent fuel and radioactive waste management.
2. Member States shall ensure that the competent regulatory authority is functionally separate from any other body or organisation concerned with the promotion or utilisation of nuclear energy or radioactive material, including electricity production and radioisotope applications, or with the management of spent fuel and radioactive waste, in order to ensure effective independence from undue influence on its regulatory function.
3. Member States shall ensure that the competent regulatory authority is given the legal powers and human and financial resources necessary to fulfil its obligations in connection with the national framework as described in Article 5(1)(b), (c), (d) and (e).

### Position of regulatory body

Structure of national administration in Croatia and position of SORNS is shown schematically in following picture.



According to the Act on Organisation and Scope of Ministries and Other Central State Administration Bodies (Official Gazette 93/16, 104/16), supervision over the work of SORNS is performed by the Government of the Republic of Croatia.

According to tasks and responsibilities of SORNS as defined in the Act on Radiological and Nuclear Safety (Official Gazette 141/13, 39/15 and 130/17) (the Act), SORNS is neither promotor nor user of nuclear or radiation related technologies. A clear separation from organizations or bodies charged with responsibilities for the promotion or application of nuclear or radiation related technologies are derived from the fact that SORNS is responsible directly to the Government.

According to the Act, the director of the SORNS shall be appointed by the Government of the Republic of Croatia and he/she shall be responsible to the Government for his/her work.



## Legal powers and human and financial resources

Every year the regulatory body SORNS proposes budget for the next year to the Government, which is in accordance with discharging its responsibilities and performing its functions. The Government adopts the budget for the next year and if necessary, revise it during the year. Also, every year the SORNS adopts strategic plan for next three years in accordance with its responsibilities and functions in line with the proposed budget. SORNS reports on implementation of the strategic plan twice a year.

Consistent with its effective independence, SORNS has the authority to intervene in any facilities or activities that present significant radiation risks by conducting inspection activities related to supervision of implementation of the provisions of the Act on Radiological and Nuclear Safety and regulations adopted on the basis thereof. In the case of radioactive waste storage facility, SORNS exercised its authority to intervene, irrespective of the costs to the authorized party.

Staffing in SORNS is regulated by the process of admission to the civil service in accordance with the provisions of the Civil Servants Act (Official Gazette 92/05...61/17) and the Regulation on Issuing and Processing Public and Internal Announcements in the Civil Service (Official Gazette 78/17). Job vacancies in state bodies are completed through a public tender or internal announcements.

For the purpose of performing activities within the scope of the SORNS the following internal organizational units have been established: Sector for Nuclear Safety and Inspection, Sector for Radiological Safety and Independent Service for Joint Affairs. The number of staff necessary and the essential knowledge, skills and abilities for them to perform all the necessary regulatory functions are prescribed (predetermined) in the Ordinance on Internal Organisation of the State Office for Radiological and Nuclear Safety (2012, 2013, 2015 changes and amendments). Description of each working place in SORNS contains a list of basic knowledge, skills, abilities and the educational qualifications as well as time of working experience.

The number of working places according to this Ordinance is 49, but present number of employees in SORNS is only 22. The staff of the regulatory body has the necessary competence and remain focused on performing their functions in relation to safety. The number of qualified and competent staff in the regulatory body is not sufficient, but with the great efforts and devotion of the present staff, all responsibilities and tasks of the regulatory body are fulfilled. The SONRS is launching new public announcements for vacancy and in the meanwhile a number of young experts are working on temporary positions. All jobs directly influencing safety and security are performed completely and rearranged among SORNS personnel when necessary.

The regulatory body has adequate arrangements for obtaining technical or other expert professional advice or services in support of its regulatory functions by engaging professional technical services or nuclear safety experts.

In the case where advice or assistance can be obtained only from organizations whose interests potentially conflict with those of the regulatory body, SORNS will assess given advice for conflicts of interests. SORNS has competent staff who could assess advice provided by advisers and information submitted by authorized parties or applicants, in such a way that Director General is able to take responsible decisions.

Formal mechanism of communication between SORNS and authorized parties on all safety related issues is according to the procedure prescribed in the General Administrative Procedure Act (Official Gazette 47/09).

Informal mechanism of communication between SORNS and authorized parties is by conducting a professional and constructive liaison through meetings and other open communication for the purpose of transparency about the basis and justifications for the regulatory decisions.

Policies, principles and criteria to be observed in the implementation of core processes of the regulatory body (e.g. establishment of regulatory requirements, licensing, review and assessment, inspection, enforcement, etc.) as well as formal procedures for the implementation of the regulatory body core processes are defined in the Act and ordinances adopted on the basis of this Act.



## G. LICENCE HOLDERS (ARTICLE 7)

### Article 7 – Licence holders

1. Member States shall ensure that the prime responsibility for the safety of spent fuel and radioactive waste management facilities and/or activities rest with the licence holder. That responsibility cannot be delegated.
2. Member States shall ensure that the national framework in place require licence holders, under the regulatory control of the competent regulatory authority, to regularly assess, verify and continuously improve, as far as is reasonably achievable, the safety of the radioactive waste and spent fuel management facility or activity in a systematic and verifiable manner. This shall be achieved through an appropriate safety assessment, other arguments and evidence.
3. As part of the licensing of a facility or activity the safety demonstration shall cover the development and operation of an activity and the development, operation and decommissioning of a facility or closure of a disposal facility as well as the post- closure phase of a disposal facility. The extent of the safety demonstration shall be commensurate with the complexity of the operation and the magnitude of the hazards associated with the radioactive waste and spent fuel, and the facility or activity. The licensing process shall contribute to safety in the facility or activity during normal operating conditions, anticipated operational occurrences and design basis accidents. It shall provide the required assurance of safety in the facility or activity. Measures shall be in place to prevent accidents and mitigate the consequences of accidents, including verification of physical barriers and the licence holder's administrative protection procedures that would have to fail before workers and the general public would be significantly affected by ionising radiation. That approach shall identify and reduce uncertainties.
4. Member States shall ensure that the national framework require licence holders to establish and implement integrated management systems, including quality assurance, which give due priority for overall management of spent fuel and radioactive waste to safety and are regularly verified by the competent regulatory authority.
5. Member States shall ensure that the national framework require licence holders to provide for and maintain adequate financial and human resources to fulfil their obligations with respect to the safety of spent fuel and radioactive waste management as laid down in paragraphs 1 to 4.

According to the Act holder of the approval (licence holder) is a legal or natural person, a state administration body, any other state body or a body of a local or regional self-administration unit that has been granted a licence and that is responsible for performing a certain operation involving ionising radiation sources, or nuclear operation, or an operation involving management of radioactive waste, disused sources or spent nuclear fuel, or performing work activities. Also, holder of the approval (licence holder) is a legal or natural person a state administration body, any other state body or a body of a local or regional self-administration unit that has been granted a decision on registration.

Ordinance on the Management of Radioactive Waste and Disused Sources in Article 10 prescribes that the licence holder, i.e. producer or holder of radioactive waste and disused sources must ensure that radioactive waste and disused sources are produced in the lowest possible quantities, is obliged to implement the prescribed radiological and nuclear safety measures, and must prevent unauthorised removal, damage, unauthorized access, sabotage, loss, unauthorised transfer or other malicious acts, in order to provide adequate protection for individuals, society and the environment from the harmful consequences of ionising radiation and the prevention of abuse of radioactive waste and disused sources.

Any operations involving ionising radiation sources shall not begin prior to the issuance of the approval or decision on registration by the SORNS. This approval or decision on registration shall be

granted or denied by a decision against which no appeal may be filed, but an administrative dispute may be initiated and shall be issued for a maximum period of ten years.

The request for issuance of approval for carrying out activities involving radioactive waste and disused sources management shall be accompanied by:

1. plan for radioactive waste and disused sources management,
2. plan in the case of an emergency event in accordance with the regulations governing the scope and content of plans and programs for dealing with a case of an emergency event and reporting to the public and the relevant state administration bodies,
3. proof of technical capacity for carrying out the described activity,
4. certificate of special vocational education on the application of radiological safety measures for exposed workers,
5. certificate of medical fitness of exposed workers,
6. proof of assured monitoring of exposed workers' personal doses and application of measures for protection against ionising radiation,
7. opinion of an authorised professional technical service that the equipment and the space where disposal procedures will be carried out will meet the conditions of protection against ionising radiation,
8. quality assurance program.

The licence holder has an obligation to adopt and regularly update risk analysis which must contain general information on the practice, exposure to ionising radiation resulting from performing the practice and the disposal of radioactive waste (description of work posts and tasks with the highest risk of irradiation, assessment of irradiation of exposed workers under normal work conditions, assessment of irradiation of a critical group of population resulting from performing the practice involving ionising radiation sources and the disposal of radioactive waste), irradiation in case of emergency, plan for optimising protection against ionising radiation and certification and expert opinion of an authorised technical service with proposed measures for risk reduction.

The licence holder has an obligation to draw up a Plan and programme of measures to be taken in emergency cases, and to submit it to approval to the SORNS. The Plan and programme referred contains the following chapters: Introduction, Emergencies, Emergency response, Immediate activities, Informing the public and competent bodies, Maintaining a state of alert and Annexes. Costs of implementation of the Plan and programme are provided for and borne by the licence holder. The licence holder has obligation to inform public about important facts from this Plan and programme.

The licence holder has obligation to draw up a Nuclear security plan and is liable for the implementation of physical protection of ionizing radiation sources and nuclear installations. Licence holder bears the costs of this implementation. The manner of implementation of the physical protection is prescribed by the Ordinance on Nuclear Security, issued by the director of the SORNS in cooperation with the minister in charge of internal affairs.



knowledge in the field of radiological safety, to organize additional professional training and skills refreshment courses on application of radiology and nuclear safety measures and to stimulate and support scientific research and development activities, encourage development, statistic and other research in accordance with demands and requirements pertaining to the development of radiological and nuclear safety in Croatia. Training curricula and programmes are being developed, within the existing education system, for newly appointed experts in the Act (expert in medical physics and expert in the protection against ionising radiation). New regulations provided the certification of experts for certain areas of radiological safety (Ordinance on Radiation Protection Experts (Official Gazette 36/18)), as well as giving permissions to Expert technical services (Ordinance on Giving Permissions to the Expert Technical Services to Perform Tasks Related to the Radiological Safety (Official Gazette 40/18)).

Efforts are undertaken that industry and the academic community cooperate at the national and international level, so as to create a functional framework to support education and training. The same is with educational programmes which must be aligned with the professional needs of industry, and with radiological and nuclear safety standards, standardised, and useful for cooperation programmes to be established with internationally recognised institutions holding developed programmes for the research, development and establishment of RW, DS and SNF management processes.

Currently there are no many research and development programmes covering activities of RW, DS and SNF management, but efforts will be undertaken in its promotion for the purpose of maintaining and improving expertise and the necessary skills.

## H. EXPERTISE AND SKILLS (ARTICLE 8)

### Article 8 – Expertise and skills

Member States shall ensure that the national framework require all parties to make arrangements for education and training for their staff, as well as research and development activities to cover the needs of the national programme for spent fuel and radioactive waste management in order to obtain, maintain and to further develop necessary expertise and skills.

The existing human resources in Croatia are sufficient for the current level of activities in the area of management, which consisted of tasks of handling disused sources and for the temporary storage of institutional RW and DS in Croatia. However, for the implementation of the future goals, the current resources are insufficient. The establishment of the necessary programmes and management facilities significantly increases the need for educated personnel in the area of management of RW, DS and SNF. Additionally, the facilities and management activities must be under the supervision of the regulatory body, and as such, the regulatory body must have a sufficient number of the appropriately educated and trained employees. If it is necessary to increase the number of expert personnel, it will be necessary to organise employee education and/or new recruitment to ensure adequate personnel. The recruitment of new expert persons and the training of the existing personnel of the SORNS and other organisations that will participate in the drafting and implementation of the management plan should be planned and implemented prior to the construction of the management facility. Also, it is necessary to plan for and ensure replacements for employees going into retirement. Regarding the human resources, the Fund, from the moment of being appointed as the operator of the Radioactive Waste Management Centre, is working on the enhancement of the number of staff with required knowledge and skills as well as on the enhancement of knowledge, skills and abilities of current employees to perform all necessary functions. It is important to point out that all institutions, organisations etc. involved in management of radioactive waste and in the use of ionising radiation sources will need to increase the number of experts.

Education and training in the areas of RW, DS and SNF management are not systematically organised in Croatia. As such, it is planned to establish cooperation with the relevant universities, professional and international organisations, such as the IAEA, in order to enable education and training in line with the need for human resources for the establishment and implementation of RW, DS and SNF management. Reinstating of classes in higher education institutions addressing the issues of RW, DS and SNF and methods for their management and the general issues of safety and security culture, as well as higher education in the relevant areas of management are considered at tertiary education institutions and at research and development institutes. Good examples of the organisation of specialist courses, aimed at providing practical knowledge from the area of RW, DS and SNF management are the specialised IAEA courses and workshops that have been organised by the SORNS on the basis of the technical cooperation programme with the IAEA, which it is also required to do pursuant to Article 7, paragraph 2, point 23 of the Act. The SORNS staff is regularly participating in trainings and workshops organized by various international organizations, such as the IAEA and/or international professional associations. Furthermore, SORNS was engaged in the project EuropeAid/130051/D/SER/HR Strengthening Administrative Capacity of the State Office for Radiological and Nuclear Safety.

The basis for requirements for professional competencies of licensees and their workers handling ionising radiation sources (especially exposed workers) is partially prescribed in Article 47 of the Act while the details are prescribed in corresponding Ordinance issued by the Director General of SORNS. Based on the Act (Article 7) the responsibilities of SORNS is to develop technical platforms for training curricula and programmes for regular and additional education as well as for refreshment of



## I. FINANCIAL RESOURCES (ARTICLE 9)

### **Article 9 – Financial resources**

Member States shall ensure that the national framework require that adequate financial resources be available when needed for the implementation of national programmes referred to in Article 11, especially for the management of spent fuel and radioactive waste, taking due account of the responsibility of spent fuel and radioactive waste generators.

Article 9 of Directive 2011/70 defines that Member States shall ensure that the national framework require that adequate financial resources be available when needed for the implementation of national programmes for the management of RW and SNF, taking due account of the responsibility of those generating spent fuel and radioactive waste. It is important to note that the financial resources needed for the implementation of individual activities in the management of RW, DS and SNF must be available at the time of implementation of the appropriate management activity.

Furthermore, Article 4, paragraph 1 of Directive 2011/70 prescribes that Member States shall have the ultimate responsibility for management of the spent fuel and radioactive waste generated in its territory. In line with the above, the financial resources necessary for managing inherited institutional RW and DS will be secured from the Croatian State Budget. It is often very difficult or impossible to determine the owner of this waste, and therefore ensuring the necessary financial resources becomes the subsidiary responsibility of the Republic of Croatia.

By the Act on the Fund for Financing the Decommissioning of the Krško NPP and the Disposal of Radioactive Waste and Spent Nuclear Fuel from Krško NPP (Official Gazette 107/07) which passed by the Croatian Parliament at its session on 3 October 2007 this Fund was established. The founder of the Fund is the Republic of Croatia, and the Fund is accountable in respect of its work to the central state administration body in charge of energy affairs, i.e. the Ministry of Environment and Energy.

The Fund's activities include activities related to the acquisition, maintenance and increase of value of assets for financing the preparation, review and implementation of the Krško NPP Decommissioning and Radioactive Waste and Spent Nuclear Waste Disposal Programme (Decommissioning Programme) pursuant to Articles 10 and 11 of the Agreement between the Government of the Republic of Slovenia and the Government of the Republic of Croatia on the Regulation of the Status and Other Legal Issues Regarding Investments in Krško NPP and its Exploitation and Decommissioning (Official Gazette - International Agreements, 09/02).

The primary purpose of the Krško NPP Decommissioning and RW and SNF Disposal Programme from 2004, which addresses the overall issues at a generic level, was to assess the amount of financial resources that HEP (Croatian electricity company) and GEN Energy (Slovenian electricity company) needed to pay into each fund annually. On the basis of the results of that assessment, Croatia and Slovenia agreed to make annual payments in the amount of EUR 14.25 million to the account of the Fund, and about EUR 8 million to the account of the fund in Slovenia. The reason for lower payments to the account in Slovenia lies in the fact that at the time of passing the said decision, the fund in Slovenia had already collected a certain amount of funding. The co-owners of Krško NPP (HEP and GEN Energy) regularly make payments of previously allocated funds into their respective funds. Currently, the Croatian Fund contains about EUR 252 million at the end of 2017.

According to the Act on amendments to the Act on Radiological and Nuclear Safety, implementing agency for activities regarding radioactive waste and spent nuclear fuel is the Fund for financing the decommissioning of the Krško Nuclear Power Plant and the disposal of NEK radioactive waste and spent nuclear fuel which has the obligation to establish the Radioactive Waste Management Centre as its part. It will be financed by disposal compensation paid by the radioactive waste and spent nuclear fuel producers/owners and by a special purpose fund established by the Act

on the Fund for financing the decommissioning of the Krško Nuclear Power Plant and the disposal of NEK radioactive waste and spent nuclear fuel .

Financing of management of newly generated radioactive waste and disused sources will be ensured by applying the polluter pay principle and for the financing of legacy waste management the Government has the subsidiary responsibility.

In case that legal or natural person, a state administration body, any other state body or a body of a local or regional self-administration with its actions causes contamination of environment, premises, surfaces and persons with radioactive substances above the limits prescribed in the Act issued by the director of the SORNS or due to the loss of control over ionising radiation sources or another reason that causes the damage, is liable for the damage incurred and must without delay take care of remediation at their own expense.

If the licence holder or user, due to bankruptcy, liquidation or for another reason, cannot ensure implementation of remediation, or if the licence holder or user cannot be established or is not on the territory of the Republic of Croatia, the Republic of Croatia shall ensure the entire remediation process. The Republic of Croatia covers the costs of the remediation mentioned previously if the financial warranties provided by the licence holder or user are not sufficient and that person does not have the means to cover the costs in question. If these reasons cease to apply, the Republic of Croatia shall demand remuneration of the costs for carrying out the remediation from the responsible party obliged to carry the costs.



## J. TRANSPARENCY (ARTICLE 10)

### Article 10 – Transparency

1. Member States shall ensure that necessary information on the management of spent fuel and radioactive waste be made available to workers and the general public. This obligation includes ensuring that the competent regulatory authority inform the public in the fields of its competence. Information shall be made available to the public in accordance with national legislation and international obligations, provided that this does not jeopardise other interests such as, inter alia, security, recognised in national legislation or international obligations.
2. Member States shall ensure that the public be given the necessary opportunities to participate effectively in the decision- making process regarding spent fuel and radioactive waste management in accordance with national legislation and international obligations.

### Legal basis

The issue of public information on RW, DS and SNF in Croatia is regulated by the legislative framework that includes the following:

- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Official Gazette – International Agreements 03/99)
- Convention on Access to Information, Public Participation in Decision-Making, and Access to Justice in Environmental Matters from June 1998, Aarhus Convention (Official Gazette – International Agreements 01/07)
- Convention on Environmental Impact Assessment in a Transboundary Context, Espoo Convention (Official Gazette – International Agreements 6/96, 7/08 and 1/09)
- Act on Radiological and Nuclear Safety (Official Gazette 141/13, amended 39/15 and 130/17)
- Strategy for the Management of Radioactive Waste, Disused Sources and Spent Nuclear Fuel (Official Gazette 125/14)
- Environmental Protection Act (Official Gazette 80/13, 153/13, 78/15 and 12/18)
- Regulation on the Information and Participation of the Public and Interested Public on Environmental Protection Matters (Official Gazette 64/08)
- Regulation on the Strategic Impact Assessment for Strategies, Plans and Programmes on the Environment (Official Gazette 03/17)
- Regulation on the Environment Impact Assessment of Projects (Official Gazette 61/14 and 3/17)
- Act on the Right to Access Information (Official Gazette 25/13 and 85/15)
- The Code of Practice on Consultation with the Interested Public in Procedures of Adopting Laws, Other Regulations and Acts (Official Gazette 140/09)

Paragraph IV of the preamble of the **Joint Convention** emphasizes the importance of informing the public on matters relating to the safe management of RW and SNF.

**The Convention on Access to Information, Public Participation in Decision-Making, and Access to Justice in Environmental Matters (Aarhus)** establishes rights involving the environment, and represents a reliable basis for including citizens in environmental policy, and confirms the obligations towards future generations. The provisions of the Convention, like the provisions of the European Commission directives arising from the Convention, have been transposed into the Croatian legislation through the Environmental Protection Act and through several implementing regulations.

**The Convention on Environmental Impact Assessment in a Transboundary Context (Espoo)** prescribes that for the following activities relating to RW and SNF management:

- the disposal of irradiated nuclear fuel
- exclusively for RW disposal, or
- exclusively for storage (planned for longer than 10 years) of irradiated nuclear fuel or RW at a location other than the location of its generation,

provisions must be carried out that include the introduction of an environmental impact assessment procedure that permits public participation. The country of origin, as soon as possible and no later than the time of informing their own population of that planned activity, is required to inform all signatories it deems could be affected so as to ensure the appropriate and effective consultations in line with Article 5 of the Convention on Environmental Impact Assessment in a Transboundary Context.

Article 59 of **Act on Radiological and Nuclear Safety** prescribes that the SORNS will inform the public regarding RW and SNF management, with the exemption of those data that could potentially jeopardise security interests, in the manner ensuring that the necessary information on the management of RW and SNF are accessible to workers and the population, in line with the national legislation and international obligations.

**Strategy for the management of radioactive waste, disused sources and spent nuclear fuel** describes, among other, the national management system for radioactive waste, disused sources and spent nuclear fuel. It must be organised in the way to ensure accessibility to information to all participants in management activities and the public. System must also provide public education on the management of radioactive waste, disused sources and spent nuclear fuel and ensure public right to participate in decision-making processes.

**Environmental Protection Act** prescribes the principle of the access to information and the manner of public participation in environmental protection matters, which is further regulated by the Regulation on Notification and Participation of Public and Interested Public in Environmental Protection Matters (Official Gazette 64/08). The Act stipulates that public has the right to access information regarding the environment, has the right to timely notification of environmental pollution and has the right to participate in procedures for determining premises, drafting and adopting of strategies, plans and programmes, and the drafting and adopting of regulations and general acts concerning environmental protection. The state administration bodies are obliged within their competence to regularly release information on the environment. If this is a request for information pertaining to RW and SNF, emissions and other releases into the environment, the state administration bodies are obliged, if they possess such information, to inform the applicant of the place where they can obtain, if they exist, information on measurements procedures, including methods of analysis, sampling, previous processing of samples used in the collection of data or to direct the applicant to the appropriate standardized procedure used, if the public authority body has been informed thereof (Article 159).

**Regulation on the Information and Participation of the Public and Interested Public on Environmental Protection Matters** regulates the manner of information and participation of the public in the following procedures: strategic assessments, adoption of plans and programmes for which strategic assessments are not carried out, drafting of laws, implementing regulations and other applicable legally binding rules that could have an impact on the environment; assessment of the impact of a project on the environment and determining the uniform conditions of environmental protection for installations. Among other things, the Regulation prescribes the manner of implementing public debates, including public insight and public presentation, and the relevant time frames.

**The Regulation on the Strategic Impact Assessment for Strategies, Plans and Programmes on the Environment** regulates the manner of implementing the strategic assessing, including informing the public and public participation. The assessment procedure is carried out for all strategies, plans and programmes that give a framework for projects subject to the environmental



impact assessment. Article 73 of the Environmental Protection Act lays down that prior to submission to the adoption procedure, when determining the final proposal of the strategy, plan or programme, consideration must be given to public comments, proposals and opinions given to the draft proposal of the strategy, plan and programme.

**The Regulation on the Environment Impact Assessment of Projects** establishes those projects for which an environmental impact assessment is carried out, and those projects subject to the assessment of the need to assess the environmental impact of the project, and the manner of informing the public and participation of the public and interested public in the said procedures. According to this Regulation, which is aligned with the Convention on the Environmental Impact Assessment in a Transboundary Context (Official Gazette – International Agreements 6/96, 7/08 and 1/09) and Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment (SL L 26, 28. 1. 2012), the environmental impact assessment is obligatory for the following installations that regard the management of RW and SNF:

- for the disposal of SNF,
- for the disposal of RW, and
- for the storage of SNF or RW at a location other than the site of generation (planned storage period of longer than 10 years).

**The Act on the Right of Access to Information** regulates the right of access to information and the reuse of information possessed by public authorities, prescribes the principle of the right of access to information, limitations to the right of access to information, procedure for attaining and protection of the right to access information and reuse of information.

**The Code of Practice on Consultation with the Interested Public in Procedures of Adopting Laws, Other Regulations and Acts** in procedures of adopting laws, other regulations and acts includes drawing up the draft Strategy and National Programme for implementation of the Strategy, and defines the general principles, standards and measures for the implementation of consultation with the interested public, including the timelines for holding internet consultations. The Code defines the following minimal standards and measures:

- timely information,
- accessibility and clarity of content,
- implementing deadlines,
- feedback on the effects of the conducted consultation, and
- alignment of the application of standards and measures of consultation in state bodies.

## Public relations

The participation of all interested groups on matters concerning RW and SNF management require the establishment of communication mechanisms among interested parties, and those responsible for decision making. The significant characteristic of a good communication programme is the desire of all parties to establish and maintain constructive two-way interaction. The primary goal for every participant is to listen and understand the concerns, issues and questions raised by each side, and to resolve those relevant questions responsibly and in the most easy to understand way. The characteristic difficulties in this process are: frequent use of emotional thinking, dogmatism or the provision of information from experts that is difficult to understand. Therefore, it is important to understand the public concerns and to establish the level of information on security issues that the public demands.

Communication is currently focused on those issues where there is a great interest, where there is a need for accurate information upon which decision-making is based. Public trust is greater when those issues raised by the public are considered, and carefully and openly validated. Therefor

communication is always based on facts, complete, understandable and timely to the most possible extent. The information is created with goal to be sufficient for obtaining the fundamental knowledge on relevant issues and should enable the public to draw reasonable and informed conclusions on the risks and benefits of RW and SNF management. The timely inclusion of interest groups and transparency in decision-making improve understanding, can improve safety and certainly can contribute to obtaining public trust.

As part of the RW and SNF management programme, professional associations are included and, through their activities, efforts are undertaken to improve dialogue between the interested public on the one hand and those authorised for RW and SNF management and the state administration on the other. Professional organisations, such as the Croatian Nuclear Society (CNS) and Croatian Radiation Protection Association (CRPA), through their participation in informing the public significantly contribute to building the best possible relationship with interest groups. The Fund for financing the decommissioning of the Krško Nuclear Power Plant and the disposal of NEK radioactive waste and spent nuclear fuel also organized public visits to some interesting locations and maintains web page [www.radioaktivniotpad.org](http://www.radioaktivniotpad.org) with numerous information regarding RW. The objectives and activities of these professional organisations include improving knowledge and procedures in the area of peaceful applications of nuclear science, technology and the appropriate safety cultures and informing the public of the needs and specificities of using nuclear technology.

Communication activities should be carried out on the basis of a Communication plan developed for a one-year period. The Fund is responsible for initiating and implementing an agreement procedure with representatives of the local community and for activities of informing, education and public participation.

Education is important for the public to effectively participate in the decision-making process on RW, DS and SNF management. Decision-making process includes all steps from drafting, discussion with stakeholders to adoption by Government or Parliament. The Act does not define the manner of participation of the interested public in the decision-making process regarding RW, DS and SNF management. Therefore, during the drafting of the National programme for implementation of the Strategy, particular attention is focused on this aspect. Many studies have made the common observation that the public most often has prejudices on various issues concerning radiological and nuclear safety. In many cases, the public overestimates the risk and gravity of possible consequences, while underestimating the efforts of installation managers and regulators in assessing and preventing threats. Preconceived ideas not based on scientific facts can significantly hinder the communication process, and therefore additional efforts are taken, as it is the general right of all participants to be informed and to be included in decision-making, which affects their benefit. Furthermore, reasonable issues and uncertainties presented by the public are taken into consideration in the decision-making process.

According to the National Programme in the next five years it is necessary to initiate a series of activities on informing and participation of public, regarding the storage for LILW such as:

- consultations with interested public,
- educational-informative lectures in primary and secondary schools,
- establishing a virtual information center,
- organizing workshops on the topic of LILW management,
- establishment of a public information and education center at the location of storage for LILW.

In 2016 National Programme passed the Strategic Environmental Assessment process including the transboundary assessment (consultations with Bosnia and Herzegovina and Slovenia). The National Programme was communicated to public and it passed several public hearings, including at the local community where the proposed site for the Radioactive Waste Management Centre is situated.



## K. IMPLEMENTATION OF THE NATIONAL PROGRAMME (ARTICLES 11 AND 12)

### **Article 11 – National programmes**

1. Each Member State shall ensure the implementation of its national programme for the management of spent fuel and radioactive waste ('national programme'), covering all types of spent fuel and radioactive waste under its jurisdiction and all stages of spent fuel and radioactive waste management from generation to disposal.

2. Each Member State shall regularly review and update its national programme, taking into account technical and scientific progress as appropriate as well as recommendations, lessons learned and good practices from peer reviews.

### **Article 12 – Contents of national programmes**

1. The national programmes shall set out how the Member States intend to implement their national policies referred to in Article 4 for the responsible and safe management of spent fuel and radioactive waste to secure the aims of this Directive, and shall include all of the following:

- a) the overall objectives of the Member State's national policy in respect of spent fuel and radioactive waste management;
- (b) the significant milestones and clear timeframes for the achievement of those milestones in light of the over-arching objectives of the national programme;
- (c) an inventory of all spent fuel and radioactive waste and estimates for future quantities, including those from decommissioning, clearly indicating the location and amount of the radioactive waste and spent fuel in accordance with appropriate classification of the radioactive waste;
- (d) the concepts or plans and technical solutions for spent fuel and radioactive waste management from generation to disposal;
- (e) the concepts or plans for the post-closure period of a disposal facility's lifetime, including the period during which appropriate controls are retained and the means to be employed to preserve knowledge of that facility in the longer term;
- (f) the research, development and demonstration activities that are needed in order to implement solutions for the management of spent fuel and radioactive waste;
- (g) the responsibility for the implementation of the national programme and the key performance indicators to monitor progress towards implementation;
- (h) an assessment of the national programme costs and the underlying basis and hypotheses for that assessment, which must include a profile over time;
- (i) the financing scheme(s) in force;
- (j) a transparency policy or process as referred to in Article 10;
- (k) if any, the agreement(s) concluded with a Member State or a third country on management of spent fuel or radioactive waste, including on the use of disposal facilities.

2. The national programme together with the national policy may be contained in a single document or in a number of documents.

After the adoption of the Strategy for the Management of Radioactive Waste, Disused Sources and Spent Nuclear Fuel the National Programme for the Implementation of the Strategy was developed in accordance with the requirements given under the Articles 57, 58, 59 and 95 of the Act, with requirements given in the Articles 10 and 11 of the Bilateral Agreement and in accordance with Articles 5, 11, 12 of the Directive 2011/70/Euratom. It was prepared for period till 2025 with glance to 2060. In 2016 National Programme passed the Strategic Environmental Assessment process including the transboundary assessment. The National Programme was communicated to public and it passed

several public hearings, including at the local community where the proposed site for the Radioactive Waste Management Centre is situated. Last revision of the National Programme was prepared in 2018. and will be adopted on the next Government session. After the adoption of the National Programme the activities on the approval of the proposed site for the RWMC can be initiated which includes public participation in decision-making process. Before the approval of the site the activities on the licensing and development of Central National Storage Facility (institutional waste) and Long-term storage facility for operational waste from Krško NPP cannot begin.

According to the Article 57 of the Act National programme contains:

- overall objectives of the Strategy for management of radioactive waste, disused sources and spent nuclear fuel,
- breakthroughs with corresponding deadlines for their accomplishment for the purpose of achieving the overall objectives of the National programme for implementation of the Strategy for management of radioactive waste, disused sources and spent nuclear fuel,
- inventory of radioactive waste spent nuclear fuel and disused sources including decomposition and natural radioactive substances having properties that have been altered by means of technological procedures, for the existing state and expected generation in the future, in a manner that clearly discerns the accompanying locations with the quantity of materials classified according to their level of radiological danger,
- concepts, plans and technical solutions for the management of the inventory referred to in subparagraph 1 from its generation to its final disposal,
- concepts and plans for the period following closure of the disposal facility, including the period in which appropriate controls are to be conducted, and resources necessary for long-term safekeeping of knowledge on the facility in question,
- description of the research and development activities necessary to demonstrate justification of solutions for the management of radioactive waste, spent nuclear fuel and disused sources, including natural radioactive substances having properties modified by means of technological processes,
- basic steps to serve efficient monitoring of the implementation of individual parts of the National programme, with clearly defined time lines in which these steps must be achieved and the division of responsibility for their implementation,
- basic indicators of success of the implementation of the National programme,
- estimation of costs of the implementation of the National programme, with clearly outlined assumptions and hypotheses of the assessment shown in the time profile of interest,
- description of the financial scheme which must include all costs with the guarantee for their implementation according to the envisaged schedule,
- strategy of informing of and communicating with the public, ensuring that necessary information on the management of spent nuclear fuel and radioactive waste are available to the workers and population in the manner that the SORNS informs the public on occurrences in its area of competence, with the exception of information that may potentially endanger security interests. The Strategy shall also envisage the manner of ensuring efficient participation of the public concerned in the decision-making process regarding management of spent nuclear fuel and radioactive waste,
- an agreement or agreements on the management of spent nuclear fuel or radioactive waste, including use of disposal facilities, concluded with EU Member States or third countries, if there are any.

The National Programme foresees remediation of sites with NORM, establishment of the Central National Storage Facility for IRW and DS and construction and commissioning of storage facility for LILW from Krško NPP. SNF generated in the Krško NPP is currently stored (now in wet storage and by 2020 long term dry storage should be constructed). Approximately in year 2050, the site selection process for the disposal of SNF and HLW in deep geological formation will begin and will be carried



out in the Republic of Croatia or the Republic of Slovenia. The establishment of repository for IRW, DS and LILW is not required before year 2058.

It should be noted that the Bilateral Agreement (Articles 10 and 11) favours development of a common solution for management of radioactive waste and spent nuclear fuel from Krško NPP. When it comes to SNF, there is such a deal, and its disposal continues as a joint activity. As for management of RW, the Republic of Croatia and the Republic of Slovenia have not achieved a mutually satisfactory common solution so the Republic of Croatia, in line with the objectives of the Strategy, plans with National Programme a series of activities to establish the storage facility for LILW from Krško NPP.

Fund for financing the decommissioning of the Krško Nuclear Power Plant and the disposal of NEK radioactive waste and spent nuclear fuel has already started working on preliminary activities for implementing activities planned in National Programme.

## L. PEER REVIEWS AND SELF-ASSESSMENTS (ARTICLE 14.3)

### **Article 14 – Reporting**

3. Member States shall periodically, and at least every 10 years, arrange for self-assessments of their national framework, competent regulatory authority, national programme and its implementation, and invite international peer review of their national framework, competent regulatory authority and/or national programme with the aim of ensuring that high safety standards are achieved in the safe management of spent fuel and radioactive waste. The outcomes of any peer review shall be reported to the Commission and the other Member States, and may be made available to the public where there is no conflict with security and proprietary information.

At the request of the Government of the Croatia, an international team of senior safety experts met representatives of the State Office for Radiological and Nuclear Safety (SORNS) from 6 June to 17 June 2015 to conduct an Integrated Regulatory Review Service (IRRS) mission. During the mission there were meetings with representatives of other organizations having responsibilities for radiation protection and safety in Croatia. The purpose of the peer review was to review the Croatian regulatory framework for radiation safety and to exchange knowledge and experience on regulatory issues.

The review team compared the Croatian regulatory framework for safety against IAEA safety standards as the international benchmark for safety. The mission was also used to exchange information and experience between IRRS team members and Croatian counterparts.

The IRRS team comprised ten senior regulatory experts from nine IAEA Member States, three IAEA technical officers and one IAEA administrative assistant. The IRRS team carried out the review in the following areas: responsibilities and functions of the government; the global nuclear safety regime; responsibilities and functions of the regulatory body; the management system of the regulatory body; the activities of the regulatory body including authorization, review and assessment, inspection and enforcement processes; development and content of regulations and guides; emergency preparedness and response; occupational radiation protection, patient protection, public and environmental exposure control, waste management and decommissioning.

Integrated Regulatory Review Service (IRRS) mission gave two recommendations regarding the management of spent fuel and radioactive waste. The first recommendation refers to absence of active central storage facility for radioactive waste, disused sources or orphan sources and the IRRS mission recommendation is that the Government should implement the provisions for the safe management of radioactive waste in particular with the construction and operation of the Central National Storage Facility in compliance with the Strategy. As it was mentioned before, the adoption of the National Programme will facilitate commencement of the project for licensing and construction of the CNFS. The second recommendation states that SORNS should develop and approve Ordinance regarding the detailed requirements for licensing the site, construction, operation and closure of radioactive waste management facility as prescribed in the 2013 Act. In the period after the mission SONRS drafted the new Ordinance on the Management of Radioactive Waste and Disused Sources which was adopted in the beginning of 2018. This Ordinance prescribes radioactive waste classification that is in accordance with Classification of Radioactive Waste, IAEA General Safety Guide No. GSG-1, 2009 (that was also required). Also, Act on Radiological and Nuclear Safety was amended, about 20 new by-laws were issued and Strategy on Radiological and Nuclear Safety for the period 2017-2025 was adopted by which we aligned with the new Basic Safety Standards Directive. The IRRS mission report was made public and can be downloaded from the SONRS web site.



## M. FUTURE PLANS TO IMPROVE SAFE AND RESPONSIBLE MANAGEMENT OF SPENT FUEL AND RADIOACTIVE WASTE

The future plans and actions to improve safe and responsible management of spent fuel and radioactive waste are:

- Approval of the proposed site for the Radioactive Waste Management Centre in consultation with all stakeholders and public participation
- Licensing and construction of CNFS and long-term storage facility for operational radioactive waste from Krško NPP
- Information and education of public and involvement of local community in planning and establishment of RWMC and
- Continuing human resources development at Fund and SONRS.

## N. ANNEXES

### N.1. Relevant Legislation in Force (as of July 2018) and Relevant Reports

The list provided below includes all legislation and regulation relevant for the spent fuel management and/or radioactive waste management.

#### 1. Acts

- Act on Liability for Nuclear Damage (Official Gazette 143/98)
- Act on Civil Protection System (Official Gazette 82/15)
- Dangerous Goods Transport Act (Official Gazette 79/07)
- Act on Fund for Krško NPP Decommissioning, Radioactive Waste and Spent Nuclear Fuel Management (Official Gazette 107/07)
- Act on Sanitary Inspections (Official Gazette 113/08, amended 88/10)
- Act on Criminal Procedure (Official Gazette 152/08, amended 76/09, 80/11, 121/11, 91/12, 143/12, 56/13, 145/13, 152/14 and 70/17)
- Act on Radiological and Nuclear Safety (Official Gazette 141/13, amended 39/15 and 130/17)
- Environmental Protection Act (Official Gazette 80/13, 153/13, 78/15 and 12/18)
- Physical Planning Act (Official Gazette 153/13 and 65/17)
- Building Act (Official Gazette 153/13 and 20/17)

#### 2. Regulations

- Regulation on Measures for Protection Against Ionising Radiation and Procedures in Case of Emergency (Official Gazette 24/18)

#### 3. Ordinances

- Ordinance on Notification, Registration, Approvals and Transport of Ionising Radiation Sources (Official Gazette 54/18)
- Ordinance on Conditions and Measures for the Protection Against the Ionising Radiation in Performing the Activities with Ionising Radiation Sources (Official Gazette 53/18)
- Ordinance on Conditions for Application of Ionising Radiation Sources for the Purpose of Medical and Non-medical Irradiation (Official Gazette 42/18)
- Ordinance on Education Necessary for Handling Ionising Radiation Sources, Application of Radiological Safety Measures and Managing the Technical Processes in Nuclear Installations (Official Gazette 42/18)
- Ordinance on the Monitoring State of Radioactivity in the Environment (Official Gazette 40/18)
- Ordinance on Giving Permissions to the Expert Technical Services to Perform Tasks Related to the Radiological Safety (Official Gazette 40/18)
- Ordinance on Dose Limits, Recommended Dose Constraints and Assessment of Individual Doses (Official Gazette 38/18)
- Ordinance on Content and Conditions, Criteria and Approval of the Remediation Plan (Official Gazette 38/18)
- Ordinance on Nuclear Security (Official Gazette 38/18)
- Ordinance on Radiation Protection Experts (Official Gazette 36/18)
- Ordinance on the Management of Radioactive Waste and Disused Sources (Official Gazette 12/18)



- Ordinance on the Content, Scope and Frequency of the Reports on the Operation of the Nuclear Installation (Official Gazette 94/17)
- Ordinance on the Periodicity, Content, Scope and Implementation of the Periodic Safety Reviews of the Nuclear Installations (Official Gazette 94/17)
- Ordinance on the Content of a request for Approval for the Start or End of Operation or Decommissioning of a Nuclear Installation (Official Gazette 47/17)
- Ordinance on the Validation of a Location for a Nuclear Installation (Official Gazette 38/17)
- Ordinance on the Required Documents and their Content for Approval of Nuclear Activities (Official Gazette 29/17)
- Ordinance on Content of the Request for Approval for the Commissioning of Nuclear Installation (Official Gazette 29/17)
- Ordinance on the Safety Analysis Report for Nuclear Installations (Official Gazette 29/17)
- Ordinance on Certified Expert Organizations in the Field of Nuclear Safety (Official Gazette 29/17)
- Ordinance on Establishing Quality Assurance Programme for Management of Nuclear Facilities (Official Gazette 29/17)
- Ordinance on Nuclear Safety Requirements for Nuclear Installation Construction (Official Gazette 36/16, amended 79/16)
- Ordinance on Official ID Card and Badge of Radiological and Nuclear Safety Inspectors (Official Gazette 125/15)
- Ordinance on the Scope and Content of the Plan and Programme of Measures in the Event of an Emergency and of Informing the Public and Competent Bodies (Official Gazette 123/12)
- Ordinance on the Supervision and Control of Transboundary Shipments of Radioactive Waste and Spent Fuel (Official Gazette 11/13)
- Ordinance on the Conditions and Procedure for Issuing and Withdrawing the Approval for Packaging Used for Transport of Radioactive and Nuclear Materials (Official Gazette 42/13, amended 19/17)
- Ordinance on Health Conditions of the Exposed Workers and Persons Being Educated to Work with the Ionising Radiation Sources (Official Gazette 66/18)
- Ordinance on the Manner and Procedure for Supervision During Import or Export of Material for Which There is Justified Suspicion of Contamination by Radionuclides or of Containing Radioactive Sources (Official Gazette 114/07)

#### 4. Strategies and Plans

- National Energy Strategy (Official Gazette 130/09)
- Protection and Rescue Plan for the Republic of Croatia (Official Gazette 96/10)
- Threat Assessment for the Republic of Croatia for the Case of Natural and Technological Disasters and Severe Accidents (2013)
- Strategy for Management of Radioactive Waste, Disused Sources and Spent Nuclear Fuel (Official Gazette 125/14)
- Strategy on Radiological and Nuclear Safety for the period 2017-2025 (Official Gazette 65/17)
- National Programme for Implementation of the Strategy for Management of Radioactive Waste, Disused Sources and Spent Nuclear Fuel (proposal 2018)

#### 5. Multilateral agreements

- Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention (Official Gazette 12/93)
- Convention on Nuclear Safety (Official Gazette 13/95)
- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Official Gazette 03/99)
- Convention on the Physical Protection of Nuclear Material (Official Gazette 05/01, amended 05/06)
- Vienna Convention on Civil Liability for Nuclear Damage (Official Gazette 01/06)
- Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency (Official Gazette 01/06)
- Convention on Early Notification of a Nuclear Accident (Official Gazette 01/06, amended 05/06)

#### 6. Bilateral agreements

- Agreement Between the Republic of Croatia and the International Atomic Energy Agency for Application of Safeguards in Connection with the Treaty on Non-proliferation of Nuclear Weapons (Official Gazette 13/94)
- Agreement Between the Republic of Croatia and the Republic of Slovenia on the Early Exchange of Information in the Event of a Radiological Emergency (Official Gazette 06/98, amended 3/00)
- Agreement Between the Government of the Republic of Croatia and the Government of the Republic of Hungary on the Early Exchange of Information in the Event of a Radiological Emergency (Official Gazette 11/99, amended 03/00)
- Protocol Additional to Agreement Between the Republic of Croatia and the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-proliferation of Nuclear Weapons (Official Gazette 7/00)
- Agreement Between the Government of the Republic of Croatia and the Government of the Republic of Slovenia on Regulating the Status and Other Legal Relations Pertaining to Investments, Use and Decommissioning of the Krško Nuclear Power Plant (Official Gazette 09/02)
- Protocol on the Means of Information and Data Exchange Between the State Regulatory Agency for Radiological and Nuclear Safety of Bosnia and Herzegovina and the State Office for Radiological and Nuclear Safety of the Republic of Croatia (2013)

#### 7. Official National and International Reports Related to Safety and Reports on International Review Missions

- 6<sup>th</sup> National Report on Implementation of the Obligations Under the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, Zagreb, September 2017
- National report - "On the Implementation of the Obligations under The Convention on Nuclear Safety", Zagreb, August 2016
- National Report as Required Under Article 14.1 Of Council Directive 2011/70/EURATOM F 19 JULY 2011 Establishing a Community Framework for the Responsible and Safe Management of Spent Fuel and Radioactive Waste (1<sup>st</sup> Report, Zagreb, August 2015)
- IAEA-NS-IRRS-2015/09 "Report of the Integrated Regulatory Review Service (IRRS) Mission to the Republic of Croatia", June 2015



## N.2. List of Abbreviations and Acronyms

Act	Act on Radiological and Nuclear Safety (Official Gazette 141/13, amended 39/15 and 130/17)
Bilateral Agreement	Agreement Between the Government of the Republic of Croatia and the Government of the Republic of Slovenia on Regulating the Status and Other Legal Relations Pertaining to Investments, Use and Decommissioning of the Krško Nuclear Power Plant (Official Gazette 09/02)
CNSF	Central National Storage Facility
DS	Disused Sources
Fund	Fund for Financing the Decommissioning of the Nuclear Power Plant Krško and the Disposal of Nuclear Power Plant Krško Radioactive Waste and Spent Nuclear Fuel
HLW	High Level Waste
ILW	Intermediate Level Waste
IMROH	Institute for Medical Research and Occupational Health
IRB	Institute Ruđer Bošković
IRW	Institutional Radioactive Waste
LILW	Low and Intermediate Level Waste
LLW	Low Level Waste
National Programme	National Programme for the Implementation of the Strategy for the Management of Radioactive Waste, Disused Sources and Spent Nuclear Fuel
NORM	Naturally Occurring Radioactive Materials
NPP	Nuclear Power Plant
RW	Radioactive Waste
RWMC	Radioactive Waste Management Centre
SFDS	Spent Fuel Dry Storage
SNF	Spent Nuclear Fuel
SORNS	State Office for Radiological and Nuclear Safety
Strategy	Strategy for the Management of Radioactive Waste, Disused Sources and Spent Nuclear Fuel
VLLW	Very Low Level Waste

