Republic of Croatia

CROATIAN REPORT ON NUCLEAR SAFETY

8TH CROATIAN NATIONAL REPORT ON THE IMPLEMENTATION OF THE OBLIGATIONS UNDER THE CONVENTION ON NUCLEAR SAFETY

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ABBREVIATIONS

CPD	Civil Protection Directorate
DS	Dissused Sources
EU	European Union
HERCA	Heads of the European Radiological Protection Competent Authorities
IAEA	International Atomic Energy Agency
IRRS	Integrated Regulatory Review Service (performed by the IAEA)
LILW	Low and Intermediate Level Waste
MoI	Ministry of the Interior
NPP	Nuclear Power Plant
NPRD	National Protection and Rescue Directorate
OG	Official Gazette
OG IA	Official Gazette - International Agreements
PWR	Pressurized Water Reactor
RW	Radioactive Waste
SORNS	State Office for Radiological and Nuclear Safety
VVER	Vodo Vodnoj Energetičarskij Reaktor

SUMMARY

The Republic of Croatia is a country without nuclear installations and without the intention to build such installations in the near future. In the early eighties of the last century state power utilities of Croatia and Slovenia constructed the Krsko Nuclear Power Plant (NPP) in Slovenian territory, some 10 kilometers from the Croatian national border. Presently, two states share the nuclear liability and the ownership of the Krsko NPP. As the facility is located in Slovenia it is subject of Slovenian law, meaning that the Croatian regulatory body does not have any authorities regarding its operation.

Although without nuclear installations, Croatia applies widely recognized principles and tools to achieve and maintain a high level of nuclear safety. This report illustrates how the objectives of *the Convention on Nuclear Safety* have been achieved. It refers to the period from August 2016 till August 2019. In the report the articles of *the Convention* which are applicable for Croatia are addressed, namely Article 4 (Implementing Measures), 7 (Legislative and Regulatory Framework), 8 (Regulatory Body), 11 (Financial and Human Resources), 15 (Radiation Protection) and 16 (Emergency Preparedness). As Croatia hosted the IRRS mission at 7 – 17 June 2015, the findings, recommendations and follow-up actions related to each article are provided.

Article 4 is of general nature and it is addressed simply by declaring that the approach taken in Croatia allows for continuous fulfillment of all the applicable requirements of the Convention. This follows from the legislative, regulatory and administrative measures implemented.

Article 7 is covered by describing *the Act on Radiological and Nuclear Safety* as the main legislative instrument in the area of interest and by providing basic information about the most important regulatory acts. The *Strategy for the Management of Radioactive Waste, Disused Sources and Spent Nuclear Fuel* and the *National Programme* are also described. The recommendations and suggestions of the IRRS mission regarding the legislative and regulatory framework are presented.

Article 8 is addressed by describing the responsibilities and the organization of Civil Protection Directorate of Ministry of the Interior (CPD of MoI) established for the purpose of conducting all professional and administrative tasks in the field of radiological and nuclear safety. The challenge regarding the limited staff is explained and the related IRRS mission findings are presented.

Articles 11 and 15 are only partially applicable for Croatia. Article 11 is covered by explaining Croatian obligations towards the management of the radioactive waste and spent fuel from Krsko NPP and by describing how the obligations are fulfilled. Article 15 is addressed by providing the information on how the radiation exposure of the public is controlled, especially the exposure related to the operational discharges from Krsko NPP. The procedure for the surveillance of nuclear propelled vessels which enter Croatian territorial waters is also described.

Article 16 is again extensively addressed because the process of changes addressed in in *the 7th Croatian National Report on the Implementation of the Obligations under the Convention on Nuclear Safety* has continued in the timeframe of this report. Firstly, the overview of the emergency management system is given covering the hazards, emergency preparedness categorization and the changes in roles and responsibilities in the emergency preparedness and response. Following that, important international exercises are described, as well as the work done based on previous assessments. The next chapter presents the current status of the upgrade of the emergency preparedness system. The new legal basis, hazard assessment and concepts of operation have been developed. Definition of roles and responsibilities and the national plan need to be revised because of organizational changes and will be finished early in the timeframe of the next report. The upgrade should be finished by the end of the timeframe of the next report. Finally, further efforts in the harmonization of the response with Slovenia

are described, subject whose importance has been proven during the exercises, especially during the INEX-5 exercise.

Status of implementation of findings from the last National Report

Since the last National Report, Croatian legislation in the field of radiological and nuclear safety is harmonized with 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(further in the text Council Directive 2013/59/Euratom) and with 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 (further in the text Council Directive 2014/87/Euratom). Also, recommendations and suggestions from IRRS mission in 2015 regarding changes needed in the Croatian legislation in the field of radiological and nuclear safety were taken into account.

Regarding activities in relation with recommendations and suggestions from IRRS mission, many of them were implemented since the last National Report and the preparation for IRRS Follow-up mission is underway. IRRS Follow-up mission will be held in October 2019.

Finaly, pursuant to amendments to the Act on Radiological and Nuclear Safety (OG 118/18) implementing the Decision of the Government of the Republic of Croatia of 2 August 2018, the tasks and activities pertaining to radiological and nuclear security fall under the competence of the Ministry of the Interior as of 1 January 2019 and the State Office for Radiological and Nuclear Safety (SORNS) ceased to exist.

The National Program for the Implementation of the Strategy *for the Management of Radioactive Waste, Disused Sources and Spent Nuclear Fuel* (OG 125/14) - Programme for the period up to 2025, with a view to 2060 (*the Programme*) was adopted by the Government in November 2018. *The Programme* provides more detailed interpretations of the requirements and goals from *the Strategy* and covers the period up to 2025 with an overview of the developments till 2060. It advocates the application of the proven and widely accepted solutions from international best practice. The Programme foresees the remediation of sites that are contaminated with naturally occurring radionuclides, the establishment of a storage facility (temporary solution) for radioactive waste located on the territory of the Republic of Croatia and for 50% low and low and intermediate level radioactive waste (LILW) located in Krško NPP, which waste the Republic of Croatia is obligated to manage. According to *the Programme*, spent nuclear fuel shall continue to be stored at Krško NPP by 2043 at the least, after which a common permanent solution will be sought with the Republic of Slovenia. *The Strategy*, together with *the Program*, offer a systematic framework for the management of the radioactive waste and spent fuel.

General conclusion of the report is that the Croatian regulations and practices are in compliance with the obligations of *the Convention on Nuclear Safety*.

1. INTRODUCTION

The Republic of Croatia attaches great importance to the nuclear safety, actively cooperates with the International Atomic Energy Agency (IAEA) and commends the work of IAEA in this field. Croatia became a party of *the Convention on Nuclear Safety* in 1995 (OG IA 13/95). Other nuclear safety related conventions have been accepted as well: *the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management* (OG IA 3/99), *the Convention on the Physical Protection of Nuclear Material* (OG IA 12/93, OG IA 5/01 and amended OG IA 5/06), *the Convention on Early Notification of a Nuclear Accident* (OG IA 12/93, OG IA 1/06) and *the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency* (OG IA 12/93, OG IA 1/06). According to the Constitutional provisions, the requirements of the mentioned conventions automatically became a part of the national legislation. In order to allow for more direct implementation, the requirements were also transposed into relevant laws and by-laws.

Croatia is a country without nuclear installations and does not have the intention to build such installations in the near future. In the early eighties of the last century state power utilities of Croatia and Slovenia constructed Krsko Nuclear Power Plant (NPP) in Slovenian territory, some 10 kilometers from the Croatian national border. Presently, two states share the nuclear liability and the ownership of Krsko NPP. As the facility is located in Slovenia it is subject of Slovenian law, meaning that the Croatian regulatory body does not have any authorities regarding its operation.

Although without nuclear installations, Croatia applies widely recognized principles and tools to achieve and maintain a high level of nuclear safety. This report illustrates how the objectives of *the Convention on Nuclear Safety* (*the Convention*) have been achieved. It addresses all aspects of the obligations and provides comprehensive information based on actual situation. The report is the 8th in a row and covers the period from August 2016 till August 2019. It aims to support the review process by indicating the changes since the previous one, while still providing the whole picture. This way it should be possible to perform the review process without the need to go back to the earlier reports.

The report is prepared and structured in line with the *Guidelines Regarding National Reports Under the Convention on Nuclear Safety, INFCIRC/572/Rev.6*. It consists of three sections (including this one), two appendices and a summary.

Section 2 follows an article-by-article approach. As Croatia is a country without nuclear installations, not all articles of *the Convention* are applicable. The reporting on each applicable article addresses various aspects of the obligations to enable a complete and comprehensive review by other contracting parties. It begins with short description of the current status and continues by focusing on the changes since the last report. As Croatia hosted the IRRS mission, the findings, recommendations, follow-up actions and current status are provided where applicable.

The main body of the report contains all the key elements of information necessary to assess in which way Croatia is trying to attain the objectives of *the Convention*. Additional information is provided in the appendices. In the first one the list of the most relevant documents within the Croatian legislative and regulatory framework is given, while the second one explains the purpose, scope, results and follow-up actions of already mentioned IRRS mission.

2. ARTICLE-BY-ARTICLE REVIEW

Since Croatia is a contracting party without nuclear installations and since there are no plans to embark on a nuclear power program in the near future, certain requirements of *the Convention* do not apply.

In the following subsections only applicable or partly applicable articles are addressed, namely Articles 4, 7, 8, 11, 15 and 16. To assist reviewers, the full text of the article is included at the beginning of each subsection. Moreover, each subsection concludes with a summary statement regarding the compliance with the obligations from *the Convention*.

2.1 ARTICLE 4. Implementing Measures

Each Contracting Party shall take, within the framework of its national law, the legislative, regulatory and administrative measures and other steps necessary for implementing its obligations under this Convention.

The legislative, regulatory, administrative and other measures necessary for implementing Croatian obligations under *the Convention* are addressed in the Subsections 2.2 to 2.6.

The overall conclusion is that the approach taken in Croatia allows for continuous fulfillment of all the applicable requirements of *the Convention*.

2.2 ARTICLE 7. Legislative and Regulatory Framework

- *Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of nuclear installations.*
- *The legislative and regulatory framework shall provide for:*
  - *(i) the establishment of applicable national safety requirements and regulations;*
  - *(ii) a system of licensing with regard to nuclear installations and the prohibition of the operation of a nuclear installation without a license;*
  - *(iii) a system of regulatory inspection and assessment of nuclear installations to ascertain compliance with applicable regulations and the terms of licenses;*
  - *(iv) the enforcement of applicable regulations and of the terms of licenses, including suspension, modification or revocation.*

In Croatia the Constitution stipulates the process by which legislative and regulatory acts are issued. The Parliament, as a representative body of the people, is vested with legislative power by adopting laws. The Government exercises executive powers by proposing bills to the Parliament, executing laws and adopting regulations (decrees) to implement laws. *The Law on the State Administration* (OG 66/19) provides that the ministers, the heads of state offices and directors of governmental authorities adopt ordinances, orders and instructions for the implementation of laws and regulations when explicitly authorized, within the limits of the authorization granted.

Croatian legislative and regulatory framework relevant for the nuclear safety is presented in Appendix A of this report. It consists of a number of acts, governmental regulations, ordinances, strategies, multilateral agreements, bilateral agreements and other documents. It should be mentioned that Croatia, as a member state of the European Union (EU), directly adopts EU regulation and transposes the directives into national legislation. It should also be noticed that the legislative and regulatory framework is constantly evolving in accordance with the changes in the international and domestic practice. The development and upgrade of the framework is the duty of regulator, while the other authorities cooperate in line with their responsibilities. The cooperation with the following ministries is of particular importance:

- the Ministry of Health (responsible for health protection of the public),
- the Ministry of Environmental and Energy (responsible for environmental protection and energy),
- the Ministry of Construction and Physical Planning (responsible for planning of land use and for issuing of construction permits),
- the Ministry of Maritime Affairs, Transport and Infrastructure (responsible for the control of transport),
- the Ministry of Finance (responsible for customs control at the borders)

The main legislative instrument in the area of interest is *the Act on Radiological and Nuclear Safety* (OG 141/13, 39/15, 130/17 and 118/18) (hereinafter referred to as *the Act*). It establishes measures for safety and protection against ionizing radiation and measures for physical protection in performing nuclear activities and practices involving the sources of ionizing radiation. The aim is to ensure adequate protection of individuals, society and the environment from harmful effects of ionizing radiation and also to ensure safe performance of practices involving ionizing radiation sources, nuclear activities and radioactive waste disposal.

The implementation of *the Act* is supported by more than fifty regulations and ordinances (see Appendix A). The following regulatory acts are the most relevant:

- *Ordinance on the Scope and Content of the Plan and Program of Measures in the Event of an Emergency and of Informing the Public and Competent Bodies* (OG 123/12) prescribes the scope, contents and other issues related to the emergency plans which have to be prepared by the users of radioactive sources, by the performers of nuclear activities and by the operators of nuclear objects
- *Ordinance on the Supervision and Control of Transboundary Shipments of Radioactive Waste and Spent Fuel* (OG 11/13) regulates the supervision and control system for transboundary shipments of radioactive waste and spent fuel in line with the *Council Directive 2006/117/Euratom*
- *Ordinance on the Conditions and Procedure for Issuing and Withdrawing the Approval for Packaging Used for Transport of Radioactive and Nuclear Materials* (OG 42/13) regulates the procedure for issuing and withdrawal of the approval for packaging in the transport of radioactive and nuclear materials according to the provisions of the *Dangerous Goods Transport Act* (OG 79/07)
- *Ordinance on Nuclear Safety Requirements for Issuing the Consent on Construction of a Nuclear Installation* (OG 36/16) - provides general and specific requirements for issuing the consent on construction of a nuclear installation which shall be applied to nuclear installations, other than nuclear power plants, by means of a graded approach, to account for the complexity and specificity of each nuclear installation.

- *Ordinance on Amendments to the Ordinance on Nuclear Safety Requirements for Issuing the Consent on Construction of a Nuclear Installation* (OG 79/16)
- *Ordinance on Authorised of Nuclear Safety Experts* (OG 29/17) – provides organizational, technical, technological and quality assurance requirements to be fulfilled by the organizations with the intend to perform nuclear safety related activities
- *Ordinance on the Management of Radioactive Waste and Disused Sources* (Official Gazette 12/18) provides a new radioactive waste categorization in accordance with Classification of Radioactive Waste, IAEA GSG-1, 2009; the definition of radioactive waste management center (RWMC) and facilities which it may include: requirements for design of radioactive waste and disused sources management facilities; procedure for licensing of radioactive waste management facilities (design, commissioning, operation, closure and decommissioning); harmonisation with IAEA Safety case and supporting Safety assessment concept for licensing of RW and DS management facilities; definition of requirements for WAC.
- *Regulation on Measures for Protection Against Ionizing Radiation and Interventions in Case of Emergency* (OG 24/18) – prescribes the response to emergencies which may occur in practices involving sources of ionizing radiation and nuclear activities as well as the measures for the protection against ionizing radiation and interventions to be taken in case of emergency
- *Ordinance on Nuclear Security* (OG 38/18) prescribes the type and scale of nuclear security measures, content of the Nuclear Security Plan and manner and scope of reporting on occurrences which pose a threat to nuclear security. *Ordinance on Dose Limits, Dose Constraints and Assessment of Personal Doses* (OG 38/18) prescribes the exposure limits applicable to the professionals, persons being educated for working with radiation sources and members of the public, as well as the exposure limits and intervention levels to be applied in case of an emergency
- *Ordinance on Environmental Monitoring of Radioactivity* (OG 40/18) regulates where, how often and in which way the radioactivity in the environment has to be monitored, as well as how to assess the impact of the facilities where nuclear activities or practices involving the sources of ionizing radiation are performed

On the basis of *the Strategy for the Management of Radioactive Waste, Disused Sources and Spent Nuclear Fuel* (OG 125/14) *the National Program for the Implementation of the Strategy* (the Programme) was adopted by the Government in November 2018. *The Programme* provides more detailed interpretations of the requirements and goals from *the Strategy* and covers the period up to 2025 with an overview of the developments till 2060. It advocates the application of the proven widely accepted solutions from international best practice. The Programme foresees the remediation of sites that are contaminated with naturally occurring radionuclides, the establishment of a storage facility (temporary solution) for radioactive waste located on the territory of the Republic of Croatia and for 50% of low and intermediate level radioactive waste (LILW) located in Krško NPP, which waste the Republic of Croatia is obligated to manage. According to the Programme, spent nuclear fuel shall continue to be stored at Krško NPP by 2043 at the least, after which a common permanent solution will be sought after with the Republic of Slovenia. *The Strategy* together with *the Program* offer a systematic framework for the management of the radioactive waste and spent fuel.

In 2015, Croatia hosted the Integrated Regulatory Review Service (IRRS) mission carried out by the IAEA (more information is provided in Section 3). The main goals of the mission were to review the legislative and regulatory framework in the area of radiation and nuclear safety against the relevant IAEA safety standards. The mission resulted with 36 recommendations and 22 suggestions, where a considerable portion was oriented towards the upgrades of the legislative and regulatory acts. The

Government accepted the results of the mission. In the Government's conclusion SORNS was obligated to prepare the proposal for the new Act on Radiological and Nuclear Safety by 28th February 2017. The proposal had to reflect all relevant recommendations. Also, public administration institutions were obligated to implement all recommendations and suggestions (including the ones related to the regulation upgrades) by 28th February 2018. The Conclusion was considered as a general action plan which provided the basis for the development of more detailed action plans at the institutional level. Since the last National Report, more than 60% of recommendations and suggestions from IRRS mision were implemented and preparation for IRRS Follow-up mission is underway. IRRS Follow-up mission will be held in October 2019.

In the period since the last National Report the *Strategy on Radiological and Nuclear Safety for the period 2017-2025* was adopted by the Government and published in the Official Gazette No. 65/17. The goal of the *Strategy on Radiological and Nuclear Safety for the period 2017-2025* is to ensure adequate protection of individuals, society and the environment against harmful effects of ionizing radiation, as well as to ensure safe performance of operations involving ionizing radiation sources, nuclear operations, radioactive waste management and physical protection of ionizing radiation sources and nuclear installations without unduly limiting the operation of facilities or the conduct of activities that may give rise to risks of exposure to ionising radiation.

In conclusion, the Croatian regulations and practices are in compliance with the obligations of Article 7.

2.3 ARTICLE 8. Regulatory Body

1. *Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in Article 7, and provided with adequate authority, competence and financial and human resources to fulfill its assigned responsibilities.*
2. *Each Contracting Party shall take the appropriate steps to ensure an effective separation between the functions of the regulatory body and those of any other body or organisation concerned with the promotion or utilisation of nuclear energy.*

SORNS was acting as Croatian regulatory body for radiological and nuclear safety since 2010. For the purpose of rationalizing the system of legal entities with public authority of the agency type, the Government of the Republic of Croatia adopted a Conclusion which accepts the proposal to reduce the number of agencies, institutes, funds, institutes, foundations, companies and other legal entities with public authority, at its meeting held on 2 August 2018, CLASS: 022-03/18-07/355; REG.NO: 50301-25/06-18-2. Pursuant to amendments to the Act on Radiological and Nuclear Safety (OG 118/18) and implementing the above-mentioned Conclusion, the tasks and activities pertaining to radiological and nuclear security fall under the competence of the Civil Protection Directorate (CPD) of Ministry of the Interior as of 1 January 2019.

The responsibilities of CPD of MoI are defined in the Act on Radiological and Nuclear Safety (OG 141/13, 39/15, 130/17 and 118/18). Subordinated regulations and ordinances and Regulation on internal organization of the Ministry of the Interior were adopted by the Government on 11 March 2019 (Official Gazette No. 24/19).

CPD of MoI and its organizational units involved in the field of radiological and nuclear safety (shown in Figure 1) are dealing with the regulatory, inspection and tehnical tasks to ensure protection of

the people and the environment from harmfull effects of ionizing radiation. This includes ensuring safe performance of activities and facilities involving ionising radiation sources, nuclear activities and radioactive waste management, trade, transport and handling of nuclear materials, expert assistance in activities for preventing illicit trafficking of nuclear material, keeping a register of nuclear activities and materials; accounting for and control of all nuclear facilities and material; the assistance in the event of a nuclear accident and early exchange of information in the event of an emergency and fulfillment of the international obligations and commitments and international cooperation with EU and IAEA.

The duties are distributed within units shown in Figure 1 according to the Regulation on internal organization of the Ministry of the Interior (OG 24/19) and in the internal act.

Implementing measures for radiological and nuclear safety are pursued through regular activities of organisational units of the Civil Protection Directorate:

- Radiological and Nuclear Safety Sector,
- Radiological and Nuclear Emergency Unit and
- Radiological and Nuclear Safety Inspection.

Radiological and Nuclear Safety Sector is resposnible for: approving of activities with ionizing radiation sources; nuclear activities; activities of managing radioactive waste and disused sources; issuing permits for transportation and transit of ionizing radiation sources; conducting independent analyses od safety and issuing decisions and approvals for location, design, construction, use and decommissioning of a nuclear facility. It takes part in the procedure for issuing location permits and building permit and in the procedure for issuing use permits for structures that accommodate ionizing radiation sources or in which operations involving ionizing radiation sources are carried out or tasks of managing radioactive waste and disused sources in accordance with the building code. This Sector is also competent for: granting authorisation to professional technical services and nuclear safety experts; organising and where necessary also carrying out tests on the presence of the type and intensity of ionizing radiation in the environment, food, feed, medicaments and general use items under regular conditions and in cases of suspected emergency; keeping records and organising professional education on the implementation of radiological safety measures and nuclear safety measures.

Radiological and Nuclear Emergency Unit within the CPD provides expert assistance in the case of a radiological or nuclear incident/accident; takes part in organising the system of preparedess in the case of an emergency; prepares and carries out necessary expert and technical activities of the preparedness program and activities in the case of an emergency which includes radiological or nuclear accident and analyses possible consequences; drafts the Assessment of nuclear and radiological risk for the Republic of Croatia; approves the preparedness and response plans for a radiological emergency and plans and programs of holders of approvals for performance of operations involving ionizing radiation sources and other tasks within its scope.

Radiological and Nuclear Safety Inspection within the CPD is responsible for carrying out inspections and monitoring the implementation of provisions of the Act and provisions adopted on the basis thereof.

Cooperation with international and national organisations and associations in the field of ionising radiation protection and nuclear safety and coordination of technical cooperation activities with the International Atomic Energy Agency for all participants is implemented through regular activities of the Civil Protection International Relations Unit within the CPD.

All organisational units of the CPD of MoI shall be responsible for their work to the head of the CPD of MoI, which is the Assistant Minister who is responsible to the Minister of the Interior. Cooperation between organisational units within CPD of MoI at horizontal level is determined by act of general scope.

Cooperation of the internal organisational units of the CPD of MoI with organisational units of other organisational entities within the Ministry of the Interior is also determined by act of general scope.

Organisational chart of the Civil Protection Directorate, shown in Figure 1, enables effective performance of all planned activities in the area of radiological and nuclear safety.

The following table illustrates the difference between the numbers of planned posts in each organisational unit as compared to the number of currently employed personnel:

Table 1. Number of planned and currently employed staff in the regulatory body

Organisational unit	**Number of planned posts**	**Number of currently employed people:**
Radiological and Nuclear Safety Sector	19	9
Radiological and Nuclear Emergency Unit	5	2
International Relations and Projects Department	2 (persons dealing with tasks of radiological and nuclear safety)	1
Inspection Sector	6 radiological and nuclear safety inspectors	3

There is a planned post within Inspection sector for a lawyer who will provide expert assistance to radiological and nuclear safety inspectors.This ensures the strengthening of competences and skills of radiological and nuclear safety inspection.

The necessary knowledge, skills, capacities, professional qualifications and work experience in the aforementioned organisational units are prescribed by the Decree on the Internal Organisation of the Ministry of the Interior (OG 24/19). Currently, less than half of job posts envisaged in the said Decree have been filled.

At the end of 2018, the number of employees in SORNS was 23 and the experts in the area of radiological and nuclear safety was 15. During the process of integration in CPD of MoI there were some changes regarding human resources. On December 2018, several persons quit the regulatory body: one inspector, two persons dealing with legal and accounting tasks and one person retired (dealing with general tasks). The other employees dealing with general, legal and accounting tasks were taken over by the central units of the MoI by Directorate for accounting and financial tasks (two persons). Current number of experts in the area of radiological and nuclear safety in CPD of MoI is 15 as it was in SORNS before.

Limits for hiring new employees in public administration prevent important progress. CPD of MoI is funded from the state budget. The budget for the next year is proposed by Ministry of the Interior to the Government. Because of the limitations of the State Budget, it will not be possible to fill all empty positions at CPD of MoI in the near future. Attempts to mitigate consequences of employee shortage are three-fold: (1) increased effort of all employed, (2) optimising and simplifying work processes and (3) planned temporary employment before the possibility of a full-time employment.

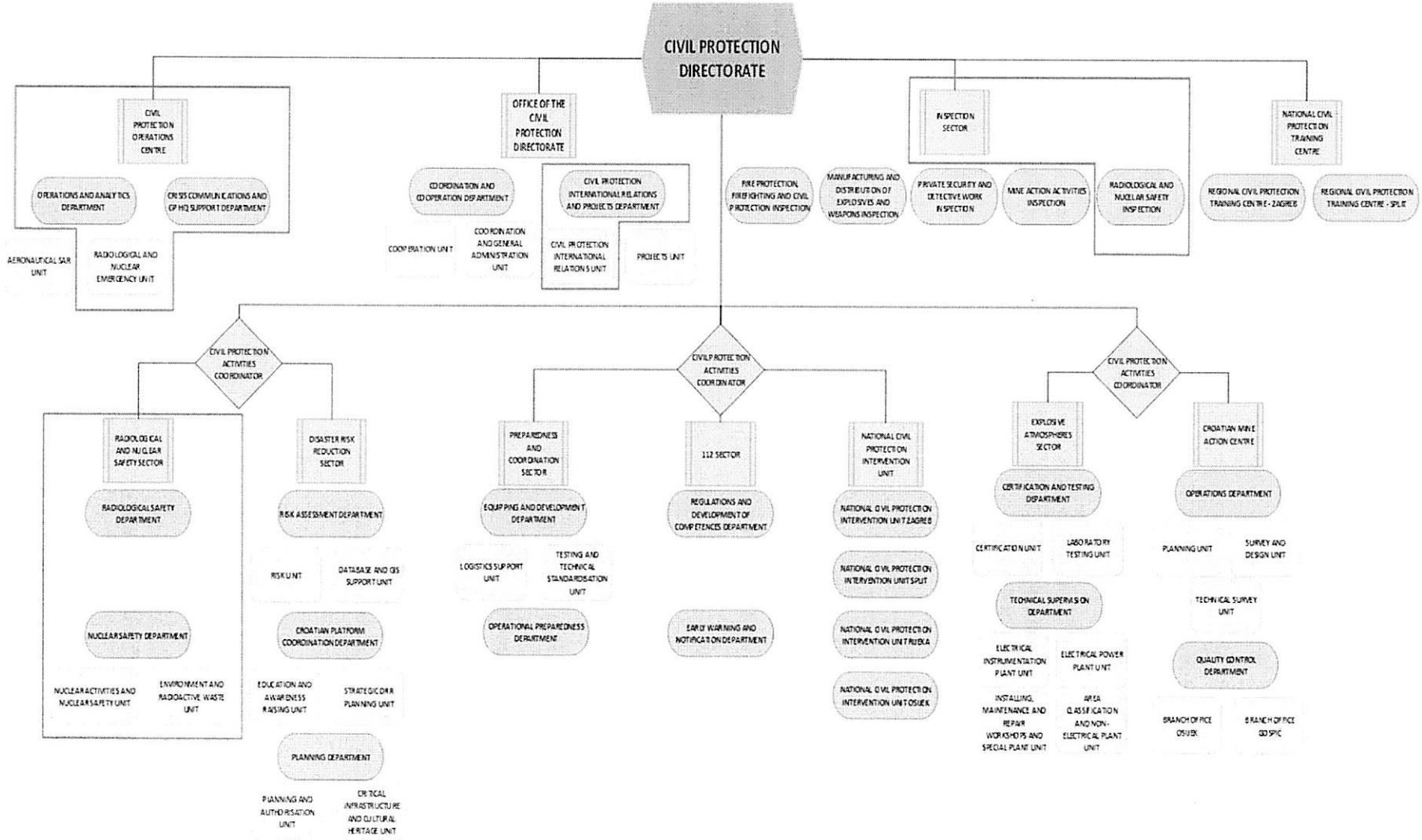

Figure 1 Organizational scheme of CPD

2.3.1 Capacity Building Within the Regulatory Body

Various forms of training and education are available for the regulatory body employees. Besides the continuous in-house training and compulsory education organized by the State School for Public Administration, the employees are engaged in training and education provided through the cooperation with the IAEA and within the scope of EU projects.

Because of the specific nature of the activities pertaining to radiological and nuclear safety, Education and training plan of the employees for a two-year period (2019-2020) is currently under development. Education related to knowledge specific to nuclear and radiological safety will be carried out by authorized Croatian institutions. When it comes to specific activities, education of employees is organised through International Atomic Energy Agency (IAEA) and the European Union.

The International Atomic Energy Agency (IAEA) conducted the Integrated Regulatory Review Service (IRRS) Mission in the Republic of Croatia from June 6 to 17, 2015. The team noted that the staff is professional and commited to work, but also that the regulatory body may face serious challenges in the future due to the workload expected to be carried out.

After the completion of the IRRS Mission, support for the implementation of the recommendations and suggestions was initiated. The project CRO9012 „Supporting Implementation of Recommendations and Suggestions of the IRRS Mission" was supported by the IAEA to strengthen the existing staff capacities. The project has provided training and education of the regulatory staff in the field of licensing, inspection, integrated management system, emergency preparedness and response and environmental monitoring.

Table 2. Training and education in the framework of the project CRO9012

Field	Fellowship (FS) and Scientific visit (SV)	Number of persons educated
Licensing	FS, SV	4
Inspection	FS	4
Integrated management system	FS	1
Emergency preparedness and response	SV	2
Environmental monitoring	SV	1

In conclusion, the Croatian regulations and practices are in compliance with the obligations of Article 8.

2.4 ARTICLE 11. Financial and Human Resources

1. *Each Contracting Party shall take the appropriate steps to ensure that adequate financial resources are available to support the safety of each nuclear installation throughout its life.*
2. *Each Contracting Party shall take the appropriate steps to ensure that sufficient numbers of qualified staff with appropriate education, training and retraining are available for all safety-related activities in or for each nuclear installation, throughout its life.*

There are no nuclear installations in Croatia. However, *the 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 Krsko Nuclear Power Plant* (OG 09/02) specifies that the management of the radioactive waste and spent fuel originating from Krsko NPP is joint responsibility of Croatia and Slovenia. In particular, Croatia (owning 50% of the facility) is obliged to ensure the disposal of a half of the radioactive waste and spent fuel. The approach taken in Croatia concerning this issue is in line with *the European Commission Recommendation of 24 October 2006 on the Management of Financial Resources for the Decommissioning of Nuclear Installations, Disposing Spent Fuel and Radioactive Waste* and pursuant to *the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management*.

In 2008 the Fund for Financing the Decommissioning of the Krsko NPP and the Disposal of Krsko NPP Radioactive Waste and Spent Nuclear Fuel was founded, with the following main goals:

- timely acquisition of a half of the amount of financial means necessary for the implementation of *the Krsko NPP Decommissioning Program* and *Radioactive Waste and Spent Nuclear Fuel Disposal Program* (According to the current *Krsko NPP Decommissioning Program*, Croatian Electric Power Utility makes a EUR 14.25 million annual payments to the Fund. These amount will be paid until Krsko NPP is in operation, that is, until the planned amount of funds in reached.)
- preservation and increase of the value of assets through effective investments, in order to ensure that the assets are sufficient and that the obligations aren't handed down to the next generations
- cooperation with Slovenia in periodical revising of *the Krsko NPP Decommissioning Program*
- implementation of the provisions from *the Strategy for the Management of Radioactive Waste, Disused Sources and Spent Nuclear Fuel* (OG 125/14), regarding the disposal of the radioactive waste and spent fuel originating from Krsko NPP

To create prerequisites for successful development of mentioned goals, the Fund is gathering Croatian scientists and experts, and improving cooperation with the relevant international organizations. From the date of the establishment of the Fund onwards, financial means are being collected as planned.

In conclusion, the Croatian regulations and practices are in compliance with the obligations of Article 11.

2.5 ARTICLE 15. Radiation Protection

Each Contracting Party shall take the appropriate steps to ensure that in all operational states the radiation exposure of the workers and the public caused by a nuclear installation shall be kept as low as reasonably achievable and that no individual shall be exposed to radiation doses which exceed prescribed national dose limits.

As there are no nuclear installations in Croatian territory, the radiation exposure of the workers is not an issue. However, the public might be exposed due to the releases from the installations in the

neighboring countries. This refers primarily to the release from Krsko NPP. In order to be sure that no individual is exposed to the radiation doses which exceed prescribed national dose limits, dedicated radiological monitoring program is developed by NPP Krsko and continuously implemented by the accredited laboratory from the Rudjer Boskovic Institute and Institute Jozef Stefan. The program includes:

- the monitoring of the radioactivity of the liquids discharged from Krsko NPP into Sava river (the limits are prescribed (1) for the concentrations of radionuclides, (2) for the activity of tritium and (3) for the total activity of other radionuclides),
- the monitoring of the radioactivity of the gaseous effluents (the limits are prescribed for the concentration of the radionuclides 500 meters from the containment) and
- the dose assessments for the most exposed individuals inhabited on Croatian territory.

The results indicate that the impacts to the human health of the operational releases from Krsko NPP are practically negligible. Measured concentrations and activities are usually at least two orders of magnitude lower than the prescribed limits. The most exposed individual, who is supposed to consume 730 liters of the water from Sava river and 16 kilograms of fish caught in that river annually, would receive the effective dose of some 0,226 microsieverts. This happens to be 0,023% of the prescribed annual dose limit for the population (1 millisievert). Moreover, the contribution of the dose caused by the releases from Krsko NPP to the total dose from man-made sources amounts to few percent only. All the results are presented in the newsletter which was issued until the end of 2018 by SORNS and now is continued to be issued by CPD of MoI quarterly. The newsletter is available for the examination and download at the CPD web site https://civilna-zastita.gov.hr/podrucja-djelovanja/radioloska-i-nuklearna-sigurnost/sluzba-za-nuklearnu-sigurnost/odjel-za-okolis-i-radioaktivni-otpad/bilteni-ne-krsko/175.

In addition to the described monitoring program conducted by NPP Krsko and oriented towards operational releases from Krsko NPP, the radiological monitoring related to the Article 35 and 36 of *the Euratom Treaty* is continuously carried out in Croatia. It conforms to *the Recommendation 2000/473/Euratom* and covers various constituents of the environment: air, precipitation, soil, groundwater, surface water, rainwater, drinking water, food and feedstuff. The number of samples and the sampling locations are determined within the annual measurement programs developed by CPD of MoI. No unexpected measuring results were obtained so far.

2.5.1 Surrveilance of Nuclear Propelled Vessels

Every few years, nuclear propelled vessel enters Croatian territorial waters within the scope of a planned visit. The most recent event took place on 14th November 2016, when French submarine Rubis anchored at military harbour Lora, Split, and stayed there for 7 days.

When a nuclear propelled vessel enters Croatian territorial waters, the MoI is obliged to develop (in advance) the radiation monitoring program to be implemented with the support of the organization authorized for performing the measurements. The program specifies the type, number and location of the measurements which will be carried out before and after the arrival of the vessel.

In this particular case, the radiation monitoring program was carried out with the support of the Institute for Medical Research and Occupational Health and by the utilization of its mobile measuring laboratory. The results indicated that there were no statistically significant differences in the radiation levels before and after the arrival of the vessel. In other words, no individual was exposed to the radiation doses which exceed prescribed national dose limits because of the presence of the vessel. The same was determined for all the previous visits. It should be mentioned that all costs related

to the development and implementation of the radiological monitoring program have to be covered by the owners/operators of the nuclear vessels.

In conclusion, the Croatian regulations and practices are in compliance with the obligations of Article 15.

2.6 ARTICLE 16. Emergency Preparedness

1. Each Contracting Party shall take the appropriate steps to ensure that there are on-site and off-site emergency plans that are routinely tested for nuclear installations and cover the activities to be carried out in the event of an emergency.

For any new nuclear installation, such plans shall be prepared and tested before it commences operation above a low power level agreed by the regulatory body.

2. Each Contracting Party shall take the appropriate steps to ensure that, insofar as they are likely to be affected by a radiological emergency, its own population and the competent authorities of the States in the vicinity of the nuclear installation are provided with appropriate information for emergency planning and response.

Contracting Parties which do not have a nuclear installation on their territory, insofar as they are likely to be affected in the event of a radiological emergency at a nuclear installation in the vicinity, shall take the appropriate steps for the preparation and testing of emergency plans for their territory that cover the activities to be carried out in the event of such an emergency.

Although the Republic of Croatia has no nuclear installations on its own territory, there are 40 operational nuclear power plants (NPPs) within 1.000 km from its national borders. The closest to the Croatian territory are Krsko NPP in Slovenia (PWR, 707 MWe) and Paks NPP in Hungary (VVER, 4x440 MWe). Krsko NPP is situated some 10 km from the border and less than 30 km from the Croatian capital of Zagreb, while Paks NPP is located some 75 km from the border. Severe accidents with large releases in those NPPs, particularly in Krsko NPP, could cause serious consequences on Croatian territory.

Besides the accidents related to the NPPs, the following types of events could also trigger nuclear or radiological emergency in Croatia:

- emergency on a nuclear ship located in the internal waters or territorial sea of the Republic of Croatia,
- emergency at the location of a stationary ionising radiation source of the licensee, which is known in advance, or the storage location for mobile ionising radiation source of the licensee, which is known in advance,
- emergency during radioactive waste management,
- emergency on an unknown location, including transport emergencies, emergency during operations involving mobile sources, discovery of an orphan source, terrorist act, loss or theft of a radioactive source, re-entry of a satellite, illicit transport of radioactive sources, radioactive waste and nuclear material,
- radioactive contamination or increased exposure to ionising radiation caused by unknown or other circumstances.

Croatian nuclear and radiological emergency management system is based on *the Regulation on Measures for Protection against Ionizing Radiation and Actions in Case of Emergency* (OG 24/18). *The Regulation* defines five emergency preparedness categories (in line with *IAEA requirements GSR Part 7*):

- Emergency preparedness category I includes facilities in which an emergency could result in severe deterministic health effects off-site that warrant the implementation of urgent and early response measures and other measures off-site.
- Emergency preparedness category II includes facilities in which an emergency may result in ionising radiation doses for the population that warrant the implementation of urgent protection and early response measures and other measures off-site. Category II, as opposed to category I, does not include facilities in which emergencies could give rise to severe deterministic health effects off the site.
- Emergency preparedness category III includes facilities in which an emergency may result in ionising radiation doses that warrant the implementation of protection measures on the location of the licensee. Category III does not include facilities for which planning zones and distances have to be designated.
- Emergency preparedness category IV includes activities and practices that may result in an emergency and warrant the implementation of urgent protection measures in unforeseeable locations.
- Facilities belonging to emergency preparedness category V (hereinafter: category V) are facilities belonging to category I and II located on the territory of another country, for which planning zones and distances have been designated on the territory of the Republic of Croatia.

The Regulation was enacted in early 2018. The main goal of *the Regulation* was to align legal framework for emergency management of radiological and nuclear emergencies with the *EU Directive 59/2013/Euratom* and *IAEA GSR Part 7*. Response to radiological and nuclear emergency is coordinated trough civil protection system where Ministry of Interior – Civil Protection Directorate is having a leading role, especially in establishment of National Civil Protection Headquarter (interagency cell nominated by Government). MoI CPD is in close coordination with regional (counties and City of Zagreb) and local (municipality and city) level of civil protection in implemeneting civil protection measures like early warning, sheltering and/or evacuation.

A change in the organization of the emergency preparedness and response in Croatia happened on 1 January 2019, when SORNS and NPRD were incorporated into the Ministry of the Interior, Civil Protection Directorate.

This Regulation is now under revision and it will take into account changes caused by ceasing of SORNS and taking over employees and tasks by CPD of MoI.

Additionally, CPD of MoI responsibilities taken over from SORNS in the emergency preparedness field include the development of legislature in the field, the development of the *Radiological and Nuclear Hazard Assessment for the Republic of Croatia*, the identification of groups of hazards for which *Concepts of Operation* should be developed, the development of *Concepts of Operation* for identified hazards, and the development of the *Emergency preparedness and response plan of the Republic of Croatia in the event of a radiological or nuclear emergency*, as well as periodical review of those documents.

Furthermore, CPD of MoI responsibilities taken over from NPRD in the emergency preparedness field include the development of legislature in the field of civil protection, the management of the operational units for protection and rescue, the maintenance of national notification system and the coordination of the response. CPD of MoI is also responsible for the organization of

training and exercises, including nuclear exercises at national level, which was previously a joint responsibility of NPRD and SORNS. In addition, CPD of MoI is now responsible for the education of the public and for informing the public.

Emergency preparedness and response plan of the Republic of Croatia in the event of a radiological or nuclear emergency has been drafted. Changes need to be made dealing with the distribution of responsibilities within the organizational structure of CPD of MoI now that CPD of MoI acts as both manager and expert body, as well as continuing in its previous role as a first responder. Enactment is expected in late 2019 or early 2020.

2.6.1 Reviews, Assessments and Evaluations through Exercising

Croatia has continued participating in exercises organized by the Slovenian regulatory body dealing with accident in NPP Krško, and does so once a year. Croatia also participates in the exercises organized by the Slovenian regulatory body about the use of Slovenian emergency communications system.

Croatia has continued its participation in ConvEx exercises organized by the IAEA. Especially important was the ConvEx-3 exercise, organized by IAEA and Hungary. The exercise lasted 36 hours continuously. The exercise was based on a severe accident on two reactors of Hungarian NPP Paks. Croatia successfully tested the ability of expert team to organize shifts and successfully work continuously through an extended period, as well as continuous communication with other relevant parties in the country, including field-measuring units.

National exercises in the timeframe of this report have been based on radiological, and not nuclear emergencies.

INEX 5 exercise was organized in March 2016, outside of the timeframe of this National Report. However, it is relevant for this report because of the results – protective measures taken (Figure 2).

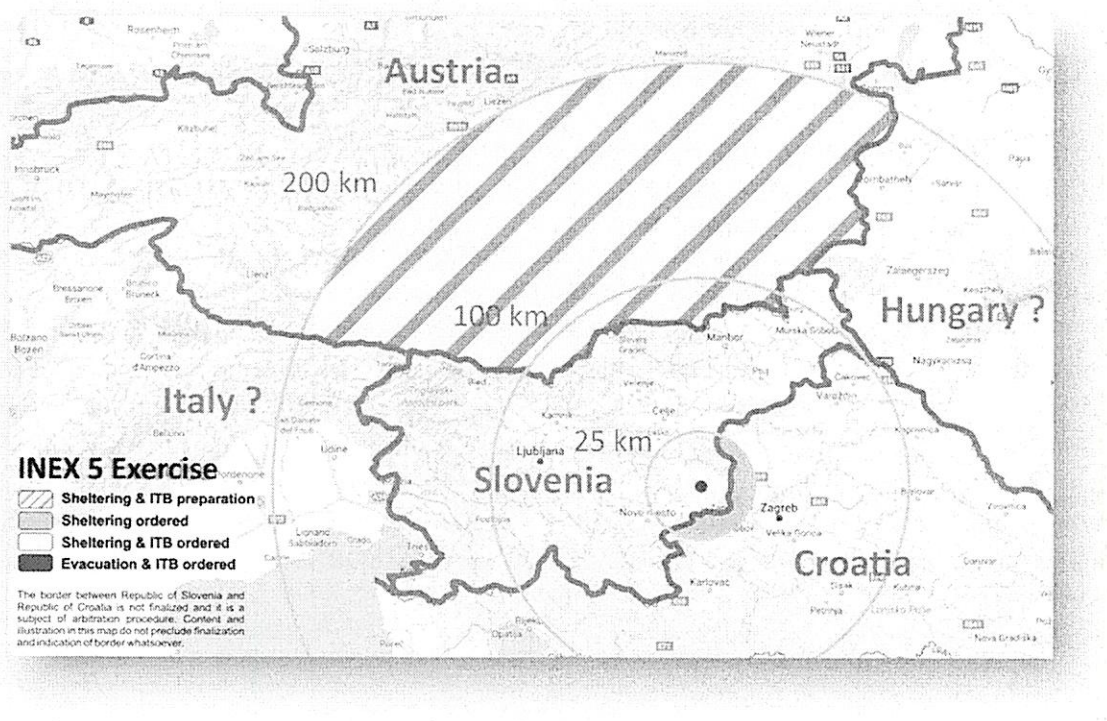

Figure 2 Protective measures prepared or ordered during the INEX 5 exercise

The results generated interest in many international meetings and workshops where they were presented and are referenced as an example why harmonization efforts between Slovenia and Croatia have to continue.

The IAEA recognized the problem of harmonization of protective actions globally. A consultancy meeting "Harmonization of the implementation of protective actions in case of nuclear or radiological emergency with transboundary or transnational consequences" was organized in June 2019 in Vienna with specific purpose to hold a table-top exercise aimed at discussing and testing bilateral and multilateral agreements and Member States' initiatives for harmonization of the implementation of protective actions in a nuclear or radiological emergency with transboundary consequences, identification of best practices and possible futher actions.

IRRS Mission was conducted in 2015 and Follow-up Mission will be performed in October 2019, both outside of the timeframe of this report. During the timeframe, Croatia worked on fulfilling six recommendations and five suggestions given by the IRRS Mission in the field of emergency. Some of the suggestions and recommendations, such as better protection of emergency workers, were fulfilled through *the Regulation*. Others will be fulfilled once *the Plan* is enacted. Recent organizational changes mean that some of suggestions and recommendations have to be reassessed, because recommendations given to SORNS as a regulator cannot be directly applied to CPD of MoI, since CPD of MoI is now a regulator, first responder and a coordinating body.

2.6.2 Major Upgrade of the System

As was previously reported in *the 7th Croatian National Report on the Implementation of the Obligations under the Convention on Nuclear Safety*, Croatia responded to the results of the reviews, assessments and evaluations by initiating the major upgrade of the nuclear and radiological emergency preparedness and response system, launched in the second half of 2015. The main steps of the upgrade are:

1) upgrade of the hazard assessment and the revision of the emergency planning zones,
2) development of the concepts of operation,
3) revision of the roles and responsibilities,
4) development of the national emergency preparedness and response plan (for the radiological and nuclear accidents),
5) revision of the national protection and rescue plan,
6) development or revision of the emergency plans for the local and regional self-government units and institutions/organizations participating in the response and
7) development of the operational procedures.

Before any of steps one through six could be fully implemented, legal basis needed to be established. *The Regulation*, establishing the legal basis for the whole upgrade process, was enacted in early 2018. New hazard assessment and the revision of the emergency planning zones were performed and published. Concepts of operation, the assignment of roles and responsibilities and national emergency preparedness and response plan (for the radiological and nuclear accidents) were developed, but they were not finalized because of the organizational changes. They need to be updated taking into account the new role of the MoI CPD, taking over for SORNS and National Protection and Rescue Directorate (NPRD).

During the development of concepts of operation, it became clear that some of the concepts suggested in *the 7th Croatian National Report on the Implementation of the Obligations under the*

Convention on Nuclear Safety should be combined, while others need to be changed in scope. The final list of concepts is:

1) N1 – emergency at Krsko NPP,
2) N2 – emergency at Paks NPP,
3) N3 – emergency in other NPPs in the world,
4) N4 – accident on the nuclear ship,
5) R1 – accident during the use of dangerous fixed source,
6) R2 – transport accident or the accident with the mobile source,
7) R3 – lost or stolen dangerous source,
8) R4 – found source or the detection of increased radiation levels,
9) R5 – detection of the medical symptoms of radiation exposure,
10) R6 – terrorist threat or attack which includes radioactive or nuclear materials,
11) R7 – re-entry of the satellite with radioactive material.

The concepts which refer to the accidents in NPPs are based on the IAEA publication *EPR-NPP Public Protective Actions*. For the remainder, the recommendations provided in the documents *EPR-Method*, *GS-G-2.1*, *TECDOC-1162* and *TS-G-1.2* were followed. In all concepts of operation, the so-called graded approach is applied, which means that the response is proportional to the severity of the accident. Also, the response time objectives are introduced.

New *Radiological and Nuclear Hazard Assessment for the Republic of Croatia* now covers both nuclear and radiological hazards. It was developed in 2018, after *the Regulation* enabled legally to include radiological hazards. The results of the assessment of nuclear hazards are similar to the results of the threat assessment from 2016 (described in *the 7th Croatian National Report on the Implementation of the Obligations under the Convention on Nuclear Safety)*, and the emergency planning zones and distances have remained the same as the ones described in *the 7th Croatian National Report on the Implementation of the Obligations under the Convention on Nuclear Safety*.

2.6.3 Harmonization with Slovenia in the Area of Nuclear Emergency Preparedness and Response

While the activities described in the chapter 3.1 of *the 7th Croatian National Report on the Implementation of the Obligations under the Convention on Nuclear Safety* did not result in harmonization of the emergency planning zones and distances, Croatia and Slovenia have continued to discuss their emergency preparedness and response systems and to attempt to reach a higher level of harmonization. In 2016, Croatian regulatory body received full access to KID (at that time called MKSID), the Slovenian information exchange system used in nuclear emergencies. This allows Croatia to have a real-time access to all the information and documents shared with all Slovenian response bodies, although it does not cover direct communication between the NPP Krsko and Slovenian regulatory body during the emergencies, so some delay in access to information is still possible.

In 2017, the new harmonization process started, where emphasis was not on trying to harmonize full response, but on identifying situations where response will not be harmonized and harmonizing explanations to the public, so that public trust is preserved. The process was based on *the Guidance for Bilateral Arrangements* developed by HERCA in 2015. The process is still ongoing.

In 2018, the new above-meantioned IAEA initiative started, with a consultancy meeting on harmonization of the implementation of protective actions in the event of a nuclear or radiological emergency with transboundary or transnational consequences held in October 2018 in Vienna. One of the working groups consists of Slovenia and neighbouring countries. One of the conclusions of the

meetings is that full and open access to all information is necessary to be able to have any chance of harmonized response.

Croatian and Slovenian emergency planning zones used to prepare for the potential accidents in Krsko NPP still remain not harmonized. Although both counties have recognized the importance of the coordinated response in case of an emergency, the attempts to harmonize the zones didn't produce any results so far (although, during those attempts both countries significantly improved the understanding of each other's emergency preparedness and response systems and improved communication).

In conclusion, the Croatian regulations and practices are in compliance with the obligations of Article 16.

3. Status of implementation of findings (or challenges) from the last National Report

Since the last National Report, Croatian legislation in the field of radiological and nuclear safety is harmonized with the Council Directive 2013/59/Euratom and with Council Directive 2014/87/Euratom. Also, recommendations and suggestions from the IRRS mission in 2015 regarding changes needed in the Croatian legislation in the field of radiological and nuclear safety were taken into account.

Regarding activities in relation with recommendations and suggestions from IRRS mission, the status of implementation of recommendations and suggestions since the last National Report are as follows:

- „Responsibilities and functions of the Government" 3 recommendations and 1 suggestion are closed (meaning implemented) and 1 recommendation is still opened (meaning not implemented);
- „The global safety regime" 1 recommendation is opened;
- „Responsibilities and functions of the regulatory body" 1 recommendation and 1 suggestion are closed and 1 recommendation is opened;
- „Management system of the regulatory body" 1 recommendation is closed and 1 recommendation and 2 suggestions are opened;
- „Authorization" 2 recommendations and 1 suggestion are closed;
- „Review and Assessment" 1 recommendation and 1 suggestion are opened;
- „Inspection" 3 recommendations are closed and 1 suggestion is opened;
- „Enforcement" 1 recommendation is closed and 1 suggestion is opened;
- „Regulations and guides" 3 suggestions are closed;
- „Emergency Preparedness and response – regulatory aspects" 3 recommendations and 3 suggestions are closed and 3 recommendations and 2 suggestions are opened;
- „Control of medical exposures" 1 recommendation and 2 suggestions are closed and 6 recommendations are opened;
- „Occupational radiation protection" 2 recommendations and 3 suggestions are closed and 1 recommendation is opened;
- „Control of radioactive discharges, materials for clearance, and existing exposures; environmental monitoring for public radiation protection" 4 recommendations and 1 suggestion are closed.

The overview of IRRS mission recommendations and suggestions status is given in Appendix B. All recommendations and suggestions regarding regulatory review are closed (implemented). Open ones refer to the implementation of changes to the regulatory framework. The reasons are mainly related to the lack of staff and their insufficient education and training.

Preparation for IRRS Follow-up mission is underway. IRRS Follow-up mission will be held in October 2019. As a result of the Follow up mission, an assessment of the closed recommendations and suggestions and proposals for further action are expected.

Pursuant to amendments to the Act on Radiological and Nuclear Safety (OG 118/18) implementing the Decision of the Government of the Republic of Croatia of 2 August 2018, the tasks and activities pertaining to radiological and nuclear security fall under the competence of the Ministry of the Interior CPD as of 1 January 2019 and the State Office for Radiological and Nuclear Safety ceased to exist.

Implementation of the Strategy for Management of Radioactive Waste, Disused Sources and Spent Fuel

In accordance with the Act on Radiological and Nuclear Safety and 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, *the National Program for the Implementation of the Strategy for the management of radioactive waste, disused sources and spent nuclear fuel - Programme for the period up to 2025, with a view to 2060* (*the Programme*) was adopted by the Government. *The Programme* provides more detailed interpretations of the requirements and goals from *the Strategy* and covers the period up to 2025 with an overview of the developments till 2060.

It advocates the application of the proven and widely accepted solutions from international best practice.

In the period up to 2025 *The programme* goals for management of radioactive waste are:

- establishment of a central storage facility for institutional RW and DS
- establishment of a storage facility for LILW from Krško NPP.

According to *the Programme*, the central storage facility for institutional RW and DS and storage facility for LILW from Krško NPP are supposed to be located in the Dvor municipality at the Cerkezovac site. This site hosted a military installation, but now it is declared as non-perspective for further military utilization.

In the case of confirming of the Čerkezovac site, the design and construction of the adequate infrastructure would follow.

After 2025, field research will be started on the macrolocation of Trgovska gora in order to select the optimal microlocation for the disposal of LILW. At the selected location, LILW created by the decommissioning of Krško NPP will be disposed of.

It should be emphasized that storage facility may not be transformed into a disposal facility automatically, since they are physically different facilities with different security and other requirements, and that for each stage a process of environmental impact assessment and safety analyses are required with the appropriate site-based research carried out.

Althoug *The Strategy* together with *the Program* offer a systematic framework for the management of the radioactive waste and spent fuel the implementation will be still demanding in the aspects mentioned in the 7th National Report:

- Considering that the storage facility for the LILW has to be licensed before the end of 2023, it is clear that the schedule is tight.
- No alternatives to Cerkezovac site are currently offered in Croatia. While it seems that there are no technical reasons for its exclusion, it still hasn't been approved as a site for LILW radioactive waste storage.
- Solving sociopolitical problems could prove to be more complex than fullfiling technical requirements. It is still uncertain whether the consent will be obtained from the local community to host LILW radioactive waste management facilities.
- The location is close to the border with Bosnia and Herzegovina, which gives the realization of the RW Center an international importance.

Harmonization with Slovenia in the Area of Nuclear Emergency Preparedness and Response

At the moment efforts are being made to ensure as much coordinated response as possible with non-harmonized planning zones, in order to cover the period until the harmonization is achieved. While it might be possible to reach certain level of coordination this way, fully aligned response cannot be guaranteed. In addition, the differences in the planning zones tend to increase the complexity of the emergency preparedness arrangements, which will probably result with the increase of the resources spent on both sides. Because of all this, the harmonization within reasonable timeframe should stay the priority.

4. APPENDIX A - List of the Most Relevant Documents Within the Croatian Legislative and Regulatory Framework

4.1 National Legal Frame

Acts:

- Act on Radiological and Nuclear Safety (OG 141/13, amended 39/15, 130/17 and 118/18)
- Act on Liability for Nuclear Damage (OG 143/98)
- Act on Civil Protection System (OG 82/15 and 118/18)
- Dangerous Goods Transport Act (OG 79/07)
- Act on Fund for Krško NPP Decommissioning, Radioactive Waste and Spent Nuclear Fuel Management (OG 107/07)

Governmental regulations:

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

Ordinances (chronologically):

- Ordinance on Health Conditions of the Exposed Workers and Persons Being Educated to Work with the Ionising Radiation Sources (OG 66/18)
- Ordinance on Notification, Registration, Approvals and Transport of Ionising Radiation Sources (OG 54/18)
- Ordinance on Conditions and Measures for the Protection Against the Ionising Radiation in Performing the Activities with Ionising Radiation Sources (OG 53/18)
- Ordinance on Conditions for Application of Ionising Radiation Sources for the Purpose of Medical and Non-medical Irradiation (OG 42/18)
- Ordinance on Education Necessary for Handling Ionising Radiation Sources, Application of Radiological Safety Measures and Managing the Technical Processes in Nuclear Installations (OG 42/18)
- Ordinance on the Monitoring State of Radioactivity in the Environment (OG 40/18)
- Ordinance on Giving Permissions to the Expert Technical Services to Perform Tasks Related to the Radiological Safety (OG 40/18)
- Ordinance on Dose Limits, Recommended Dose Constraints and Assessment of Individual Doses (OG 38/18)
- Ordinance on Content and Conditions, Criteria and Approval of the Remediation Plan (OG 38/18)
- Ordinance on Nuclear Security (OG 38/18)
- Ordinance on Radiation Protection Experts (OG 36/18)
- Ordinance on the Management of Radioactive Waste and Disused Sources (OG 12/18)
- Ordinance on the Content, Scope and Frequency of the Reports on the Operation of the Nuclear Installation (OG 94/17)

- Ordinance on the Periodicity, Content, Scope and Implementation of the Periodic Safety Reviews of the Nuclear Installations (OG 94/17)
- Ordinance on the Content of a request for Approval for the Start or End of Operation or Decommissioning of a Nuclear Installation (OG 47/17)
- Ordinance on the Validation of a Location for a Nuclear Installation (OG 38/17)
- Ordinance on the Required Documents and their Content for Approval of Nuclear Activities (OG 29/17)
- Ordinance on Content of the Request for Approval for the Commissioning of Nuclear Installation (OG 29/17)
- Ordinance on the Safety Analysis Report for Nuclear Installations (OG 29/17)
- Ordinance on Certified Expert Organizations in the Field of Nuclear Safety (OG 29/17)
- Ordinance on Establishing Quality Assurance Programme for Management of Nuclear Facilities (OG 29/17)
- Ordinance on Nuclear Safety Requirements for Nuclear Installation Construction (OG 36/16, amended 79/16)
- Ordinance on Official ID Card and Badge of Radiological and Nuclear Safety Inspectors (OG 125/15)
- Ordinance on the Conditions and Procedure for Issuing and Withdrawing the Approval for Packaging Used for Transport of Radioactive and Nuclear Materials (OG 42/13, amended 19/17)
- Ordinance on the Supervision and Control of Transboundary Shipments of Radioactive Waste and Spent Fuel (Official Gazette 11/13)
- 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 (OG 123/12)
- 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 (OG 114/07)

Strategies and implementation programs:

- National Energy Strategy (OG 130/09)
- Protection and Rescue Plan for the Republic of Croatia (OG 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 (OG 125/14)
- Strategy on Radiological and Nuclear Safety for the period 2017-2025 (OG 65/17)
- National Programme for Implementation of the Strategy for Management of Radioactive Waste, Disused Sources and Spent Nuclear Fuel (adopted 09 November 2018)

Other documents:

- Decision on Areas/Zones for the Implementation of Urgent Protective and Rescue Measures and on Threat Perimeters (SORNS, 2016)

4.2 Multilateral Agreements

- Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention (OG IA 12/93)
- Convention on Nuclear Safety (OG IA 13/95)
- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (OG IA 03/99)
- Convention on the Physical Protection of Nuclear Material (OG IA 05/01, amended 05/06)
- Vienna Convention on Civil Liability for Nuclear Damage (OG IA 01/06)
- Convention on Assistance in the Case of a Nuclear Accident of Radiological Emergency (OG IA 01/06)
- Convention on Early Notification of a Nuclear Accident (OG IA 01/06, amended 05/06)
- Agreement between the Kingdom of Belgium, the Kingdom of Denmark, the Federal Republic of Germany, Ireland, the Italian Republic, the Grand Duchy of Luxembourg, the Kingdom of the Netherlands, the European Atomic Energy Community and the International Atomic Energy Agency in Implementation of Article III (1) and (4) of the Treaty on the Non-Proliferation of Nuclear Weapons and Protocol Additional to the Agreement between the Kingdom of Belgium, the Kingdom of Denmark, the Federal Republic of Germany, Ireland, the Italian Republic, the Grand Duchy of Luxembourg, the Kingdom of the Netherlands, the European Atomic Energy Community and the International Atomic Energy Agency in Implementation of Article III (1) and (4) of the Treaty on the Non-Proliferation of Nuclear Weapons (OG IA 3/16).

4.3 Bilateral Agreements

- Agreement Between the Republic of Croatia and the Republic of Slovenia on the Early Exchange of Information in the Event of a Radiological Emergency (OG 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)
- 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 (OG 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)
- Arrangement between the State Office for Radiological and Nuclear Safety of the Republic of Croatia and the United States Nuclear Regulatory Commission for the Exchange of Technical Information and Cooperation in Nuclear Safety Matters (September 19, 2018)

Remark: The Republic of Croatia, as a member state of the European Union, directly adopts EU regulation and transposes EU directives into national legislation.

5. Appendix B Status of IRRS Mission Recommendations and Suggestions

AREA		RECOMMENDATIONS (R) AND SUGGESTIONS (S)		STATUS (July 2018)
1	RESPONSIBILITIES AND FUNCTIONS OF THE GOVERNMENT	R1	The Government should establish a national policy and strategy for safety in accordance with Requirement 1 of GSR Part 1.	Closed
		R2	The Government should complement the framework for safety with: provisions for ensuring the continuity of responsibility where activities are carried out by several persons or organizations successively; provisions related to a graded approach; provisions on criteria for release from regulatory control; provision that stipulates that compliance with regulations does not relieve the person or organization responsible for a facility or an activity of its prime responsibility for safety.	Closed
		R3	The Government should provide SORNS with human and financial resources enabling SORNS to completely fulfill its statutory obligations for regulatory control.	Closed
		S1	The Government should consider organizing training and refresher courses in a way that do not compromise effective independence of SORNS.	Closed
		R4	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 for the Management of Radioactive Waste, Disused Sources and Spent Nuclear Fuel.	Open
2	GLOBAL SAFETY REGIME	R5	SORNS should established and maintain process and procedures for analyzing and disseminating the lessons learned from national and international operating experience and regulatory experience to be used by SORNS, other authorities and authorized parties.	Open
3	RESPONSIBILITIES AND FUNCTIONS OF THE REGULATORY BODY	R6	SORNS should have sufficient resources and optimize them in order to discharge its responsibilities and perform its functions in a manner commensurate with the radiation risks associated with facilities and activities.	Closed
		R7	SORNS should prepare and implement comprehensive training plans in order to improve knowledge, skills and abilities to perform all the functions and responsibilities.	Open

		S2	SORNS should consider performing systematic periodic screening/review of radiological and nuclear safety legislation, to ensure keeping regulatory safety requirements complete and up-to-date.	Closed
4	MANAGEMENT SYSTEM OF THE REGULATORY BODY	R8	SORNS should appoint an individual with the authority to coordinate and develop the integrated management system and to raise issues relating to the management system to the senior management.	Closed
		R9	SORNS should develop an integrated management system in line with IAEA safety standard GS-R-3.	Open
		S3	SORNS should consider revising its strategic plan to expand the requirements on management system from the quality assurance programme to the integrated management system.	Open
		S4	SORNS should consider preparing the plan for establishment, development, and implementation of an integrated management system where the priorities are stressed out such as defining responsibilities for the management system, defining key processes related to inspection, licensing, etc. and defining the interactions among the processes.	Open
5	AUTHORIZATION	R10	The Government should establish a regulatory system for protection and safety that includes notification process, with criteria for when notification only is sufficient.	Closed
		S5	SORNS should consider developing a system of authorization commensurate with the radiation risks associated with the facility or activity taking into account a graded approach.	Closed
		R11	SORNS should develop and approve Ordinance regarding the detailed requirements for licensing the site, construction, operation and closure radioactive waste management facility as prescribed in the 2013 Act.	Closed
6	REVIEW AND ASSESSMENT	R12	SORNS should establish process and procedures governing the review and assessment activities for all types of facilities and activities under their regulatory control, taking into account graded approach.	Open
		S6	SORNS should consider introducing pre-licensing verification of the contents of the documents submitted for review and assessment of an application for authorization to confirm credibility of submitted documents, where appropriate.	Open

7	INSPECTION	R13	SORNS should establish inspection programme that commensurate with the radiation risks associated with the facility or activity in accordance with a graded approach that covers all areas relevant to safety and radiation protection and implement this programme.	Closed
		R14	The Government should empower SORNS inspectors to carry out announced inspections.	Closed
		R15	SORNS should review the draft "Manual for conducting inspection supervision" to cover all elements of inspections and approve it.	Closed
		S7	SORNS should review its inspection programme and include tests and measurements as a method of inspection.	Open
8	ENFORCEMENT	R16	SORNS should establish detail procedures for determining and exercising enforcement actions. All inspectors and other staff of SORNS should be trained in, and knowledgeable about, the procedures.	Closed
		S8	SORNS should consider providing inspectors with legal support to carry out enforcement actions.	Open
9	REGULATION AND GUIDES	S9	SORNS should consider developing guides to help users striving to achieve the high levels of safety.	Closed
		S10	SORNS should establish within its regulatory framework processes and procedures for reviewing and revising regulations, taken into account internationally agreed standards and the feedback of relevant experience.	Closed
		S11	SORNS should consider reviewing its ordinances for compliance with GSR Part 3.	Closed
10	EMERGENCY PREPAREDNESS AND RESPONSE	R17	SORNS should revise and strengthen its regulatory framework in EPR consistently with IAEA Safety Standards to also include inspection, enforcement and evaluation of some of operator's exercises and should implement a graded approach.	Open
		R18	SORNS should require that operators develop and implement a system for classifying all potential nuclear or radiological emergencies and for activation of an adequate level of emergency response consistently with IAEA Safety Standards.	Closed
		S12	SORNS should consider setting response time objectives for notification of an emergency and for activation of an emergency response.	Closed

		R19	The Government should review and revise the responsibility of SORNS to manage the on-site emergency response, to implement urgent protective actions on-site in relation to facilities and activities under the responsibility of an operator and, in this regard, to provide public information as a single source.	Closed
		R20	SORNS shall require operators to implement clear command and control system to manage effectively the on-site emergency response.	Closed
		S13	SORNS should consider requesting that operators establish formal arrangements or protocols with off-site emergency services providing the operator with an assistance and support during the on-site emergency response.	Open
		S14	SORNS should consider continuing its efforts to coordinate and harmonize emergency planning zones with their Slovenian counterparts in relation to Krsko NPP in line with relevant IAEA Safety Standards.	Open
		S15	SORNS should consider updating the intervention levels and generic action levels for taking protective actions set forth in Ordinance 59/13 taking account of the latest IAEA Safety Standards.	Closed
		R21	SORNS should develop a regulatory guide to facilitate systematic development of on-site emergency arrangements by operators and an internal process to facilitate its systematic review and assessment of the operator's emergency plan and programme.	Open
		R22	SORNS should develop its own emergency arrangements consistently with IAEA Safety Standards to fulfill its roles in emergency response.	Open
		S16	The Government should consider reviewing and revising the roles and responsibilities assigned to SORNS in emergency response in order to avoid compromising SORNS regulatory responsibilities and taking into account IAEA Safety Standards as well as the responsibilities of other State bodies and organizations.	Closed
11.1	CONTROL OF MEDICAL EXPOSURES	R23	SORNS, in coordination with The Ministry of Health, should initiate arrangements for assigning responsibilities for justification. SORNS should also ensure that only justified practices are authorized.	Open
		R24	The Ministry of Health and SORNS should issue the necessary guidelines, in cooperation with the relevant professional and scientific bodies, in accordance with the requirement of GSR Part 3.	Open

		R25	The Government should recognize medical physicists as a profession at a national level and develop specialization in medical physics with objective to ensure the radiation protection of patients.	Open
		R26	SORNS should review its regulation to supplement the responsibilities of medical physicists so that they are fully integrated in all medical practices in accordance with GSR Part 3.	Open
		S17	SORNS should consider making provisions for informing carers, comforters and patients, in particular breast feeding women, about the radiation risks, in accordance with GSR Part 3.	Closed
		R27	SORNS should ensure that the existing requirements for optimization are fully implemented in all medical practices and that requirements regarding responsibilities of medical physicists, quality assurance, quality control and calibration are in accordance with the IAEA standards.	Open
		R28	SORNS should ensure that the existing requirements for reviews and records related to medical exposure are implemented in all medical practices and supplement its Ordinances to improve assessment and recording of patient doses in accordance with GSR Part 3.	Open
		R29	SORNS should ensure that all requirements related to unintended and accidental medical exposure are implemented in compliance with the requirement of GSR Part 3.	Closed
		S18	Since SORNS has not received any unintended or accidental exposure reports to date, SORNS should consider supporting this notification process through developing guidelines or/and training of medical staff and medical physicists.	Closed
11.2	OCCUPTIONAL RADIATION PROTECTION	R30	SORNS should put in place a programme of inspection of authorized TSOs as part of their annual inspection programme to establish that all authorized TSOs are maintaining the prescribed requirements of their authorizations.	Open
		R31	SORNS should initiate in consultation with the relevant government departments and state agencies the development of a formal recognition for qualified experts and an additional requirement for TSOs to have a qualified expert on their staff should be included in SORNS process for authorizing TSOs.	Closed

		R32	The Government should define the concept of an emergency worker taking into account the IAEA safety standards and should establish a programme for managing, controlling and recording the doses received in an emergency by emergency workers. This programme should be implemented by response organizations, licensees and SORNS.	Closed
		S19	SORNS should consider reviewing and revising its regulatory system for existing exposure situations with a view to implementing only those relevant requirements for occupational exposure of exposed workers.	Closed
		S20	SORNS should consider revising Article 23 (3) of the Ordinance on Measurement of Personal Doses, Examination of Ionizing Radiation Sources and Working Conditions and on Reports and Registers (OG 41/12) in accordance with IAEA Safety Guide RS-G-1.3 Section 8.	Closed
		S21	SORNS, in light of the introduction of the new dose limit for the lens of the eye and the development of the radwaste management programme, should consider introducing arrangements so that a national capability for extremity dose assessment $Hp(0.07)$ and $Hp(3)$ together with a national capability for internal dosimetry is available. The relevant ordinance on Measurement of Personal Doses, Examination of Ionizing Radiation Sources and Working Conditions and on Reports and Registers (OG 41/12) should be revised in accordance with IAEA Safety Guides.	Closed
11.3	CONTROL OF RADIOACTIVE DISCHARGES AND MATERIAL FOR CLEARANCE, ENVIRONMENTAL MONITORING ASSOCIATED WITH AUTHORIZED PRACTICES FOR PUBLIC RADIATION PROTECTION PURPOSES CONTROL OF CHRONIC EXPOSURES	R33	SORNS should review their regulatory framework with regards to liquid and gaseous radioactive discharges and ensure the optimization of protection and safety is achieved and discharge limits imposed on licensees that cover such discharges.	Closed
		R34	SORNS should ensure that monitoring programmes are developed and implemented in accordance with IAEA standards and supported by its regulatory framework.	Closed
		S22	SORNS should consider implementing a calibration programme for all of its monitoring and measuring instruments.	Closed
		R35	The Government should ensure that existing exposure situations that have been identified are evaluated to determine which occupational exposures and public exposures are of concern from the point of view of radiation protection, in accordance with IAEA standards.	Closed

		R36	SORNS should revise their Ordinances to address the remediation process of areas contaminated with residual radioactive material in accordance with IAEA standards.	Closed