



REPUBLIC OF SLOVENIA

MINISTRY OF THE ENVIRONMENT AND SPATIAL PLANNING

SLOVENIAN NUCLEAR SAFETY ADMINISTRATION

Slovenian Report on Nuclear Safety

Slovenian 8th National Report as Referred
in Article 5 of the Convention on Nuclear Safety





REPUBLIC OF SLOVENIA
MINISTRY OF THE ENVIRONMENT AND SPATIAL PLANNING
SLOVENIAN NUCLEAR SAFETY ADMINISTRATION

Slovenian Report on Nuclear Safety

**Slovenian 8th National Report as
Referred in Article 5 of the Convention on Nuclear Safety**

July 2019

Publisher:
Slovenian Nuclear Safety Administration
Litostrojska 54
1000 Ljubljana
Slovenia

Phone: +386 1 472 11 00

Fax: +386 1 472 11 99

E-mail: snsa@gov.si

Website: www.ursjv.gov.si

URSJV/RP-110/2019

Keywords:

Convention on Nuclear Safety, post-Fukushima action plan, design and construction, Design Extension, Conditions, operation, nuclear power plants, emergency preparedness, exercises, human factors, initial authorisation, Krško NPP, management system, operating experience, operational limits, priority to safety, radiation protection, regulatory framework, regulatory surveillance, siting, training, verification of safety, Vienna Declaration on Nuclear Safety.

EXTENDED SUMMARY

The eighth Slovenian Report on Nuclear Safety covers the period since the previous review meeting of the contracting parties, i.e. from 2017 to 2019. The report focuses on safety of the only Slovenian nuclear power plant Krško, which was assessed by the Slovenian Nuclear Safety Administration as satisfactory in the given period. No major problems or deviations were encountered in its operation. The details about the operation are in the chapter describing the implementation of Article 19. As in the previous national reports, the main highlight of this reporting period remained the implementation of the post-Fukushima National Action Plan and within it, the Krško NPP Safety Upgrade Programme (SUP), which was also identified as one of the three challenges, besides the dry spent fuel storage and harmonizing the emergency response with the neighbouring countries. The report follows the structure of the Convention on Nuclear Safety, i.e. the chapters correspond to relevant articles. There are two Appendices. The Appendix I comprises the relevant legislation in force and the Appendix II deals with challenges and special topics which address the issues of the previous review meeting as well as describe the implementation of the Vienna Declaration.

Post-Fukushima National Action Plan

The most important part of the post-Fukushima National Action Plan consists of the Krško NPP Safety Upgrade Programme (SUP), which is divided into three phases. The phase I has been completed in 2013. Approximately 80% of the SUP improvements were completed by the end of 2018. All Phase II improvements are on schedule to be completed by the end of 2019.

The Phase III projects, which shall be implemented by the end of 2021, are:

- Installation of additional injection systems for the reactor cooling system/containment and steam generators with dedicated reservoirs for cooling water (also borated) capable of being replenished with water from underground wells. These systems are located in the Bunkered Building 2 and are part of the so called BB2 project, and
- Construction of a dry spent fuel storage facility.

Additional systems, structures and components, which will be implemented within the SUP, will be designed and structured in accordance with the design extension conditions (DEC) requirements specific for the Krško NPP design and site location. The implementation of Phase III projects, i.e. the construction of BB2 project and the designing phase of the spent fuel dry storage (SFDS), have already started and are well underway, on schedule and are to be finished on time. For the SFDS project the implementation of the strategic environmental assessment as well as the environmental impact assessment was required by the Ministry of the Environment and Spatial Planning. The SFDS project is still planned to be finished by the end of 2021, which is the final deadline for the SUP.

Challenges

Besides the implementation of the post-Fukushima National Action Plan there were two other challenges identified during the last review meeting, i.e. the completion of the spent fuel dry storage (SFDS) and the harmonization of the emergency response with the neighbouring countries.

In response to the Fukushima accident, the Krško NPP reassessed the possibilities for an alternative spent fuel management strategy and decided that the best strategy would be storing the spent fuel in a dry cask storage with a possibility to combine it with the reprocessing later. The available number of storage locations in the spent fuel pool is estimated to meet the demand by 2021. The new facility will be designed in line with the basic safety functions, such as sub-criticality, heat removal and confining radioactive material, which are met during the operational states, design basis accident and design extension conditions. Natural hazards are considered an integral part of the SFDS safety demonstration.

The SFDS was designed for a minimum operation of 100 years. The analyses were made to prove the stability of materials for this period or still longer. The Krško NPP commenced with preparation of the SFDS project in 2015. The licensing process for the dry storage construction began in August 2017. The construction of the SFDS shall begin in 2020. The first campaign of the spent fuel transfer is planned for the year 2022.

The IAEA consultancy meeting on harmonization of the transboundary protective actions in response to a nuclear emergency, organized in autumn 2018, gave the initiative to organize a table-top exercise with the three non-nuclear neighbouring countries (Croatia, Italy and Austria). This exercise was conducted in June 2019 and participated by three out of four Slovenia's neighbouring countries (Croatia, Italy and Austria). In this exercise the draft agreement for nuclear or radiological Emergency Preparedness and Response (EPR) between Slovenia and Croatia was tested and its concept discussed also among the other participating countries.

Special Topics

These topics address the issues, which were considered in the Summary Report and the President's Report of the 7th Review Meeting of the Contracting Parties to the Convention on Nuclear Safety finished in April 2017, as well as the implementation of the Vienna Declaration on Nuclear Safety.

In the Krško NPP the nuclear **safety culture** is promoted by the management and implemented by the entire staff as outlined in The Code of Safety and Business Ethics. Open communication is enabled so that the employees feel free to raise nuclear safety concerns without any fear. To improve the safety culture and performance of personnel, the Internal Commitments and Goals Management Manual has been recently supplemented with three priority areas by setting examples: in the safety upgrade implementation using teamwork, in the work preparation and implementation, and in the relationships between co-workers. In 2018 the Krško NPP conducted a self-assessment of safety culture. Improvements were recognized in the area of understanding and paying attention to several principles of safety culture.

The SNSA performs the oversight of licensees' safety culture through: permanent assessment of the licensees' safety culture, during the periodic safety review (PSR) and also during the inspections

dedicated to safety culture. The inspections on safety culture are planned annually or every two years. In the recent years three inspections related to the safety culture in Krško NPP have been carried out (in 2014, 2016, 2017).

Concerning the Krško NPP **knowledge management**, various approaches are used to ensure that appropriately qualified workforce is being attracted, employed and retained. Human resources activities are planned several years in advance to predict the future workforce needs from the aspects of plant technology and processes development and due to retirements. Knowledge management at the Krško NPP takes place through different processes and covers the areas such as professional training, management of documentation and operating procedures, preparation for different activities, the use of information technology and human resource management. All these activities are implemented through regular working processes. Managers at all levels of organization support and ensure that knowledge transfer and retention are implemented while all the employees are obliged to play an active role in the process.

In this reporting period, in the area of **the international peer reviews**, the OSART mission was conducted in May 2017 and the OSART Follow-Up mission in October 2018 in the Krško NPP. Some other peer review missions are planned in the next years, such as the, IRRS mission, already scheduled for 2021, the SALTO mission and the RAMP mission after the completion of the Krško NPP's Safety Upgrade Program.

The Krško NPP intends to extend its operation beyond its original design life to 60 years based on the established aging management program (AMP), which is one of the prerequisites for the **lifetime extension**. The Krško NPP approach to **long term operation** follows the U.S. NRC regulations, the industry practices and the Slovenian legislation. The AMP is a living program constantly being improved based on internal and external operating experiences and results of R&D activities in the world. There are some challenges and areas for improvement in the future. The most challenging and interesting areas for R&D are electrical cables and the impact of the reactor vessel irradiation on the Krško NPP lifetime. Systematic monitoring and addressing foreign operational experience in the field of ageing, as well as current issues or events in other countries are one of the key elements for safe long-term operation.

With the transposition of the Euratom 2014 Amended Nuclear Safety Directive into the Slovenian legal framework and with active participation at the CNS review meetings as well as with adherence to the CNS provisions Slovenia is fully aligned with the principles of the **Vienna Declaration on Nuclear Safety**.

Lessons Learned from Emergency Exercises

The international exercise ConvEx-3, hosted by Hungary, revealed that the regional cooperation should be improved. Slovenia as a neighbouring state could not communicate directly with the accident country in spite of using pre-planned communication channels. The likely cause for this shortcoming was probably the fact that the host country was overburdened. Another lesson learned was the overflow of information published on the international information exchange web systems, e.g. WebECURIE and USIE. As a result, the SNSA developed the criteria for filtering the

information and adjusted its organizational procedures to prepare the SNSA emergency team for future situations of this kind.

In January 2019 the SNSA organized the first national exercise on cyber security at nuclear facilities. The exercise showed the improvement of the information sharing on a national and international level and the harmonization of the response arrangements and raised awareness between the participants for potential cyber-attacks.

Practically all the exercises carried out during the reporting period recognized the importance of regular and frequent trainings of the emergency personnel. The procedure at the national level for the offer of international assistance was amended and defined in more detail, based on lessons learned during the participation in the ConvEx-2b exercise in October 2018.

Operating Experience

At the Krško NPP the root cause analysis of significant events is regularly performed regularly. The lessons learned from the analysis are followed up and training is given where appropriate. Human performance is included in the root cause analysis through the event and causal factor charting, barrier analysis and change analysis. The plant policy for a restart following a reactor trip requires that the cause of the trip is known, understood and corrected before the restart. The SNSA supervises corrective actions defined by the facility. More complex events are also analysed through internal SNSA investigation and the results are compared to the facility's corrective actions. If necessary, additional actions are required.

The operating experience feedback program is in place, which includes the consideration of in-house as well as external operating events. Off-site event reports safety screening is a part of the Krško NPP operating experience assessment program. In the period from 2016 to 2018, the plant evaluated 537 potentially interesting events for potential applicability and analysed 20 events in detail.

The SNSA has also created the system for screening and analysing all kinds of operating experiences, not only incidents. It covers two types of events: (i) in the Krško NPP, as well as (ii) international operating experiences, which are screened and analysed for their applicability to nuclear safety in Slovenia. The results of such screening and analyses are communicated internationally either through formal channels such as the International Reporting System for Operating Experience (IRS) or at different international meetings and conferences. In the period from 2016 to 2018, 125 potentially interesting events were evaluated by the SNSA.

Actions to improve transparency and communication with the public

The Krško NPP operates a dedicated public relations unit which provides the public with regular updates about the operation of the plant and organizes press conferences related to important events, e.g. at refuelling outages, when the goals and major modifications are presented. The Krško NPP produces press releases at each reactor shutdown or at the events, which may cause public interest or concern. The information centre is located in the building headquarters of one of the NPP owners, the company GEN Energija, where the public can get basic information about the

plant operation. The Krško NPP organises the open-door days and numerous visits from the schools and other interested parties, as well as the guided tours of the plant.

The SNSA regularly, twice a year, publishes a newsletter *News from Nuclear Slovenia* in English on its website. The SNSA Director regularly meets with the interested NGOs at scheduled meetings approximately twice a year to discuss issues raised by the NGOs. All important information, e.g. the background for the SNSA decisions and events related to the NPP, are published on the SNSA website.

Other Topics

The other topics cover the items which have not been addressed above, but are also important in ensuring nuclear safety, such as stable financing, state-of-the-art regulatory framework, minimizing the radiation doses, emergency preparedness, operating experience, verification of safety, design control, severe accident management, etc.

A major prerequisite for the stable and safe operation of the Krško NPP is the long-term financing commitments of its owners, i.e. the Slovenian state-owned utility GEN Energija and the Croatian utility Hrvatska Elektroprivreda (HEP). In the reporting period the Krško NPP had a reliable income, as well as the owners continued to support all safety related investments, including the post-Fukushima Safety Upgrade Program.

The Act on Protection against Ionising Radiation Protection and Nuclear Safety was amended in 2015 and it was completely refurbished and re-published in 2017 (hereinafter “the 2017 Act”). The changes in the 2015 Act included the provisions based on the lessons learned following the Fukushima Daiichi NPP accident and the European Union stress tests, while the 2017 Act introduced provisions to align the Slovenian legislation with the Euratom Basic Safety Standards (BSS) Directive. The 2015 Act included the requirements for the extended design basis of a nuclear facility, provisions on safety culture management systems, and on preventing the incorporation of non-conforming, counterfeit, fraudulent and suspect items.

In 2018 the conservatively estimated effective dose received by a member of the general public as a result of the Krško NPP emissions amounts to a value of less than 0.15 μSv per year including atmospheric and liquid discharges. This value represents 0.3% of the authorised effective dose limit (50 μSv) which is the sum of the contributions from all exposure pathways to the member of the public at 500 m distance from the reactor.

Throughout the reporting period the Krško NPP maintained the operability of its emergency centres and equipment, regularly revised the emergency documentation and performed systematic communication testing and checking of the emergency personnel response. The Krško NPP increased its frequency of major on-site exercises from one to two per year. The SNSA regularly takes part in these exercises as a player and the exercises are being monitored on-site by the SNSA inspectors as well.

The Severe Accident Management Guidelines (SAMG) for the Krško NPP were upgraded in 2014 to adapt strategies after the introduction of passive autocatalytic recombiners and filtered venting modifications. In 2014 the new SAMG for shutdown modes and for spent fuel pool accident were

also introduced. The SAMG are being continuously revised and developed according to the results of the plant specific PSA and deterministic analyses, as well as results from the international research and development. The full scope PSA (including Level 2) for low power and shutdown modes is partially completed, because the review requested some improvements.

More details about nuclear safety and operation of the nuclear power plant in Slovenia can be found in the annual Reports on Nuclear and Radiation Safety, available at the SNSA home page www.ursjv.gov.si.

It can be concluded that the Slovenian regulations and practices are in compliance with the obligations of the Convention on Nuclear Safety.

CONTENTS

EXTENDED SUMMARY	3
CONTENTS	9
INTRODUCTION	13
COMPLIANCE WITH ARTICLES 4 AND 6 TO 19	17
ARTICLE 4. Implementing Measures	17
ARTICLE 6. Existing Nuclear Installations	19
6.1 The Krško NPP Safety Upgrade Programme	19
6.2 Topical Peer Review (TPR)	19
6.3 OSART Peer Review Mission	21
6.4 The Second Periodic Safety Review (PSR2)	22
6.5 Events in the Krško NPP	22
ARTICLE 7. Legislative and Regulatory Framework	25
7.1 Description of the Legislative and Regulatory Framework	25
7.2 Summary of Legislation	28
7.3 Inspection and Enforcement	29
ARTICLE 8. Regulatory Body	33
8.1 The Slovenian Nuclear Safety Administration (SNSA)	33
8.2 Other Regulatory Bodies	36
ARTICLE 9. Responsibility of the Licence Holder	39
ARTICLE 10. Priority to Safety	41
10.1 Regulatory Requirements for a Licensee to Prioritize Safety	41
10.2 Implementation of Regulatory Requirements for Priority to Safety	41
10.3 Regulatory Oversight of Licensees on Prioritization of Safety	44
10.4 Priority to Safety Provisions of the Regulatory Body	45
10.5 Voluntary Activities	45
ARTICLE 11. Financial and Human Resources	47
11.1 Financial Resources	47
11.2 Human Resources, Training and Qualification	48
11.2.1 The Krško NPP	48
11.2.2 The Slovenian Nuclear Safety Administration and the Technical Support Organisations	50
ARTICLE 12. Human Factors	51
12.1 Legal Requirements	51
12.2 Licensee Methods and Programs at the Krško NPP	51
ARTICLE 13. Quality Assurance	55
13.1 SNSA Quality Management System	55

13.2 Regulatory Requirements for Quality Assurance Programmes and Quality Management Systems of Licensees	57
13.3 The Krško NPP Quality Assurance System	57
13.4 The SNSA Review and Control Activities Regarding Quality Assurance/Management System Program of the Licensee	58
ARTICLE 14. Assessment and Verification of Safety.....	61
14.1 Comprehensive and Systematic Safety Assessment	61
14.1.1 Regulatory requirements.....	61
14.1.2 Implementation.....	62
14.1.3 Current actions and upgrading measures.....	63
14.2 Verification of Safety	64
14.2.1 Actions of the Licensee.....	64
14.2.2 Regulatory Surveillance.....	65
ARTICLE 15. Radiation Protection.....	67
15.1 Dose Limits and Control of Occupational Exposure	67
15.2 Radioactive Discharges and Environmental Monitoring	69
15.3 Implementation of the optimisation principle (ALARA)	71
15.4 Regulatory Control Activities	71
ARTICLE 16. Emergency Preparedness.....	73
16.1 Regulatory Requirements	73
16.2 Implementation of Emergency Preparedness Measures	74
16.3 Informing the Public	75
16.4 Training and Exercises	75
16.5 International Agreements and International Projects	76
ARTICLE 17. Siting.....	77
17.1 Evaluation of Site Related factors	77
17.2 Impact of the Installation on Individuals, Society and Environment	80
17.3 Re-Evaluation of Site Related Factors	80
17.4 Consultation with other Contracting Parties Likely to be Affected by the Installation	80
ARTICLE 18. Design and Construction.....	83
18.1 Implementation of Defence in Depth	83
18.2 Incorporation of Proven Technology	85
18.3 Design for Reliable, Stable and Manageable Operation	85
ARTICLE 19. Operation.....	87
19.1 Initial Authorization for Operation	87
19.2 Operational Limits and Conditions	88
19.3 Operation, Maintenance, Monitoring, Inspection and Testing	88

19.4 Anticipated Operational Occurrences and Accidents	89
19.5 Engineering and Technical Support	89
19.6 Incidents, Significant to Safety	90
19.7 Programs to Collect and Analyse Relevant Operating Experience	90
19.8 Radioactive Waste Resulting from Operation	91
APPENDICES.....	95
Appendix I: List of Legal Documents in Force in Slovenia (as of 30 April 2019).....	95
A. National legal frame	95
Third Party Nuclear Liability	97
Decommissioning of the Nuclear Power Plant Krško	97
Radioactive Waste.....	97
Civil Protection and Disaster Relief.....	98
Administrative	98
Energy	98
Environment.....	99
B. International instruments to which Slovenia is a party	99
B.1 Multilateral agreements.....	100
Appendix II: Challenges and Special Topics	103
A. Challenges	103
i. Completion of the Safety Upgrade Program by 2021 (Challenge 2017-SI-1)	103
ii. Completion of the Spent Fuel Dry Storage and the LILW Repository (Challenge 2017-SI-02)	109
iii. Harmonizing emergency response with neighbouring countries (Challenge 2017-SI- 3).....	111
B. Special Topics	111
i. Safety Culture	111
ii. Knowledge Management	113
iii. International Peer Reviews	114
iv. Managing the Safety of Ageing Nuclear Facilities and Plants Life Extension	114
v. Implementation of VDNS (Vienna Declaration on Nuclear Safety)	115

INTRODUCTION

On 20 September 1994 Slovenia signed the Convention on Nuclear Safety (hereinafter – the Convention) and ratified it in the Parliament in October 1996. The Convention entered into force for Slovenia in February 1997. The fulfilment of the obligations in the period from 2017 to 2019 is evaluated in this eighth report. The report presents the achievements and contributions to the safety of the only nuclear power plant in Slovenia in the recent years, focusing on its major projects, programs and modifications. The most prominent piece of legislation is the Act on Protection against Ionising Radiation and Nuclear Safety – ZVISJV 1 (Official Gazette of the Republic of Slovenia, No. 76/17 and 26/19; hereinafter referred to as “the 2017 Act”), which entered into force in January 2018. The previous Act was adopted in 2002 and subsequently revised four times. It has to be noted that after the adoption of the 2017 Act substantial work was devoted to updating the whole set of secondary legislation (the so-called Rules), which is practically finished, as of May 2019. The report also addresses the areas which were identified during the previous evaluation and during the Seventh Review Meeting as well as the areas, which need additional attention, including the findings from the last review meeting rapporteur’s report. These areas are described in the Appendix II. The detailed information about the post-Fukushima related activities is given in the Appendix II, chapter A. Challenges.

Slovenia has one operating nuclear power plant, one research reactor, a central radioactive waste storage for low and intermediate level solid radioactive waste from institutional users (these are all the other users excluding the nuclear power plant), and one uranium mine in decommissioning. In July 2009, the local municipality gave consent to the location of the final low and intermediate level radioactive waste repository at Vrbina site near the Krško NPP. In December 2009, the Government adopted the Decree about National Spatial Plan for this repository. After many years of stalemate in 2015 the company IBE won the contract for the design of the new repository. The procedure for obtaining the environmental consent began in 2017, when the Agency for Radwaste Management (ARAO) filed the application to the Slovenian Environment Agency (ARSO). In May 2018 in the framework of this process the SNSA was asked for draft preliminary consent on the nuclear and radiation safety, which was finally issued in April 2019.

The Krško Nuclear Power Plant, situated in the south-eastern part of Slovenia, is the only nuclear installation according to this Convention. It is a Westinghouse two-loop pressurised water reactor with the capacity of 696 MWe. The basic safety features of the plant are typical for a two-loop Westinghouse plant. The construction started in 1974. The full power was reached in August 1982, and the first full year of commercial operation was 1983.

The Krško NPP was constructed as a 50/50 joint venture project of the electric utilities of Slovenia and of the neighbouring Croatia. In December 2001, the Government of Slovenia and the Government of Croatia signed the Agreement on Settlement of Statutory and Other Legal Relations Regarding the Investments into Krško NPP, its Exploitation and Decommissioning. The Agreement, which was first ratified by the Croatian Parliament, entered into force on 11 March 2003, after it was also ratified by the Slovenian Parliament on 25 February 2003.

Based on the above-mentioned Agreement, the Krško NPP is registered as a company for production of electrical energy, engineering design, technical expertise, testing, analyses, as well as research and development in the area of nuclear technology. Since the Krško NPP is located in Slovenia, it is a subject of the Slovenian law and pertinent nuclear safety regulations.

The safety features of the Krško NPP design were originally based on the 1973 requirements of the US Atomic Energy Commission. The commitment of the plant and of the regulatory body, the Slovenian Nuclear Safety Administration (SNSA), has been to follow international experience in the field of nuclear safety and to fulfil the western safety standards. During the years numerous modifications and improvements have been implemented in the plant based on the developments in the industry and following the changing international standards and regulatory practices. An ambitious programme of safety upgrades (the so-called SUP, Safety Upgrade Programme) has been in place since the Fukushima Daiichi accident, and is due to be finished in 2021. The SUP includes modifications such as the alternative design of spent fuel pool cooling, the Operation Support Centre reconstruction, installation of the ventilation and habitability system of the new Emergency Control Room, the new Technical Support Centre, additional heat removal pump, as well as the Design Extension Conditions (DEC) systems (e.g. the alternate safety injection and alternate auxiliary feedwater) in the bunkered building.

Solid radioactive waste and spent nuclear fuel are stored on-site. After the Fukushima Daiichi accident a dry storage of spent fuel was planned as a SUP item and the start of construction is foreseen in 2019. The solid low and intermediate radioactive waste is treated and then packed into steel drums, which are stored in the solid waste storage. The Krško NPP makes a significant effort to minimize the amount of low and intermediate level radioactive waste (LILW) in the Krško NPP (i.e. super-compaction, incineration, in-drum drying system).

The Research Reactor TRIGA Mark II of the Jožef Stefan Institute is a 250 kWth pool reactor, manufactured by General Atomic and it is situated in the vicinity of Ljubljana. The research reactor was initially licensed in 1966. The second INSARR mission review was conducted in November 2012. The INSARR Follow-up mission checked the progress made in implementing the recommendations and suggestions in 2015. At present the reactor staff has plans to continue its operation well into next decade or even longer.

The Žirovski Vrh Uranium Mine and Mill was in operation during the period from 1985 to 1990. Its lifetime production was 607.700 tons of ore corresponding to 452.5 tons (U_3O_8 equivalent) of yellow cake. All entrances to the underground mine have been closed. The uranium mill was dismantled and the resulting waste is disposed of on the mining waste disposal site Jazbec. All mining waste from numerous other mining waste piles has been moved to this site and disposed of. The total amount of disposed material on this site is 1,910,425 tons with total activity of 21.7 TBq. On the Boršt uranium mill tailings disposal site, 610,000 tons of hydrometallurgical waste, 111.000 tons of mine waste and 9,450 tons of the material collected during decontamination of the immediate vicinity of Boršt site were disposed of. In March 2013 the SNSA approved the safety analysis report for the Jazbec repository. With this action the condition was met that the Jazbec repository ceased to be a radiation facility and it became a subject of long-term radiation monitoring.

The Central Radioactive Waste Storage at the Jožef Stefan Institute in Brinje is used for storage of the low and intermediate level solid radioactive waste from the reactor centre and other small waste producers such as medical, research, and industrial applications of ionising radiation.

In 2012 the SNSA issued a decision which allows the Krško NPP to extend its life span beyond 2023 if the given conditions are met. The US NRC requirements were used in the regulatory process. Amongst the conditions to extend its operational life span, the Krško NPP will have to finalize the planned safety upgrades, regularly implement periodic safety reviews in ten-year cycles and maintain the Ageing Management Programme (AMP).

It can be concluded that the Slovenian regulations and practices are in compliance with the obligations of the Convention.



COMPLIANCE WITH ARTICLES 4 AND 6 TO 19

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 under this Convention.

The legislative, regulatory, administrative and other steps necessary for implementing Slovenian obligations under the Convention on Nuclear Safety are discussed in this report. It was concluded that the approach taken in Slovenia ensures continuous fulfilment of the requirements presented in the articles of the Convention.

ARTICLE 6. EXISTING NUCLEAR INSTALLATIONS

Each Contracting Party shall take the appropriate steps to ensure that the safety of nuclear installations existing at the time the Convention enters into force for that Contracting Party is reviewed as soon as possible. When necessary in the context of this Convention, the Contracting Party shall ensure that all reasonable practicable improvements are made as a matter of urgency to upgrade the safety of the nuclear installation. If such upgrading cannot be achieved, plans should be implemented to shut down the nuclear installation as soon as practically possible. The timing of the shut-down may take into account the whole energy context and possible alternatives as well as the social, environmental and economic impact.

In the period from 2016 to 2019 the SNSA assessed the safety of the only Slovenian nuclear power plant Krško as satisfactory and in compliance with the legal requirements. This fact was pointed out in the respective annual Reports on Nuclear and Radiation Safety prepared by the SNSA and published on its website.

Besides the continuous regulatory safety assessment, the Krško NPP has experienced number of different reviews and assessments of its safety since 2016. The most important activities in the area of safety reviews and assessments are also described in the following paragraphs.

6.1 The Krško NPP Safety Upgrade Programme

In September 2011 the SNSA issued a decision for the Krško NPP determining the requirements for the implementation of the Krško NPP Safety Upgrade Programme (SUP). The requirements were based on the Slovenian legislation and on the lessons learned from the Fukushima Daiichi accident in March 2011. The plant performed the analysis of the needed improvements and prepared a proposal for the SUP based on the analysis. The SUP proposal was reviewed by the SNSA and approved in February 2012. The original deadline for the SUP implementation was December 2016, but was later extended, first to December 2018, and again in 2017 to December 2021. By the end of 2018 around 80% of the SUP improvements were completed. All Phase II improvements are on schedule to be completed by the end of 2019. Likewise, the implementation of Phase III projects i.e. the BB2 project and the construction of the spent fuel dry storage (SFDS) is well underway and is on schedule to be finished on time. For the SFDS project the implementation of the strategic environmental assessment as well as the environmental impact assessment was required by the Ministry of the Environment and Spatial Planning. The SFDS project is still planned to be finished by the end of 2021, which is the final deadline for the SUP. For more information on the Krško NPP's SUP see Appendix II, chapter A.: Challenges.

6.2 Topical Peer Review (TPR)

In 2014 the Council of the EU adopted the 2014 Amended Nuclear Safety Directive (Directive 2014/87/EURATOM) to incorporate lessons learned following the accident at the Fukushima Daiichi nuclear power plant in 2011. Recognizing the importance of peer review in delivering continuous improvement to nuclear safety, the 2014 Amended Nuclear Safety Directive introduced a European system of Topical Peer Review (TPR) commencing in 2017 and every six years thereafter. The 30th Meeting of the European Nuclear Safety Regulators Group (ENSREG)

in July 2015 identified ageing management of nuclear power plants as the topic for the first Topical Peer Review.

In the first phase the national self-assessments were conducted against the WENRA Technical Specification. Based on that in December 2017 Slovenia prepared the National Assessment Report (NAR) within the TPR on aging management. The report focuses on the ageing management of the Krško NPP.

Table 1: Country specific findings of Topical Peer Review for Slovenia

	Overall AMP	Concealed Piping	RPV	Containment
Good practice	External peer review services (e.g. OSART...)	-	-	-
Areas for improvement	Methodology for SSCs scoping subject to ageing management	Inspection of safety-related pipework penetrations	-	-
Good performance	International cooperation: participation in international projects, experience exchange within groups of common reactor design and the use of existing international databases	Scope of concealed pipework included in AMPs Opportunistic inspections	Volumetric inspection for nickel base alloy penetration Environmental effect of the coolant: Fatigue analyses are revalidated	-

The second phase started in January 2018 when the NARs were made available for questions and comments from stakeholders. As an indication of the commitment to the Peer Review and the importance of the selected topic this phase resulted in numbers of questions and comments. Subsequently, in May 2018, ENSREG organized a one-week workshop to discuss the results of the self-assessments, the questions and comments on the NAR, as well as the replies to the questions, with a goal to identify and discuss both generic and country-specific findings on Ageing Management Programmes. Slovenia received one good practice, four good performances, five

areas for improvement (actions for improvement for cables are not included) and four overall challenges applicable for all countries. The country-specific findings for Slovenia are presented in Table 1.

In the third phase of the TPR the Report and Country Specific Findings have been compiled to provide input for national action plans and ENSREG work.

The Slovenian National Action Plan on the implementation of their Country Specific Findings will be prepared and submitted to ENSREG by September 2019. The status report of the implementation of the action plan should be prepared in 2021.

6.3 OSART Peer Review Mission

As a part of the post-Fukushima National Action Plan the Republic of Slovenia invited the OSART mission to carry out a review of the operational safety of the Krško NPP.

A review of the operational safety of the Krško NPP within the framework of the OSART mission took place between 15 May and 1 June 2017. The OSART mission reviewed all aspects of the operational safety of the Krško NPP, divided into thirteen different thematic areas.

The final report of the OSART mission contained four recommendations, sixteen suggestions for improvement, and three examples of good practice. The recommendations were related to the areas of training and the qualifications of staff, operations and operational experience feedback.

The OSART suggestions for improvement (the number of suggestions are given in brackets) referred to the following areas: leadership and management for safety (3), maintenance (1), technical support (1), operational experience feedback (1), radiation protection (1), chemistry (2), emergency preparedness and response (1), human technology and organisation interaction (1), long-term operation (1) and the use of probabilistic safety analyses (1).

Examples of good practice were identified in the fields of operation, maintenance and the use of probabilistic safety analyses.

In response to the report of the OSART mission, the Krško NPP prepared a detailed action plan for the implementation of measures by defining the actions to the unresolved issues which were to be implemented by the end of 2018.

The OSART Follow-Up Mission was conducted between 15 and 19 October 2018. The Follow-Up Mission concluded that all levels of organization were involved in and committed to improving overall performance of the plant as well as the processes and human factors. Visible progress has been made in all reviewed areas. The OSART mission leadership praised the implemented measures, which fully completed 70% of the given recommendations and suggestions, with the rest 30% of measures still under implementation at the time of the mission.

The SNSA followed both missions closely. It reviewed the OSART report, the plant's action plan, and it also developed its own plan for monitoring the implementation of the OSART recommendations and suggestions at the Krško NPP. Out of all the plant's actions only one of

them is still open, i.e. the development of Operations' task management software tool, which is in the final stages of development and is to be completed by the end of September 2019.

6.4 The Second Periodic Safety Review (PSR2)

In May 2014 the SNSA approved the second Periodic Safety Review (PSR2) and the resulting implementation plan. The Krško NPP reports to the SNSA every six months in accordance with the SNSA decision on the progress of the changes and improvements implementation plan of the PSR2, which includes 225 improvements. In total, 204 actions have been completed by 31 December 2018, among them 71 out of 71 actions scheduled for completion in one year, 82 out of 84 actions scheduled for completion in three years, and 51 out of 70 actions scheduled for completion in five years. The Krško NPP shall complete the implementation plan by 30 May 2019.

6.5 Events in the Krško NPP

In the period from 2016 to 2019, the following events occurred in the Krško NPP:

- The earthquake – 9 April 2016,
- Control valve PCV 56572 leaks and does not maintain stable pressure on the outlet – 7 December 2016,
- Automatic shutdown due to the closure of the main feedwater regulation valve (discussed in detail in Article 19.6) – 16 February 2017,
- Failure of the hydraulic controller during testing on emergency diesel generator No. 2 – 6 July 2017,
- Preventive shutdown due to the high voltage measuring problems of the main transformer GT2 – 29 July 2018 (discussed in detail in Article 19.6).

The two events, which caused the shutdown of the Krško NPP, are described below. None of these events compromised nuclear and radiation safety. All events were reviewed and analysed by the SNSA.

Automatic shutdown due to the closure of the main feedwater regulation valve

On 16th February 2017 at 8:13, there was a rapid decrease in the level of the steam generator No. 1 due to the closure of the main feedwater line regulation valve (FCV551). The valve was closed despite the need for the valve to be open. The reactor operator recognised decrease of the steam generator level, when it was approximately 30 % of the narrow measurement range. The main operator attempted manual shutdown, but the reactor protection function overrode the manual action. An automatic shutdown occurred when the water level in the steam generator reached 13%. The isolation of the main steam line was carried out. At 8:52, by means of the motor-driven auxiliary feedwater pump, the power plant restored the normal water level (69 %) in steam generator No. 1. During the event all safety systems performed their function as intended.

After the inspection of the feedwater line regulation valve (FCV551), the fault in the current/pressure converter on the regulation valve (FCV551) was discovered, which was the direct

cause of the event. A detailed overview of this converter ascertained its poor quality (e.g. the soldered joints were weak, foreign objects were found, and during the inspection it was found that the converter was sensitive to shock/vibration). The Krško NPP replaced the defective position converter with a new one. The same corrective actions were preventively performed on another regulation valve (FCV552) on main feedwater line No. 2.

Plant shutdown due to the high voltage measuring problems of the transformer GT2

After the 2018 outage, there have been occasional loss of signals on the voltage measuring line of the main transformer GT2 at one of the three phases (phase C). The long-term operation with the occasional loss of signal on this measuring line or interruption of the measuring loop presented overvoltage risks for the bushing and consequently for the transformer GT2. In case these problems were not resolved, there could have been a short circuit on the wiring and consequently there could have been a fire or explosion of the main transformer GT2. Such an event could potentially jeopardize nuclear safety and there would be very serious economic damage.

In order to prevent such an event, the power plant was shut down on 29 July 2018 for a short period of time. Six connectors for high voltage measuring on both transformers (GT1 and GT2) were preventively removed and dedicated plugs for grounding of connectors were installed. The operation is safe even without control measurements on the bushings. The final remediation with the replacement of all connections will be carried out in the 2019 outage.

The Krško NPP and the SNSA examined the event in detail and carried out the analysis.

In conclusion, the Slovenian regulations and practices are in compliance with the obligations of Article 6.

ARTICLE 7. LEGISLATIVE AND REGULATORY FRAMEWORK

1. *Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of nuclear installations.*
2. *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.*

7.1 Description of the Legislative and Regulatory Framework

In Slovenia, the main act in the area of nuclear and radiation safety is the 2017 Act. As defined in its first article, the main purpose of the 2017 Act is “to regulate ionising radiation protection for the purposes of reducing, to the maximum possible level, damage to human health due to ionising radiation exposure and radiation contamination of the living environment and at the same time allow the development, production and use of radiation sources and the performance of activities involving radiation. This Act regulates the execution of nuclear and radiation safety measures for radiation sources intended for production of nuclear energy and execution of special protective measures in cases where nuclear materials are used.”

At its session on 12 December 2017, the National Assembly of the Republic of Slovenia adopted the new 2017 Act, which was published in the *Official Gazette of the Republic of Slovenia* No. 76/2017 on 22 December 2017 and entered into force 15 days after its publication, i.e. on 6 January 2018. The 2017 Act completely replaced the previous act of the same name from 2002, last amended in 2015.

Shortly after the entry into force of the 2017 Act, it became evident that changes were needed in the field of security checks for foreign nationals who intend to work in vital parts of the nuclear facility or to participate in the transportation of nuclear materials. The amendments of the 2017 Act which are related to the field of security clearance and also to some additional minor (terminological) changes of other provisions were adopted by the National Assembly of the Republic of Slovenia in April 2019 and were published in *Official Gazette of the Republic of Slovenia* No. 26/2019 on 26 April 2019 and entered into force 15 days after its publication, i.e. on 11 May 2019.

The 2017 Act transposes the contents of the Euratom Basic Safety Standards (BSS) Directive¹ and it was determined that due to the number of required amendments it was better to prepare a new act rather than keep supplementing the previous act. However, the 2017 Act largely follows the same fundamental goals and principles of the previous act and regulates all the necessary areas:

- to minimise the exposure of individuals to ionising radiation either due to natural sources of radiation or due to the use of radiation sources for industrial or research purposes or in health and veterinary medicine,
- to minimise the possibility of a nuclear or radiological emergency,
- to minimise the consequences in the event of such an accident as effectively as possible, and
- to prevent any harmful or prohibited use of nuclear or radioactive substances.

Since the Slovenian experts had been participating in the preparation of the Euratom Basic Safety Standards (BSS) Directive, they were acquainted with the changes well before its adoption. The provisions of this Directive are based on the latest findings of radiological protection experts, summarised in the ICRP (International Commission on Radiological Protection) reports. These reports are recognised almost universally in all the countries of the world as radiological protection standards and are transposed into their legal systems.

With the adoption of the 2017 Act, most of the provisions of the latest radiological protection standards were transposed into Slovenian legislation. With the adoption of the amendments to the Decree on the Content and Elaboration of Protection and Rescue Plans in April 2019 the complete transposition of the Euratom Basic Safety Standards (BSS) Directive into the Slovene legal system was achieved.

In addition, some of the provisions of the 2014 Amended Nuclear Safety Directive², which was adopted based on the lessons learned from the Fukushima Daiichi nuclear power plant accident in 2011, introduced in the 2015 Act (ZVISJV-D), were also carried over into the 2017 Act.

The 2017 Act was drafted by the Slovenian Nuclear Safety Administration in close cooperation with the Slovenian Radiation Protection Administration. The first drafts of the articles were prepared by the end of 2014 and then coordinated within the two authorities for more than one year. In October 2016 the draft was publicly announced for the first time. It was followed by almost half a year of coordination with experts, radiological protection practitioners and operators of radiation and nuclear facilities. In the spring of 2017, the text was co-ordinated with the ministries and government offices for several months. The draft was also sent to the European Commission

¹ 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, *Official Journal of the European Union* (OJ) L 13 (17 January 2014) (the Euratom Basic Safety Standards (BSS) Directive).

² 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, OJ L 219 (25 July 2014) (the 2014 Amended Nuclear Safety Directive).

for review. In July 2017 the Government approved the proposal of the 2017 Act and sent it to the National Assembly where it was adopted in December 2017.

The 2017 Act extended the validity of certain executive regulations issued under the previous Act, last amended in 2015 (ZVISJV-D) and, on the other hand, it determined a nine-month (and exceptionally an eighteen-month) deadline for the adoption of other new executive regulations, in particular those related to the transposition of the Euratom Basic Safety Standards (BSS) Directive.

By the end of April 2019, five Governmental Decrees (denoted by the abbreviation “UV”), two Rules of the Minister responsible for the Environment (denoted by the abbreviation “JV”) and six Rules of the Minister responsible for Health (denoted by the abbreviation “SV”) were adopted. The adopted regulations are:

- Decree on radiation activities – UV1 (*Official Gazette RS*, No. 19/18),
- Decree on dose limits, reference levels and radioactive contamination – UV2 (*Official Gazette RS*, No. 18/18),
- Decree on national radon programme – UV4 (*Official Gazette RS*, No. 18/18),
- Decree on the reduction of exposure due to natural radionuclides and existing exposure situations – UV5 (*Official Gazette RS*, No. 38/18),
- Decree on the checking of the radioactivity of consignments that could contain orphan sources – UV11 (*Official Gazette RS*, No. 10/19),
- Decree on the Content and Elaboration of Protection and Rescue Plans (*Official Gazette RS*, No. 26/19),
- Rules on the use of radiation sources and on activities involving radiation – JV/SV2 (*Official Gazette RS*, No. 27/18),
- Rules on the monitoring of radioactivity – JV10 (*Official Gazette RS*, No. 27/18),
- Rules on the criteria of using ionising radiation sources for medical purposes and for the deliberate exposure of individuals for non-medical purposes – SV3 (*Official Gazette RS*, No. 33/18),
- Rules on special radiation protection requirements and the method of dose assessment – SV5 (*Official Gazette RS*, No. 47/18),
- Rules on authorizing ionising radiation practitioners – SV7 (*Official Gazette RS*, No. 39/18),
- Rules on authorising radiation protection experts – SV7A (*Official Gazette RS*, No. 47/18),
- Rules on the obligations of the person performing radiation practices and holders of ionising radiation sources – SV8 (*Official Gazette RS*, No. 43/18),
- Rules on radiation protection measures in controlled and monitored areas – SV8A (*Official Gazette RS*, No. 47/18).

It is worth mentioning, that the following two documents are also a part of the comprehensive legislative framework: the Resolution on Nuclear and Radiation Safety in the Republic of Slovenia, adopted by the Parliament in June 2013 and published in the *Official Gazette of the Republic of Slovenia*

No. 56/13, and the Resolution on the national programme for managing radioactive waste and spent fuel for the period from 2016 to 2025 (ReNPRRO16-25), adopted by the Parliament in April 2016 and published in the *Official Gazette of the Republic of Slovenia* No. 31/16. The adoption processes and contents of both above-mentioned resolutions have already been reported on in our previous national reports.

The comprehensive legislative and regulatory framework which governs the areas related to nuclear and radiation safety is attached to this report (see Appendix I). It consists of the national legal frame and of those international instruments (multilateral and bilateral treaties, conventions, agreements/arrangements) to which Slovenia is a party.

7.2 Summary of Legislation

The 2017 Act is the most important document about nuclear safety, since it provides the requirements for protection from the effects of ionising radiation and nuclear safety measures.

The definition of "nuclear safety" is given in point 27 of Article 3:

"Nuclear safety shall mean technical and organisational measures which result in the safe operation of a nuclear facility, prevention of emergencies or mitigation of the consequences of emergencies, and which protect exposed workers, the population and the environment against ionising radiation."

Besides the main principles (among others also "primary responsibility for safety", "the causer-pays principle", "justification", "optimisation", "ALARA" and "the preparedness principle"), the 2017 Act also includes, with respect to nuclear and radiation safety area, provisions on:

- reporting an intention to carry out radiation practices or to use radiation source,
- licensing of the radiation practice or use of radiation source,
- classification of facilities (nuclear, radiation and less important radiation facilities),
- licensing procedures with respect to siting, construction, trial operation, operation and decommissioning of nuclear, radiation and less important radiation facilities,
- radioactive contamination and intervention measures,
- radioactive waste and spent fuel management,
- import, export and transit of nuclear and radioactive materials and radioactive waste and spent fuel,
- physical protection of nuclear materials and facilities,
- non-proliferation and safeguards,
- administrative tasks and inspection,
- penal provisions.

Concerning the prescribed measures on radiation protection or nuclear safety the facilities are classified as nuclear facilities, radiation facilities and less important radiation facilities. A basic selection of facilities classified as nuclear facilities has already been done by the 2017 Act itself, where in point 29 of Article 3, a nuclear facility is defined as "a facility for the processing or

enrichment of nuclear materials or the production of nuclear fuels; a nuclear reactor in critical or sub-critical assembly; a research reactor; a nuclear power plant and heating plant; a facility for storing, processing and depositing nuclear fuel or high radioactive waste; a facility for storing, processing or depositing low and medium radioactive waste. A nuclear facility shall also mean several of nuclear facilities when they are functionally linked in the same geographically confined territory and are managed by the same person.” Furthermore, the Governmental Decree on Radiation Activities (UV1) determines the criteria for the classification of radiation facilities and less important radiation facilities.

As already provided by the 2002 Act (last amended in 2015) the responsibilities for radiation protection are divided among two governmental authorities. The responsibility for the supervision of nuclear safety in nuclear facilities and radiation practices outside the medicine and veterinary activities lies with the SNSA, while the responsibility for the supervision of radiation practices in medicine and veterinary activities lies with the SRPA, the Slovenian Radiation Protection Administration, (see more in this Report under Article 8. Regulatory Body).

The licensing system for a nuclear or radiation facility can be divided into four steps after the preliminary condition (the planning of the site of nuclear facilities in the national site development plan) is fulfilled:

- application for the license for the use of land - the competent body is the Ministry of the Environment and Spatial Planning - with preliminary approval of radiation and nuclear safety requirements – the competent body is the SNSA,
- application for the license to construct a facility – the competent body is the Ministry of the Environment and Spatial Planning, with an approval from the SNSA,
- application for the license for trial operation – the competent body is the Ministry of the Environment and Spatial Planning, with an approval from the SNSA,
- application for the operation and application for the decommissioning – the competent body is the SNSA.

7.3 Inspection and Enforcement

In accordance with Article 178 of the 2017 Act, the inspection and enforcement of nuclear and radiation safety rests with the SNSA. On the other hand, the SRPA oversees the inspection and enforcement of radiation practices and use of radiation sources in health and veterinary care, while in the area of physical protection inspection the power rests with the Ministry of the Interior and the EPR with the Ministry of Defence. Since 2011 more emphasis has been given to joint inspections. During joint inspections the inspectors from different institutions, e.g. SNSA, SRPA, Administration for Civil Protection and Disaster Relief, Ministry of the Interior, cooperate and coordinate cross-cutting activities. The inspections include control over the implementation of the provisions of the 2017 Act, the ordered measures and the rules and decrees issued in accordance with the 2017 Act.

The elements of risk informed inspections are already partially incorporated into the current annual inspection program, such as the inspection assessment of the NPP activities analysed by the Probabilistic Safety Assessment (PSA) as well as review of shutdown PSA during the outages.

Within the scope of an inspection, an inspector may:

- issue decisions, conclusions and/or orders within the framework of administrative proceedings,
- order measures for radiation protection and measures for radiation and nuclear safety,
- order the cessation of a radiation practice or use of a radiation source when it is established that an applicable license has not been issued or if the prescribed methods of handling a radiation source or radioactive waste have not been followed. An appeal against such decision of an inspector does not prevent its execution.

In the 2017 Act there is only one article on inspection since the comprehensive Inspection Act (Official Gazette of the RS, No. 43/07 and 40/14) also exists and stipulates the general principles of inspection such as its organisation, status, rights and duties of inspectors, inspection measures and other issues in relation with inspection, and which is also to be followed by nuclear and radiation safety inspectors.

For each inspection, a separate administrative procedure (case) must be opened. Such “inspection case” may be closed/terminated by the decision/conclusion if there is no evidence of non-compliances with the regulations, violations of the provisions of the legislation or if the inspector does not require corrective measures. In all other situations the inspector must issue a written decision/conclusion to the licensee to remedy the errors and/or violations found. While performing an inspection, the inspector may order, for example, material sampling, temporary or permanent seizure of any means, documents check, searching of premises, examinations, hearings, and so on.

The enforcement of applicable regulations and of the terms of the licenses is ensured by the application of penal provisions, inspection provision and provisions related to suspending of the operation of a nuclear facility, as provided for in Articles 139 to 142 of the 2017 Act.

The SNSA may order the suspension of the operation of a nuclear facility on the initiative of a competent inspector or ex officio.

The SNSA can order the suspension of the operation of a nuclear facility on the initiative of a competent inspector when it can be concluded that the prescribed conditions for radiation or nuclear safety are not fulfilled and the licensee has not met the prescribed conditions within a reasonable period in spite of the request from the inspector to remedy the deficiencies. The SNSA can order the suspension of the operation of a nuclear facility ex officio if the licensee has started maintenance work, testing or introducing modifications referred to in Article 116 of the 2017 Act, which are significant for the radiation or nuclear safety of a facility, without the prior approval of the SNSA.

There is no right of an appeal against the decision on suspension of the operation of a nuclear facility.

In addition, the inspector must also apply the provisions of the general Act on Minor Offences (Official Gazette RS, No. 29/11 – official consolidated text and subsequent amendments). Based on this act, minor offences are divided into two main categories. For most of the offences the

inspector charges a fine (penalty payment) directly, while for the second category of offences (only five of them, specifically specified in the Act), the inspector may only initiate the administrative offence prosecution to the competent court. The same applies when an inspector finds more serious unlawful activities, omissions or negligence, which the Penal Code qualifies as a criminal offence; also, in these cases, as defined by the Criminal Procedure Act, the inspector may only report and initiate the criminal offence to a public prosecutor.

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



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 fulfil 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.*

The 2017 Act maintained the division of competencies in nuclear and radiation safety among two regulatory bodies, namely the SNSA and the Slovenian Radiation Protection Administration (SRPA). The SNSA is accountable for nuclear safety and safety of industrial radiation sources, while the SRPA is accountable for radiation protection of patients, medical surveillance of exposed workers, radiological surveillance of workplaces, dosimetry and dose registers and education in radiation protection. Besides this general division there are some parts of the legislative and regulatory framework, referred to under Article 7 of this Report, which are entrusted to other institutions, i.e. the Administration for Civil Protection and Disaster Relief of the Ministry of Defence is accountable for the emergency preparedness and planning, while the Ministry of the Interior is responsible for the physical protection of nuclear facilities and nuclear materials.

8.1 The Slovenian Nuclear Safety Administration (SNSA)

As a regulatory body in the area of nuclear and radiation safety the SNSA is a functionally autonomous institution within the Ministry of the Environment and Spatial Planning (MESP). The SNSA's responsibilities and competencies are defined in the Decree on Administrative Authorities within Ministries as follows: "The Slovenian Nuclear Safety Administration performs administrative and development tasks in the areas of nuclear and radiation safety, radiation practices and the use of radiation sources, with the exception of medicine and veterinary medicine, environmental protection against ionizing radiation, physical protection of nuclear materials and facilities, nuclear non-proliferation and protection of nuclear materials, radiation monitoring and liability for nuclear damage; it also carries out inspection duties in the above areas and in case of radiological or nuclear emergencies cooperates with the State Civil Protection Headquarters in the determination of protective measures for the population and informing the public."

The detailed competencies of the SNSA and other relevant administrations, entrusted with the implementation of the legislative framework in the area of radiation protection and nuclear safety, are prescribed in particular in the 2017 Act and in the other pieces of legislation are listed in Appendix I.

The SNSA is organised into six divisions:

- Division of Nuclear Safety,
- Division of Radiation Safety and Materials,
- Division of Emergency Preparedness,

- Office of International Cooperation,
- Office of General Affairs,
- Radiation and Nuclear Safety Inspection.

The Management System Coordinator is attached directly to the Director. The current organisational chart is shown in the Figure 1.

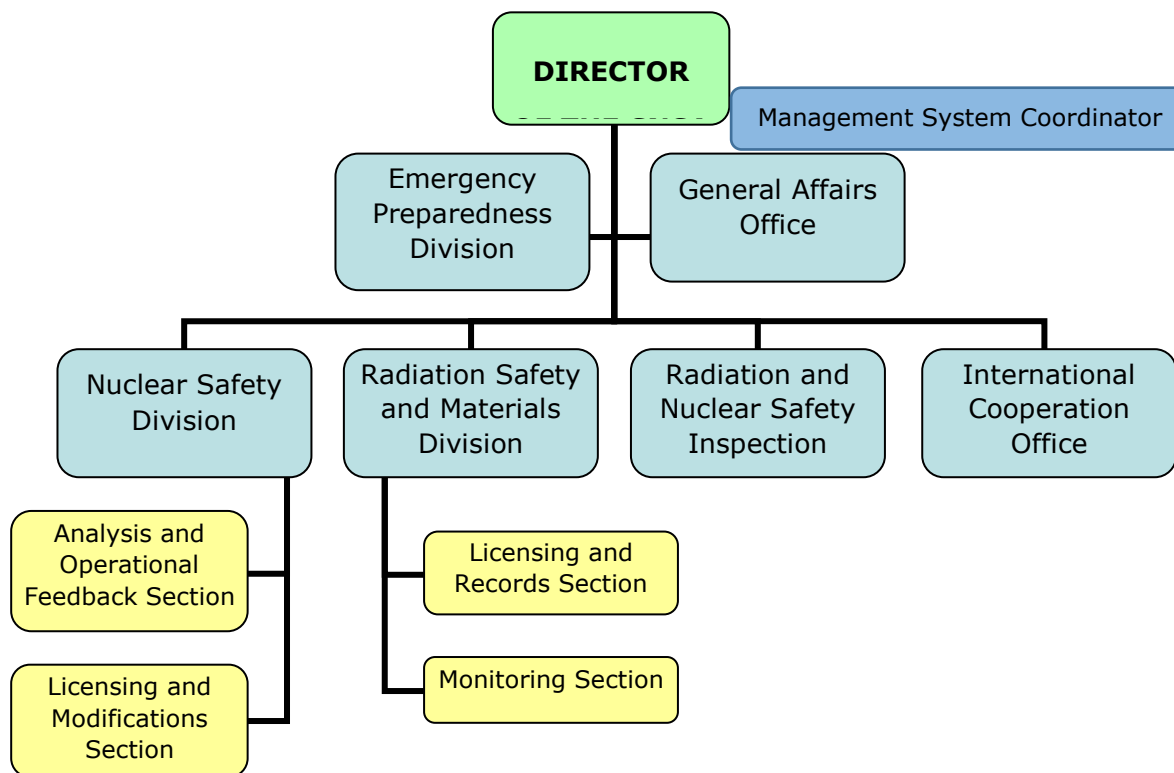


Figure 1: Organisational Chart of the SNSA

Each position in the SNSA organisational chart has recognized necessary competences for the staff member occupying it. When the SNSA employs new (and usually young) members, they usually do not yet have proper competences. In the call for application only formal requirements are written such as education, working experience and knowledge of languages. Once employed, the new employee has to pass the state exam for the public servants, which mostly covers general topics.

The individual program for acquirement of the necessary competences is in progress. The course on Fundamentals of Nuclear Technology and other courses at the Nuclear Training Centre in Ljubljana are frequently included in such program, as well as the events (courses, workshops)

organised by the IAEA. Also, many of the SNSA staff attended courses on Westinghouse Technology organized in the US NRC Training Centre in Chattanooga.

Each year the SNSA prepares the so-called Educational and Training Plan for its employees, in which special attention is given to newly employed colleagues. There are also other tools used for career development of the young staff members, such as career planning interviews, on-the-job trainings and so on. Furthermore, the so called “Systematic Approach to Training” has been finalized and it is used for the training planning for the SNSA staff.

Due to the limitations imposed by the governmental policy of not increasing the number of civil servants in the administration, the SNSA has substantially improved its management system and increased the effectiveness of its work. At the end of 2018, SNSA had 47 employees/staff members. The number covers all staff members who are employed by the SNSA for a fixed or indefinite period, regardless of the source of funding. This means that those employees whose salaries are financed from other sources were also taken into account. At the end of 2018 4 civil servants were employed based on the project work that is not financed from budgetary integral funds and which are not included in the SNSA’s staffing plan, as approved by the Government each year.

For the time being, the currently available technical staff at the SNSA and the Technical Support Organizations (TSOs) adequately covers the needs in various technical areas and has tools and abilities to conduct independent safety analyses, both deterministic and probabilistic.

The budget of the SNSA is determined based on the realisation from the previous year. The budget is the only source for financing the SNSA basic activities. The operators of nuclear or radiation installations and other licensees do not pay any licensing or inspection fees. The only fee envisaged by the general Act on Administrative Fees is the so-called administrative tax for the licensing (administrative) procedure, which is of symbolic value. Such fee is paid to the state budget and not directly to the SNSA. Furthermore, if the SNSA determines that some expertise is needed within the licensing (administrative) procedure, the applicant bears the costs according to the provision of the Act on General Administrative Procedure.

Although the SNSA is a body within the MESP, it still has its own share in the Ministry’s budget and is independent in allocating the programs, projects and other expenses from the budget. The State budget is prepared for a biennial cycle. The compositions of the SNSA budget for 2017, 2018 and 2019 is shown in Table 2. This budget comprises all activities within the SNSA competences. In addition to those provided by the budget (the so-called integral funds), Table 2 also shows the funds which the SNSA receives from its participation in the international projects (the so-called project funds).

It is noteworthy that in case of exceptional needs during the fiscal year the financial sources could also be provided through the redistribution of funds from the parent ministry's budget to the SNSA budget, as was the case in 2015, when in such a way the payment of IAEA membership arrears was settled.

Table 2: The SNSA Budget for 2017, 2018 and 2019 (in EUR)

STRUCTURE		2017 (€)	2018 (€)	2019 (€)
Salaries/wages		1.607.791	1.540.651	1.649.594
Material expenditures		276.500	117.129	130.000
Investments and maintenance costs		21.000	66.500	110.000
International projects		164.000	251.722	150.000
Membership fees: (IAEA, OECD/NEA membership, USNRC programs)		280.827	401.461	255.099
Outsourcing	Nuclear safety	80.000	110.668	107.000
	Radiation safety	101.000	136.803	141.000
Total		2.531.118	2.624.934	2.543.061

8.2 Other Regulatory Bodies

The 2017 Act gives the competence in the area of radiation practices and use of radioactive sources in health and veterinary care to the Slovenian Radiation Protection Administration (SRPA), which was established in March 2003 within the Ministry of Health. The SRPA responsibilities and competencies are also generally defined in the abovementioned Decree on Administrative Authorities within Ministries.

The SRPA performs technical, administrative, inspection and development tasks in the area of radiation practices and use of radiation sources in health and veterinary care; health protection of people against detrimental effect of ionising radiation; systematic inspection of working and living premises due to exposure of people to the natural radiation sources; implementation of monitoring of radioactive contamination of foodstuffs and drinking water; reduction, restriction and prevention of health detrimental effects of non-ionising radiation and assessment of compliance and authorisation of radiation protection experts.

Besides the SNSA and the SRPA, some other administrations, ministries and organisations are also entrusted with the implementation of the legislative frame which governs the safety of nuclear installations, in particular:

- The Administration of the RS for Civil Protection and Disaster Relief (within the Ministry of Defence), is responsible for the EPR,

- Ministry of the Interior, inter-alia, has competencies in the area of physical protection of nuclear materials and nuclear facilities in general (while the SNSA only approves the safety analysis report to which the plan of physical protection is attached as a separate and restricted document),
- The Agency for Radwaste Management,
- The Fund for Decommissioning of the Krško NPP,
- the Nuclear Insurance and Reinsurance Pool,
- Technical Support Organisations.

The position of the SNSA and the SRPA as well as the Administration of the RS for Civil Protection and Disaster Relief and Ministry of Interior in the governmental structure is shown in the Figure 2.

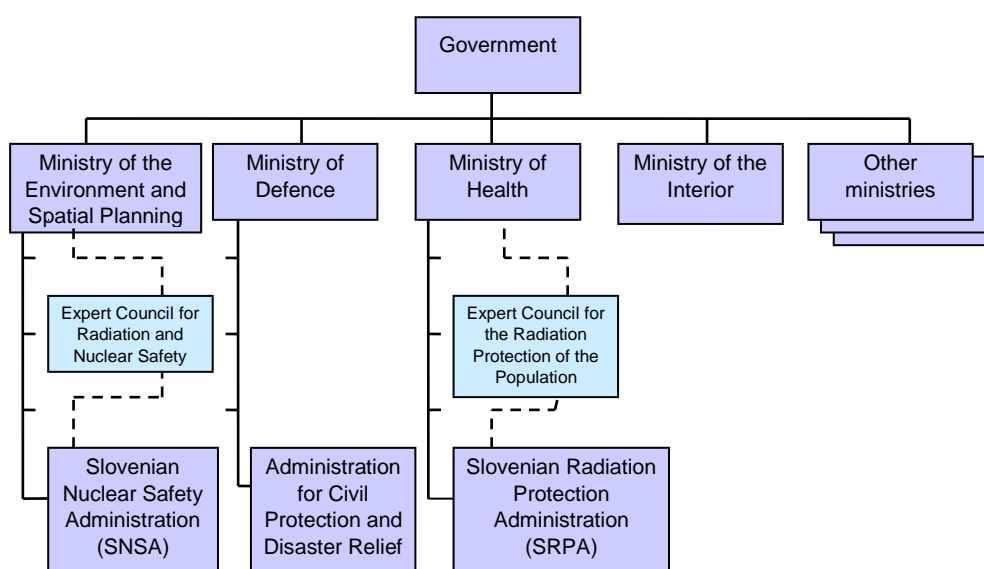


Figure 2: The SNSA and SRPA within the governmental structure

The Expert Council for Radiation and Nuclear Safety was appointed in 2003 as an advisory body to the MESP and the SNSA, and the Expert Council for the Protection of the Population against the Ionising Radiation, for Radiological Procedures and Use of Radiological Sources in Health and Veterinary Care serves as an advisory body to the Ministry of Health and the SRPA. Both Expert Councils were established based on the Act on Radiation Protection and Nuclear Safety of 2002. After the entry into force of the 2017 Act both Councils continued their work.

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

ARTICLE 9. RESPONSIBILITY OF THE LICENCE HOLDER

Each Contracting Party shall ensure that prime responsibility for the safety of a nuclear installation rests with the holder of the relevant licence and shall take the appropriate steps to ensure that each such licence holder meets its responsibility.

At the outset it should be emphasized that the IAEA GSR Part 1, rev.1 Requirement 5: Prime responsibility for safety is fully summarized in the Resolution on Nuclear and Radiation Safety in the Republic of Slovenia for the period 2013-2023 (ReJSV13-23).

Furthermore the “prime responsibility” principle is defined in the sixth paragraph of Article 4 of the 2017 Act as follows: “The user of a radiation source shall be responsible for radiation protection and the facility operator shall be responsible for the nuclear safety of a nuclear facility”.

Throughout the 2017 Act there are several provisions designed for the execution of the above stated principle. For example, the 2017 Act states that the operator of a radiation or nuclear facility shall:

- ensure the safety of a concerned facility, including the safety of radioactive substances, radioactive waste or spent fuel management, which are found or produced in a facility (second paragraph of Art. 87),
- ensure that monitoring programmes on operating experience are carried out and that the findings of such programmes shall be considered while assessing, verifying and improving radiation and nuclear safety (Art. 90),
- have sufficient financial resources guaranteed throughout the operating lifetime of a facility for implementing the prescribed measures of radiation and nuclear safety (Art. 91),
- ensure, throughout the operating lifetime of a facility, a sufficient number of qualified workers with suitable education, additionally trained for the activities related to radiation and nuclear safety (Art. 92),
- set up and implement a quality assurance programme (Art. 93).

The “prime responsibility” principle is also embodied in Article 100 (design basis of a nuclear facility), Article 111 (operation of the facility) and Article 115 (extended design basis of a nuclear facility).

In addition, the Rules on radiation and nuclear safety factors (JV5) and Rules on operational safety of radiation and nuclear facilities (JV9) include provisions for the implementation of “prime responsibility” for nuclear safety of the operator in day-to-day activities.

In conclusion, the Slovenian regulations and practices are in compliance with the obligations of Article 9.

ARTICLE 10. PRIORITY TO SAFETY

Each Contracting Party shall take the appropriate steps to ensure that all organisations engaged in activities directly related to nuclear installations shall establish policies that give due priority to nuclear safety.

10.1 Regulatory Requirements for a Licensee to Prioritize Safety

The priority to nuclear safety is given in the general principles of the 2017 Act. The Act defines nuclear safety as "technical and organizational measures which result in safe operation of a nuclear facility, the prevention of emergency events or the alleviation of the consequences of emergency events, and which protect exposed workers, the population and the environment against ionizing radiation". New requirements based on the 2014 Amended Nuclear Safety Directive and the WENRA Safety Reference Levels for Existing Reactors (2014) was already introduced in the 2015 Act. In the 2017 Act the Article 93 defines requirements for integrated management system (IMS) that has to be continuously reassessed and improved. The IMS shall include provisions for safety culture. The IMS also needs to establish the control over suppliers and contractors. Article 94 of the 2017 Act defines the Management System of the authority to be responsible for nuclear safety with the same provisions on establishing, implementing, assessing and continuous improving of the management system as it was defined in Article 93.

The Rules on radiation and nuclear safety factors (JV5) and the Rules on operational safety of radiation and nuclear facilities (JV9) further define the Act provisions and they were revised in 2016 according to the new WENRA safety reference levels of 2014. The regulation JV5 gives a detailed definition of safety culture. Chapter V (Management system) of the regulation JV5 includes requirements for integrated management system (Article 52), safety culture (Article 53), graded approach of the management system (Article 54), documentation of the management system (Articles 55 and 56), management commitment (Article 57), interaction with interested parties (Article 58), management policy (Article 59), safety policy (Article 60), responsibility and authority for the management system (Article 62), personnel and organizational structure of radiation or nuclear facility (Articles 64 and 65), process management (Article 66), supervision of subcontractors and suppliers (Article 67), quality of installed equipment (Article 68), monitoring and measurement (Article 69), non-conformances and corrective and preventive actions (Article 70), self-assessment (Article 71), independent assessment (Article 72), management system review and improvements (Articles 73 and 74).

The Article 112 of the 2017 Act defines the requirement to perform the Periodic Safety Review (PSR) and the Chapter 5 and Annex 9 of the regulation JV9 define the content of a PSR that includes the safety factors of safety culture (including priority to safety), management system and human factors. The SNSA practical guideline PS 1.01 defines the content and the scope of the PSR in more detail.

10.2 Implementation of Regulatory Requirements for Priority to Safety

In the course of harmonization of the WENRA reference levels and their transposition into the Slovenian regulation, the SNSA checked the compliance of the Krško NPP arrangements with all

the WENRA issues, including to those defining approach to priority to safety. The result has shown that all of these requirements for priority to safety have already been implemented in the Krško NPP policy, processes, programs and procedures. Most of these documents and processes have been in place for several years and this has been reported on extensively in the Slovenian national reports since the second review meeting.

The Krško NPP has a management system which gives the overriding priority to nuclear safety. Nuclear safety has the priority over operating goals, cost limitations, and operational availability by achieving adequate operating conditions, preventing accidents and/or mitigating their consequences, to ensure the safety of the employees and the environment. Nuclear safety must be dealt with proactively foreseeing difficulties and responding early enough to prevent major deviations. The nuclear safety management is an inseparable part of the management which clearly defines responsibilities and creates organisational culture in support of the nuclear safety. The managers promote and implement the safety culture as outlined in The Code of Safety and Business Ethics as well as with open communication which enables the employees to feel free to raise nuclear safety concerns without fear of retaliation. In order to improve the safety culture and performance of the personnel, the Internal Commitments and Goals Management Manual has been recently supplemented with three priority areas: to set an example in the safety upgrade implementation using teamwork, to set an example in the work preparation and implementation and to set an example in relationships between the co-workers.

In 2018 the Krško NPP conducted a self-assessment of safety culture. Improvement was recognized in the area of understanding and paying regard to several principles of safety culture. This can be derived from self-assessment results in five out of ten principles. Improvement was recognized in questioning attitude, safety communication, leadership accountability, continuous learning and in work processes. There is area for improvement in one of the attributes of leadership accountability (resources) and one of the attributes of work processes (procedure adherence). There is no major change in comparison to 2006 and 2013 self-assessments regarding personal accountability, decision-making, and respectful work environment principles.

In 2014 the second Periodic Safety Review (PSR) was completed by the Krško NPP and it also included a review of the safety culture (including the priority to safety). The PSR concluded that the Krško NPP has decent safety culture with a deep understanding of nuclear safety concept of the plant as well as willingness to continuously improve and develop competences and understanding of hazards. Some areas for improvement were identified such as a change in the management process, leadership alignment, coaching and communication between departments or vertical communication. The findings of the PSR were prioritized according to their impact on safety and appropriate actions were included in the PSR action plan; most of them have already been completed. The assessment of the Krško NPP response to the Fukushima accident was also performed but it did not reveal any additional issues.

In the Krško NPP, the nuclear safety overview is being achieved through the functioning of different committees and departments, such as the Krško Operating Committee, the Krško Safety Committee and the Independent Safety Engineering Group (ISEG). The ISEG maintains a Performance Indicators Program which also includes a set of 30 indicators for the monitoring of

safety culture. Regular reviews of performance indicators identify weak points and define corrective actions for the adverse trend indicators. The findings and corrective actions for the safety culture indicators are communicated all over the NPP organisation. The comparison of safety culture indicators status between 2013 and 2016 showed improvement and currently there are no indicators with “red” status (Unacceptable Zone), only the indicators in green (excellent), white (normal) and yellow (delayed/behind schedule).

According to the 2017 Act and the Rules on operational safety of radiation and nuclear facilities (JV9) the Krško NPP is required to assure that the Operating Experience Program is established and used effectively to promote safety within organization. This program is used for assessing its own operational experience, also including those events that are connected with the safety culture and human errors. For the foreign operation experience the Krško NPP uses a program of industry experience for effective identification, reporting and screening of reported events.

On its own initiative and based on various industry issues the Krško NPP initiated some safety improvement projects. The Safety Upgrade Program aim is to improve the plant safety against extreme external hazards and to increase plant capabilities for the prevention or mitigation of severe accidents. In the year 2013 the Krško NPP installed a Passive Containment Filtered Venting System (PCFVS) and Passive Autocatalytic Recombiners (PAR) in the containment. In the year 2015 the flood protection of safety important plant buildings against extreme flooding was implemented.

In 2011 the Krško NPP introduced the electronic business suite (EBS) that covers most of the plant processes and also includes electronic asset management (EAM) with a work order system, bill of material and warehouse database. The main benefits are data availability, configuration control and transparency. The communication between the process users and participants is transparent, immediate and available at the work place in the plant.

The Krško NPP performs control over its suppliers and contractors. The selection of suppliers is based on the evaluation of their capability to provide items or services in accordance with procurement requirements prior to the award of contract. The suppliers capable of meeting such requirements are included in the Approved Supplier List. Audits of suppliers are performed to determine their technical and quality capabilities by direct evaluation of their facilities, activities, personnel and the implementation of their Quality Assurance Program. Local and mostly EU-based suppliers are being audited directly by the Krško NPP while the suppliers from US are being audited in cooperation with Nuclear Procurement Issues Committee organization (NUPIC). Audit report with relevant findings and proposals for corrective actions is sent to the supplier and the supplier shall submit evidence on the completion of corrective actions. The Krško NPP also supervises the performance of contractors. The representatives of contractors’ companies are involved in coordination activities prior to work execution during on-line maintenance and during outage. Many contractors attend Krško NPP training courses. All contractors’ workers are required to attend Krško NPP industrial safety and fire protection training.

The already implemented actions by the Krško NPP in response to Fukushima accident as well as the planned activities can be seen as an example of good safety culture. The Krško NPP personnel

have an understanding of the nuclear safety concept of the plant with valuable knowledge and experience and are willing to continuously improve and develop their competences. The safety thinking of employees is incorporated into the training programs. The Krško NPP work force is stable. There is an open relationship of the Krško NPP with the authorities, supporting industry and local community.

There were several improvements made after the year 2016, based on the WANO Peer Review 2014 in the area of Human Performance and the OSART mission of 2017 in the area of Meeting Plant Management Expectations.

The plant operation is carefully controlled by trained personnel who operate it in accordance with approved procedures. The maintenance, test or modification requirement is processed through a detailed planning and scheduling system. Throughout this process all nuclear safety activities receive careful consideration based on Standard Technical Specification parameters, supported by deterministic as well as probabilistic safety analysis.

Permanent safety improvements are made by a number of modifications. All the changes are evaluated for the licensing applicability in accordance with the criteria defined in Rules on operational safety of radiation and nuclear facilities (JV9). For that purpose an administrative procedure called the Authorization of Changes, Tests and Experiments, was developed.

10.3 Regulatory Oversight of Licensees on Prioritization of Safety

The review of the implemented measures in the Krško NPP has been performed in the framework of the inspections and audits, as well as through safety and performance indicators

Independent reviews of outage activities and surveillance tests are performed by the TSOs. The TSOs are engaged in the inspection, witnessing and safety evaluation of refuelling, surveillance and modifications activities. The SNSA carefully monitors all the activities with an emphasis on ensuring nuclear safety during the outage of Krško NPP and writes the outage report which includes the action plan.

The level of NPP safety is also determined by a thorough review and analysis of the plant operational events. There were 16 reportable events from 2016 to 2018, all of them with low safety significance. All of these events were rated as INES level 0 and there were no negative consequences or any radiological releases to the environment.

Since 2007 the SNSA has included a set of performance indicators into the regulatory approach in supervising the Krško NPP. The SNSA maintains a set of 46 indicators that are collected based on weekly, monthly, quarterly or annual reports of the Krško NPP. The purpose of the SNSA safety and performance indicators is to identify potential weaknesses that might lead to the degradation of nuclear safety.

The SNSA has also performed a thematic inspection in 2017 covering the safety culture and another thematic inspection in 2018 covering the human and organisational Factors. For the preparation for the inspection the SNSA sent to the NPP a set of questions in advance and the Krško NPP prepared appropriate answers correspondingly. The inspection revealed that the Krško NPP has good programs and procedures for regular monitoring of the safety culture which is

reflected in a very high safety culture of the employees. The inspection also concluded that progress has been made regarding the human factor issues in the Krško NPP.

10.4 Priority to Safety Provisions of the Regulatory Body

The SNSA designed and developed an internal management system for its own use. The SNSA issues and regularly updates the Management Manual, the inspection plan, the organizational procedures and guidance, which in general cover management, control of radiological and nuclear safety, R&A and licensing, analysis (outage activities, operational events), inspection and enforcement, preparation of regulation and preparation for an emergency. The priority to safety is ensured through the principles of the manual, which are defined as the mission, the vision and the values of the SNSA. The SNSA Director monthly communicates to the SNSA staff the information on nuclear and radiation safety in Slovenia as well as presents the SNSA work and its international cooperation. As a method of the regulator's self-assessment, once per year a questionnaire is filled-out by the SNSA staff to provide feedback to the SNSA management on how the regulator is performing its duties.

The 2015 Act amendment introduced new requirements in the Article 4a for the self-assessment of the regulatory body every ten years. This self-assessment should review the regulatory organization and the legislation according to the international standards. After the completion of the self-assessment the regulatory body shall be subjected to an international expert review of the regulatory body with the aim to provide long-term and continuous improvements in nuclear and radiation safety.

The Article 8 of the 2017 Act defines the provision that all the information on radiation practices, nuclear and radiation facilities are public (except for the information relevant to the safeguards of nuclear materials and for the physical security). The Access of the public to this information is regulated by the Public Information Act. The SNSA also prepares annual reports on radiation and nuclear safety in Slovenia that are presented to the Government, the Parliament and are published on the SNSA's website to provide information to the general public.

The licensees that obtain permits and licences from the SNSA are provided with a questionnaire to assess the SNSA services and performance. In general, the licensee's feedback gives good marks to the SNSA but in case of more substantial remarks or complaints these would provide the basis for improvements of SNSA's processes.

10.5 Voluntary Activities

On the SNSA's web site (<http://www.ursjv.gov.si/>), the Slovenian Reports on Nuclear Safety, the Slovenian Report for the Second Extraordinary Meeting of the Parties on Convention on Nuclear Safety, the Slovenian National Report on Nuclear Stress Tests and the Slovenian Post-Fukushima Action Plan, the national annual reports, the reports of international missions and other similar documents are regularly published. On the website the Slovenian legislation in force can also be found, including the 2017 Act, the Governmental Decrees and the Rules, as well as the Practical Guidelines about the conduct of periodic safety review, about the contents of the safety analysis report, about the management of design changes in the NPP etc. The legislation is also translated into English and published on the web site. On its website the SNSA also publishes additional

information and reports on special issues, such as the assessment of the Fukushima accident, the reports on the seismic safety of the Krško NPP area, the reports on the event with fuel damage in Krško NPP in 2013, etc. The newsletter News from Nuclear Slovenia in English is prepared biannually by the SNSA and is also available on the website. The SNSA prepares the Radiation News, a newsletter published three times per year and delivered by mail to Slovenian licensees.

The SNSA also participates in the High-level Group on Nuclear Safety and Waste Management (ENSREG) and is a member of the Western European Nuclear Regulators Association (WENRA), an informal association consisting of representatives of nuclear regulatory authorities from European countries with nuclear power plants. Since 2011 Slovenia has been a full member of the Nuclear Energy Agency (NEA) of the Organisation for Economic Cooperation and Development (OECD). Slovenia actively participates in the NEA standing committees, namely in the Radioactive Waste Management Committee, the Committee on Decommissioning and Legacy Management, the Committee on Radiation Protection and Public Health, the Committee on the Safety of Nuclear Installations, the Committee on Nuclear Regulatory Activities, the Nuclear Law Committee, Committee for Technical and Economic Studies on Nuclear Energy Development and the Fuel Cycle and the Nuclear Science Committee. The Slovenian representatives also participate in various working groups of the standing committees.

The SNSA is involved in two EU assistance projects, both aimed at enhancing the capabilities of the Iranian Nuclear Regulatory Authority, Slovenia also successfully cooperates with the International Atomic Energy Agency (IAEA).

The SNSA believes that open communication and provision of information to the Slovenian and international public is a good practice which can improve the level of the radiation and nuclear safety in the country.

In conclusion, the Slovenian regulations and practices are in compliance with the obligations of Article 10.

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.*

The licensee has the prime responsibility for the safety of the nuclear power plant. This responsibility includes providing both adequate financial and human resources to support the safety of the power plant throughout its lifetime.

11.1 Financial Resources

The 2017 Act contains as one of the main principles the “causer pays” principle (paragraph 8 of Article 4):

2The user of a radiation source shall cover all costs related to the radiation protection measures in accordance with this Act, the preparedness for emergencies and intervention measures, as well as the costs of mitigation of the consequences of an emergency”.

Based on this principle the 2017 Act introduced a provision (Article 91) which relates strictly to the obligation of the operator of a radiation or nuclear facility to ensure sufficient financial resources guaranteed throughout the operating lifetime of a facility for implementing the prescribed measures of radiation and/or nuclear safety.

Such financial resources shall be ensured to the operator by the current owner of the facility, to the level of all operational costs as well as costs of maintenance investments, including investments in technological renewals relating to the measures of radiation or nuclear safety.

For the time being, the Krško NPP operator has allotted enough financial resources for maintaining the appropriate level of nuclear safety. The price of a kWh of electricity produced in the Krško NPP is set out by the NPP management and approved by the Supervisory Board, based on the annual business plan. Such price covers all gross operating expenses, i.e. electricity generation costs as well as necessary investments. Besides this, the Supervisory Board annually approves the Long-term Investment Plan (for five years). The amount foreseen for investments and improvements in recent years is stable and gives the management proper flexibility for the long-term maintenance of nuclear safety including the Safety Upgrade Program (see Appendix II, A. Challenges). Both owners are obliged to settle their respective obligations towards the Krško NPP within 15 days of issuing an invoice. In the reporting period there have been no problems with any delayed payments.

The suitability of ensuring financial resources, the amount thereof and the forms of warranties, as well as the method to be used for the enforcement of warranties are assessed by the SNSA during the procedure for issuing the operation license for a radiation or nuclear facility.

In conjunction with the Article 109 of the 2017 Act, which deals with licensing, the Article 137 requires that for obtaining the license the evidence about financial guarantees should be forwarded to the regulatory body. The financing of measures for the protection against ionising radiation and nuclear safety is prescribed in Chapter 12 of the 2017 Act, where the division between the regular (and extra) costs of the user of a radiation source (Article 172) and the public expenses (Articles 173 and 174) is defined.

Besides other explicitly itemised tasks and measures, the operator shall also cover the costs of ensuring the sufficient number of qualified workers involved in the operation of a radiation or nuclear facility.

In accordance with the provisions of the Treaty between the Government of the Republic of Slovenia and the Government of the Republic of Croatia on Regulating the Status and Other Legal Relations with regard to Investment in the Krško Nuclear Power Plant, Its Exploitation and Decommissioning, which entered into force in March 2003, Slovenia and Croatia are obliged to meet the obligations relating to the management and exploitation of the jointly owned power plant. The treaty stipulates that in a period of twelve months at the latest after the entry into force of the treaty, Slovenia and Croatia shall each establish a special fund to collect financial resources for their half of the expenses to cover the radioactive waste and spent nuclear fuel management and the final plant decommissioning.

For the Slovenian share adequate financial resources for the decommissioning of the Krško NPP and for the construction of a repository are ensured by the provisions of the Act on the Fund for Financing Decommission of the Krško NPP and Disposal of Radioactive Waste from the Krško NPP, adopted in 1994. The levy for every kWh of the Slovenian share of electric energy produced by the Krško NPP is regularly contributed to the Slovenian fund for decommissioning. For more information see Chapter 19.8.

In case of a nuclear accident, financial resources to compensate the claim are provided through the Slovenian third party liability legislation and through the Nuclear Insurance and Reinsurance Pool, taking into account that in 2001 Slovenia became a party to the Paris Convention on Third Party Liability in the Field of Nuclear Energy, and in 2003 also a party to the Brussels Supplementary Convention. Furthermore, the Slovenian Parliament already ratified the Protocols to both Paris Convention and to Brussels Supplementary Convention. The instruments of ratification will be deposited in accordance with the Council Decision 2004/294/EC.

11.2 Human Resources, Training and Qualification

11.2.1 The Krško NPP

At the end of 2018 there were 630 employees in the Krško NPP altogether, who adequately filled out all the necessary positions for the technical operation, including QA, training and engineering. There are six operation shifts with a minimum shift composition of five licensed operators per shift, including an on-duty shift engineer.

The training and qualification activities at the Krško NPP are governed by:

- the 2017 Act with amendments,

- the Rules on providing qualification for workers in radiation and nuclear facilities (JV4),
- the plant's Updated Safety Analysis Report, applicable plant procedures/programmes,
- the annual training program for licensed operators and shift engineers, which is submitted to the SNSA.

The education and training requirements are outlined in the Updated Safety Analysis Report, Chapter 13.2 "Training". The process is further elaborated in the administrative procedure Training and Qualification of the Krško NPP Personnel. Further training procedures cover specific areas, such as the Licensed Operator Training Program, the Licensed Shift Engineer Training Program, the Non-licensed Operator Training Program, the Health Physics Training Program etc. In addition, the Krško NPP personnel are trained and examined for using other relevant standard industry guides in areas such as occupational safety, hazardous chemicals, welding, non-destructive testing, specific equipment and machinery operation.

In general, the training programs are divided into initial and continuous trainings. In addition to the training for the Krško NPP personnel, specific training courses are conducted for subcontractors, specifically in the area of General Employee and Radiation Protection training and specific Work practices. The Systematic Approach to Training principles, including Job and Task Analyses, were applied for developing technical training programs.

The training program for a licensed operator and shift engineer is completely implemented in-house. The continuing training for the licensed personnel consists of multiple weekly training segments (four per year per each shift) which comprise a two-year cycle of re-qualification training. Each training day consists of lectures and exercises on a simulator. Initial licences and their renewals are obtained based on the examinations conducted by the Expert Commission for the Examination of the Operator's Qualifications (hereinafter "the Commission"). In accordance with the legislation, the SNSA nominates nine members of the Commission. Two members of the Commission come from the regulatory body, one from the technical support organisations, two from the Krško NPP and three are retired senior experts. The examination consists of:

- written examination: 38 to 40 questions (mainly multiple choice),
- simulator examination: GOP, AOP, EOP and EIP procedures,
- oral examination: reactor physics, nuclear safety, thermo-hydraulics, technical specifications and administrative procedures, emergency preparedness,
- walk-down (for new reactor operators only).

In 2002 the first group of operation personnel successfully finished the training program for the reactor operator on the Krško NPP full scope simulator. The last generation (3 reactor operators) successfully completed training in 2018. There were 74 licensed reactor operators, senior reactor operators and shift engineers at the end of 2018. The average age of the operators is 39 years.

Other types of training courses are conducted for specific areas, for example refuelling operations, maintenance, engineering, radiation protection, chemistry, security, emergency preparedness, SAME (Severe Accident Management Equipment) mobile equipment and others.

The training for maintenance personnel is conducted in a special training centre, either by using the Krško NPP own resources (instructors and subject matter experts) or by contracting such services from certified institutions or equipment vendors. Supervisory personnel and technicians also get specific knowledge at various equipment vendor training facilities. The maintenance training centre houses classrooms and laboratories that are designed for various maintenance groups and is equipped with practical tools needed to conduct the hands-on training.

11.2.2 The Slovenian Nuclear Safety Administration and the Technical Support Organisations

The SNSA makes sure that every employee goes through at least two months of initial training relating to nuclear technology at the Nuclear Training Centre in Ljubljana or at the US NRC Training Centre in Chattanooga, USA. The SNSA employees also take part in international workshops and courses on topics related to their areas of work. The SNSA continues with the development of the systematic approach to training and optimization of the SNSA's internal organization based on the recommendations of the IAEA

The training of the TSO personnel is organised according to the type of institution. They also attend international workshops, reactor technology and other training courses at the Nuclear Training Centre in Ljubljana and similar events. Furthermore, the 2017 Act stipulates that their training is also funded from the national budget.

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

ARTICLE 12. HUMAN FACTORS

Each Contracting Party shall take the appropriate steps to ensure that the capabilities and limitations of human performance are taken into account throughout the life of a nuclear installation.

12.1 Legal Requirements

The Slovenian legislation covers the human factor issue in the Article 92 of the 2017 Act which defines the workers' qualifications and physical as well as psychological requirements. The health surveillance of exposed workers is dealt with the Article 56 and the re-evaluation of the assessment of fitness to work in the Article 59 of the 2017 Act. The health of workers must be regularly checked. The employer shall also ensure regular updating of the workers' professional knowledge. The Rules on providing qualification for workers in radiation and nuclear facilities (JV4) further elaborate these requirements.

The Rules on radiation and nuclear safety factors (JV5) comprises basic human factors requirements in the nuclear installations design. The Rules Amending the Rules on operational safety of radiation and nuclear facilities (JV9) comprises basic human factors requirements for operating nuclear installations.

12.2 Licensee Methods and Programs at the Krško NPP

The methods of dealing with human factor issues at the Krško NPP are covered in various plant documents like policy documents, plant programs, and high-level administrative procedures. The methods which are used to prevent, detect and correct human errors are covered by the Operating Experience Assessment Program, supported by procedures such as the Use of Corrective Action Program and the Root Cause Analysis. The analysis of human errors is performed mainly by the Independent Safety Engineering Group. The man-machine interface issues are covered in the Human Factors Engineering Design Guidelines, based on ANSI/HFS 100-1988, NUREG-0700 and other documents.

Human performance aspects are taken into consideration by setting up the organisation and management of the plant. There are arrangements, such as the Quality Assurance Plan, the Plant Management Manual, the Krško NPP Policies and Goals, the Self-assessment Program, the Safety Culture Traits, the Human Performance Error Prevention Tools, the Company General Employee Training Handbook, the Operating Experience Assessment Program, and others, which focus on developing, communicating, understanding, and monitoring the strategy to improve safety. These arrangements also cover reporting and analyses of human induced events at the Krško NPP and the feedback on the lessons learned regarding plant operation procedures and training programmes.

The second Krško NPP periodic safety review in 2013 was also augmented with impact assessment of the post-Fukushima developments. The second PSR issues are related to the transfer of knowledge, the capture of critical knowledge, the training programme and the post-Fukushima actions. All of the mentioned issues were included in the PSR action plan and have been completed.

The staff workload is strictly regulated. The overtime is limited to 8 h/week, 20 h/month, and 170 h/year. Two of the plant administrative procedures deal with working time and salaries. The

responsibility for controlling the workload of the personnel according to the procedures lies with the heads of the departments. The overall monitoring of actual workload for the plant personnel is performed by the division of administration on a monthly basis. The staff turnover is rather low and is mostly due to retirement.

In May 2015 the new internal procedure ADP-1.0.050 “Monitoring of Safety Culture and Human Factors” was issued.

Based on the OSART mission suggestion in 2017 the Krško NPP created a grouping of Human Performance codes and used them to create a new Human Performance Indicator. The group of ten performance indicators from different areas was established in 2018 to monitor the Human Performance. The indicators are:

- Number of Operation Human Performance Events,
- Number of Unplanned Personnel Contamination,
- Number of Unplanned Personnel Internal-External Exposure,
- Number of Human Related Events,
- Number of Registered Industrial Safety Events,
- Percentage of Overdue Corrective Actions,
- Percentage of Overdue Analyses,
- Number of Procedures with Expired Review Date,
- Workforce Engagement Indicator,
- Number of Recurrences.

The codes and indicators are reviewed for trends by the Safety Culture Monitoring Panel which consists of representatives from each department. The codes and indicators are also reviewed in the Quality and Nuclear Oversight yearly trend report. The Krško NPP also made improvements to the Corrective Action Programme database to allow binning of the codes to be done within the on-line programme. This enables each employee to be able to see the binning of codes for their events and more easily utilize the information to develop corrective actions.

The Krško NPP is conducting cross-functional trainings as part of the Operations Simulator Training to promote the use of human performance tools. The staff from outside of Operations are included in the applicable simulator training scenarios. The review of the coaching in the leadership self-assessment resulted in subsequent action plans. The senior level managers are designated to overseeing each of the focus areas. Indicators were created for each of the focus areas and are regularly monitored, i.e. quarterly.

There were several improvements made after the year 2016, based on the 2014 WANO peer review of human performance and based on the area of the meeting plant management Expectations of the 2017 OSART mission.

Different pocket cards for workers were made to help them perform their jobs, for example pocket cards with phonetic alphabet symbols, pre-job briefing questionnaire, human performance tools and safety culture traits. In the existing human performance related events area of the Corrective Action Program two additional categories "Safety Culture" and "Human Performance Tools" were added in 2019 for a more precise monitoring of all human performance tools and safety culture traits. Improvements in practical training for human performance area in the Main Control Room Simulator and Flow-loop Simulator were made. The Krško NPP established different training approaches on human performance tools for different departments (Operations, Maintenance, etc). Human performance tools are also incorporated in the Manager in the Field Program and are analysed inside the "Team for a Continuous Monitoring of Safety Culture and Human Performance" and reported in the Quality and Nuclear Oversight Division's yearly report.

The Krško NPP included the human factor evaluation in its modification process. During the preparation of conceptual design packages for the modifications the human machine interface shall be evaluated. Design changes shall be in the agreement with the procedures "Human Factors Engineering Design Guidelines" and "Rules for Process Computer Systems HMI", where applicable.

NUREG-0700 Human-System Interface Design Review Guideline and NUREG-0711 Human Factors Engineering Program Review Model are included in the modification process.

Human factor practices and guidelines as defined in NUREG-0711 are divided into twelve elements of the Human Factors Engineering (HFE) Program and arranged in four general activities:

- Planning and Analysis: HFE Program Management, Operating Experience Review, Functional Requirements Analysis and Function Allocation, Task Analysis, Staffing and Qualifications, Treatment of Important Human Actions,
- Design: Human-System Interface Design, Procedure Development, Training Program Development,
- Verification and Validation: Human Factors Verification and Validation,
- Implementation and Operation: Design Implementation, Human Performance Monitoring.

Within the project of the new Emergency Control Room (ECR) a decision was made to follow all the requirements of the Human Factors Engineering considerations in supporting the plant safety and providing defence in depth since this project introduces significant modifications to the human-system interfaces.

Such plan describes human factors considerations and activities that will be implemented to ensure that the system is designed and evaluated according to the established human factors principles and practices. The technical elements described in the plan should be supported by subsequent verification and validation activities utilizing full scale mock-ups and simulators for the resulting design.

The SNSA performs review and supervision activities related to the human factors. The qualification of the licensed personnel is controlled by the SNSA. The Ministry of Health issues licences to the radiation protection staff while the SNSA licences the operators. As part of the operational events analysis, the SNSA independently performs root cause analyses and determines any human factors that would lead to the events. The refuelling outages are supervised by the SNSA and the analysis of the outage activities is performed, which also includes the review of organizational and human factors' deficiencies identified by the SNSA inspectors.

The SNSA conducted thematic inspections, which is described in Chapter 10.3.

In conclusion, the Slovenian regulations and practices are in compliance with the obligations of Article 12.

ARTICLE 13. QUALITY ASSURANCE

Each Contracting Party shall take the appropriate steps to ensure that quality assurance programmes are established and implemented with a view to providing confidence that the specified requirements for all activities important for nuclear safety are satisfied throughout the life of a nuclear installation.

13.1 SNSA Quality Management System

The SNSA management system is an integrated management system based on the process approach. All activities regarding the SNSA management system are performed according to the requirements of the ISO 9001.2008 standard as well as the GS-R-3 “The Management System for Facilities and Activities”, 2006.

The processes are divided into one management process, seven core processes and one supporting process, as depicted in Figure 3.

The processes are documented at five levels of the management documentation:

- Level 0: mission, vision, values and policy statement of the SNSA,
- Level 1: Management manual (Q), which defines the concept of the management system in the SNSA. This level also includes the SNSA strategic objectives and the annual plan,
- Level 2: Organizational procedures (OP) which describe management of the processes,
- Level 3: Organizational instructions (ON), in which the detailed performance of individual activities is defined,
- Level 4: Records that are a result of management system activities.

Even though the SNSA did not renew the certificate of compliance of the management system with ISO 9001.2008 at the end of 2013 due to austerity measures, the SNSA continues to carry out all its activities in accordance with the requirements of this standard and the IAEA safety standard GS-R-3 and will ensure the continuous improvement of the effectiveness and efficiency of its operations.

During the period between the two reports several measures, assessments and improvements of the SNSA management system have been performed through:

- Internal audits,
- Management system reviews,
- Reviews of fulfilment of the SNSA goals, strategies, plans and objectives.

Internal audits are conducted in accordance with the SNSA procedure “Conduct of Audits”. According to the internal audit annual plans each SNSA process has been once audited per year. Internal audits of the management system are conducted only by trained and independent auditors.

The SNSA management regularly reviews and evaluates the performance of the management. The management system reviews are performed at the beginning of each year for the performance of

the previous year. The management performs regular reviews of the management system at least in one-year intervals to ensure its continuing suitability, effectiveness and efficiency.

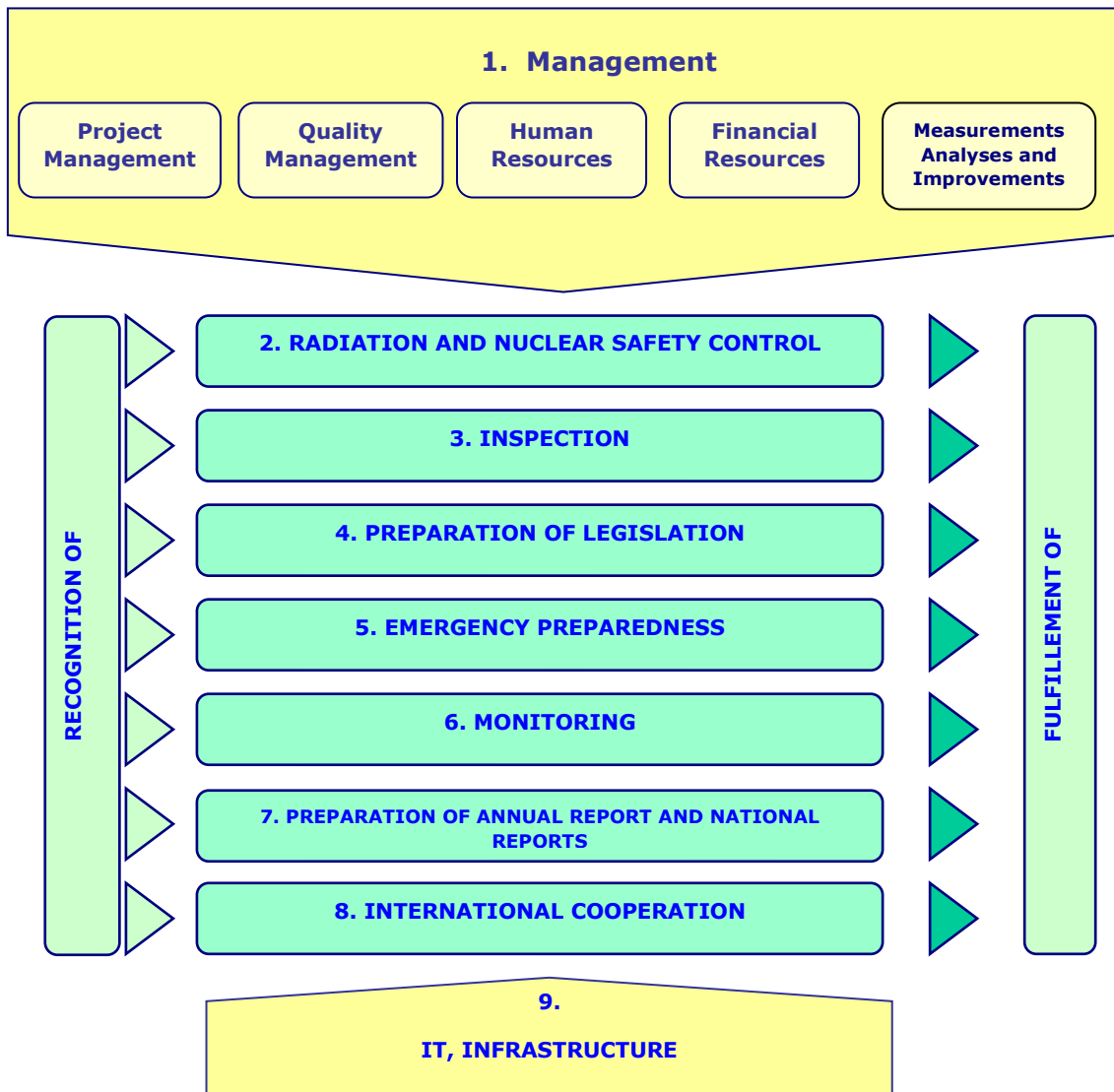


Figure 3: The SNSA Management System Processes

In 2018 the SNSA decided to upgrade the management system, namely to make the transition to meet the requirements of IAEA Safety Standard No. GSR Part 2 “Leadership and Management for Safety”. The new revision of the “SNSA Management Manual” has been issued which takes into consideration all requirements of GSR Part 2.

13.2 Regulatory Requirements for Quality Assurance Programmes and Quality Management Systems of Licensees

The regulatory requirements for management systems are defined in the Slovenian legislation, namely in:

- The 2017 Act, Article 93 – “Management System”, and Article -94 - “Management System of the Regulatory Body Competent for the Nuclear Safety” and
- Rules on operational safety of radiation and nuclear facilities (JV9) Chapter 5 - Management System.

The Article 93 of the 2017 Act, defines the requirements relating to the management system of the investor or operator of a radiation or nuclear facility.

The Article 94 of the 2017 Act additionally defines that the authority, competent for the nuclear safety, shall establish, implement, assess and continuously improve the management system.

In accordance with the 2009 Nuclear Safety Directive (Directive 2009/71/Euratom), the 2014 Amended Nuclear Safety Directive (Directive 2014/87/Euratom) and the Directive on the Responsible and Safe Management of Spent Fuel and Radioactive Waste (Directive 2011/70/Euratom), the Article 5, of the 2017 Act requires that the competent authority shall at least every ten years carry out a self-assessment, which includes harmonization of its own organization and legislation with internationally recognized standards in the field governed by this Act and regulations issued pursuant thereto, and other regulations in the field of peaceful uses of nuclear energy.

The most important regulation defining quality management systems is the Rules on radiation and nuclear safety factors (JV5) replacing a similar regulation of 2010. The fifth chapter of the Rules JV5 (Articles 52 – 74) entitled “Management System” is dedicated to the requirements of the process for an oriented integrated management system and transposes most of the requirements of the IAEA Standard GSR-Part 2 “Leadership and Management for Safety” as well as all the management system provisions from the latest WENRA Reference Levels.

The SNSA regularly performs inspections on the Krško NPP Management System.

13.3 The Krško NPP Quality Assurance System

The Krško NPP integrated management system brings together in a coherent manner all the requirements for managing the organization. The main aim of the management system is achieving and improving safety with planned and systematic actions necessary to provide adequate confidence that all these requirements are satisfied, and ensuring that health, environmental, security, quality and economic requirements are not considered separately from the safety requirements. The policy is established by the Management Board’s Statement of Policy and Authority.

The Krško NPP Quality Assurance Program is established and systematically implemented in accordance with the Slovenian regulations and the US regulation 10CFR50, Appendix B. The Quality Assurance Program defines the control activities which affect the quality and operational

conditions of nuclear fuel, systems, structures and components, as well as the quality of related services in accordance with their importance to nuclear safety. The program involves observation of work processes and activities, evaluation of their effectiveness, systematic review and monitoring of discrepancies and implementation of appropriate corrective actions. The quality related activities need to be performed under controlled conditions, which include the fulfilment of all prerequisites for the performance of activities. The program also provides for and requires special inspections, procedures, tests, tools and personnel training for achieving desired quality. The Quality Assurance Program is regularly reviewed and supplemented by the management.

Since the beginning of the Krško NPP operation, the overall Quality Assurance Program described in the Quality Assurance Plan and its applicable programs and procedures were in place to assure that all planned and systematic actions necessary to provide adequate confidence that an item or service will satisfy given requirements to quality, are in place. The overall requirements for the quality as one of the major objective for Krško NPP operation are also set forth in the Updated Safety Analysis Report as a basic document for operating license and the Quality Assurance Plan which incorporates various changes and improvements resulting from regulatory requirements (the 2017 Act, Rules JV5, Rules JV9), international standards (IAEA GSR Part 2, ISO 14001, ISO 17025, BS OHSAS 18001, ASME NQA-1, ANSI/ASME N45.2, etc.) and revised international guidelines (WANO, INPO, NRC etc.). The Quality Assurance Plan defines the expectations for the implementation of the following: internal plant audits, supplier audits, oversight of plant modifications, procedures review and approval, procurement documents control, evaluation and approval of suppliers, observation of plant activities, review and approval of outage documents, oversight of equipment manufacturing and other activities.

The Quality Assurance Program applies to safety related and seismic related structures, systems and components, including their foundation and supports, and non-safety related structures, systems and components important to quality (augmented quality). The program is an intrinsic part of the overall management system aiming at continuous progress in nuclear safety, thus ensuring that the measures taken will not jeopardize nuclear safety.

13.4 The SNSA Review and Control Activities Regarding Quality Assurance/Management System Program of the Licensee

The SNSA reviews and controls the activities regarding the licensee's quality assurance and management system program. This is performed through:

- licensing related to the changes of USAR and in particular related to the changes of the chapter 17 of USAR "Quality Assurance",
- inspection process, and
- periodic safety review (PSR).

The SNSA annual inspection plan provides at least one inspection per year dedicated to the licensee's management system and/or quality assurance system.

Additionally, reactive inspections of the management system can also be performed in a case of deficiencies of the licensee's management system found during any other inspection.

The inspection oversight of the licensee's management system is performed in three steps:

- review and assessment if the management documentation is in line with the requirements of legislation,
- review and assessment if the implementation of the management system is in line with the management documentation,
- appropriate enforcement actions in case of deficiencies.

In the period between the two reports three management system inspections were performed in the Krško NPP. One inspection was focused on the counterfeited, suspicious and fraudulent items, two of them were dedicated to the safety culture, namely to the review and assessment of the results of safety culture self-assessment report and to the implementation of the action plan to the safety culture self-assessment report.

According to the Rules on operational safety of radiation and nuclear facilities (JV9), the management system shall be reviewed as a part of the Periodic Safety Review of a nuclear facility.

In 2014 the SNSA approved the report on the NPP Krško second Periodic Safety Review (PSR 2). The review of the Safety Factor Safety Management System was performed as part of the PSR 2 in order to determine whether the Krško NPP organization and management system are adequate and efficient for ensuring the safe operation. In general, the nature and extent of programs and arrangements for an effective safety management at the Krško NPP reflect the current international requirements and good practice.

The review identified three unresolved or partially resolved issues from Krško NPP PSR 1 and four new issues. These were mostly deficiencies in the review and hierarchy of plant documents, internal audits scope and performance and responsibilities of committees. All of the issues identified are of low safety significance level. All the issues from PSR 2 have already been resolved.

In conclusion, the Slovenian regulations and practices are in compliance with the obligations of Article 13.

ARTICLE 14. ASSESSMENT AND VERIFICATION OF SAFETY

Each Contracting Party shall take the appropriate steps to ensure that:

- (I) comprehensive and systematic safety assessments are carried out before the construction and commissioning of a nuclear installation and throughout its life. Such assessments shall be well documented, subsequently updated in the light of operating experience and significant new safety information, and reviewed under the authority of the regulatory body;*
- (II) verification by analysis, surveillance, testing and inspection is carried out to ensure that the physical state and the operation of a nuclear installation continue to be in accordance with its design, applicable national safety requirements, and operational limits and conditions.*

14.1 Comprehensive and Systematic Safety Assessment

14.1.1 Regulatory requirements

The 2017 Act ensures that licensee shall write safety analysis report for a nuclear facility under construction, commissioning or operation, following termination of operation or under decommissioning. The 2017 Act incorporates the contents of the Euratom Basic Safety Standards (BSS) Directive). In this way, it transfers the main provisions of the most up-to-date standards in the field of radiation safety into the national legislation.

Details of radiation and nuclear safety, as well as operational safety of radiation and nuclear facilities are regulated by the secondary legislation. The Rules on radiation and nuclear safety factors (JV5) revised in 2016, stipulates that the safety analysis report shall provide sufficient information about the facility allowing an independent assessment of the safety of the facility. The new revision includes the introduction of the revised “WENRA Reference Level” requirements of September 2014, the changes in the Fukushima accident response (changes determined in the National Action Plan) and the changes in the Management System section due to the changed IAEA standards within this field. It also gives an exhaustive list of topics which have to be included in the report, such as the safety basis and project concepts, an analysis of the location, the object technical characteristics, the programs for quality assurance, the evaluation of the protection of exposed workers against radiation, the programs for pre-operating tests and programs for trial operation, training programs, the assessment of the exposure of the population and the environment, a safety analysis, the anticipated discharge of radioactive substances into the environment and emergency planning.

The assessment of the nuclear facility safety throughout its life is ensured through the provisions of the Rules on operational safety of radiation and nuclear facilities (JV9).

Concerning the modifications, the 2017 Act requires that for each intended modification relating to the facility or to the management method used or to the operation of the facility, including maintenance work, inspection, testing or the introduction of a technical, organizational or any other modification which affects or could indirectly affect the content of the safety analysis report, the licensee shall evaluate the modification in relation to its significance for radiation or nuclear

safety.

Modifications are classified into three categories with regard to their importance to radiation or nuclear safety:

- 1st category modifications, for which it shall be necessary to notify the SNSA,
- 2nd category modifications, for which the intention of their implementation must be reported to the SNSA; the licensee may commence the implementation of the proposed changes after the SNSA confirms in writing that it is not necessary to obtain approval for the changes,
- 3rd category modifications of significance for radiation or nuclear safety, for the implementation of which a license from the SNSA must be obtained; the licensee must attach a proposal for the amendments to the safety analysis report and an expert assessment from an authorized expert for radiation and nuclear safety.

Recommendations for the licensee considering modifications are collected in the Practical Guideline: Modifications in Radiation- or Nuclear Facilities (PS 1.02). The PS 1.02 guideline is specifically aimed at the NPPs, but it can be also applied to other radiation and nuclear facilities.

The 2017 Act requires that the licensee of a nuclear facility ensures regular, complete and systematic assessment and examination of radiation and nuclear safety of the facility by the periodic safety review (PSR) which has to be performed in the period of ten years. The operator must draw up a periodic safety review report and hand it over to the SNSA. The approved safety review report is a condition for further operation of a facility. Detailed information about performing PSR is laid down in the Rules JV9 and in the practical guidance issued by the SNSA. The SNSA can require an extraordinary safety review if new and important evidence on the radiation or nuclear safety of a facility has come to light. The 2017 Act states that the SNSA shall ensure that international missions are carried out for the purposes of fulfilling the obligations of the Republic of Slovenia in international treaties in the field of peaceful uses of nuclear energy. If the mission is the inspection of nuclear or radiation facility, the operator shall allow such inspection.

14.1.2 Implementation

At the Krško NPP a comprehensive program is established for the design modification control, which defines the roles and responsibilities of the site organizational units involved in the plant modification process. For performing the plant modifications, guidance is provided to the NPP staff as well as to the contractors. The screening criteria for determining the need for safety evaluations, guidance for the implementation of these safety evaluations and the requirements for documentation review and approval are specified in the Rules JV9.

A set of procedures covers all the aspects of design modifications, from request, prioritization, safety screening, the preparation of the design package, review and the preparation of installation package, to the evaluation of impact, testing/commissioning requirements, documentation revision and modification handover.

The control of temporary modifications is performed by a specific procedure which requires safety screening and evaluation similarly to the one for permanent modifications.

The licensee's obligations including the documentation for granting an authorization for modifications are prescribed in the 2017 Act and more specifically in the Rules JV9.

The SNSA reviews in detail the submitted documentation and assesses it in accordance with a dedicated procedure. Such assessment shall also take into account all the relevant operating experience and the significant new safety information. In accordance with the procedure a review assessment report shall be prepared as a basis for the final decision. The SNSA uses its own information system for archiving the modification data which is also useful for modification reviewers. In general, the information system stores the following operational experience (OE) data: on-site events, plant trips, modifications and corrective actions. Also, the Krško NPP PSA model, inspections database, SNSA decisions issued to licensees, interesting operation events from foreign NPPs, radiation sources database, contracts, open problems, the register of persons and organizations are accessible through the SNSA information system.

14.1.3 Current actions and upgrading measures

The Krško NPP completed the first Periodic Safety Review (PSR1) action plan in 2015. The first PSR action plan led to some important improvements such as installation of the third emergency diesel generator and upgrade of flood protection dikes.

In 2010, the second PSR (PSR2) program was approved by the SNSA. Although the final report of the NPP on the periodical safety review concluded that the plant is safe, the PSR2 identified the need for further improvements that could be introduced. In May 2014 the SNSA approved the PSR2 and the resulting implementation plan, which is going to be completed in 2019. There are two additional areas that are being examined in detail in the PSR2: the Equipment Qualification and Aging. For these two safety factors the PSR2 is the first comprehensive examination with respect to the IAEA safety guide.

The third PSR (PSR3) is in preparation, the licensee shall make the application for it by the end of 2020. The PSR3 is particularly important, since it will be the last PSR before the planned extension of the Krško NPP's operational life.

The Slovenian post-Fukushima National Action Plan (NAcP) was prepared as a result of all the activities executed in Slovenia in response to the 2011 nuclear accident in Fukushima Daiichi. These activities include, but are not limited to, the implementation of the European stress test process, the review and analysis of possible long-term improvements based on which the Krško NPP's Safety Upgrade Program (SUP) was prepared, the review of several reports and analyses regarding the Fukushima lessons learned, etc.

However, the core of the NAcP and the post-Fukushima improvements is the Krško NPP's SUP, which was required, reviewed and approved by the SNSA. This program of upgrades was already envisioned in the Slovenian legislation from 2009. It required that the plant upgrades its systems, structures and components to enable coping with severe accidents after the extension of the plant lifetime. After the Fukushima accident the SNSA ordered the plant to implement these measures in advance. The SUP is currently divided into three phases. The first one was implemented in 2013 and included installation of the passive containment filtered venting system and the replacement of active hydrogen recombiners with passive ones which are also capable to manage hydrogen in

severe accidents. The second phase is underway. Within this phase the flood protection of the nuclear island, the installation of the pressurizer PORV bypass and the upgrade of the bunkered building 1 electrical power supply have been finished. Other improvements within this phase, i.e. the reconstruction of the operations support centre, the alternative cooling of the spent fuel pool, the alternative cooling of reactor coolant system (RCS) and containment, the installation of emergency control room (ECR), the ECR ventilation and habitability system, and the replacement/upgrade of critical instrumentation are still under implementation; the deadline for their completion was extended until the end of 2019. Regardless of the state of the second phase, the third phase of the SUP has already commenced. The works began on the bunkered building 2 which will house additional sources of borated and un-borated water with injection systems to the RCS and steam generators. The new dry spent fuel storage facility is in the licensing process. The deadline for the completion of the third phase has been set to the end of 2021.

14.2 Verification of Safety

14.2.1 *Actions of the Licensee*

In 2012 the SNSA issued a decision which allowed the Krško NPP to extend its life span beyond 2023 if the given conditions are met. The US NRC requirements were used during the regulatory process. Amongst the conditions to extend its operational life span the Krško NPP will have to finalize the already planned safety upgrades, to regularly implement periodic safety reviews in a ten-year cycle and to maintain the Ageing Management Programme (AMP). The AMP was developed in accordance with the NRC requirements as stipulated by 10 CFR 50.54 (License Renewal Program) and meets all the requirements of NUREG-1801 – GALL. The objective of the AMP is to determine whether the ageing processes are being managed effectively and if the required safety margins are maintained. The programme connects more than 40 plant programmes, such as In-Service Inspection Programme, Containment Inspection Programme, Boric Acid Inspection Programme, Erosion and Corrosion Monitoring Programme, Steam Generators Programme, Air Operated Valves Programme, Cable Ageing Programme, Reactor Vessel and Control Rods Programme. In 2017 Slovenia prepared the Technical Report within the Topical Peer Review (TPR) on aging management under the 2014 Amended Nuclear Safety Directive. The report covered the aging management of electrical cables, the concealed pipework, the reactor pressure vessel and the concrete shield building in the Krško NPP. Currently the TPR Action Plan is being finalized for the Krško NPP in order to further improve the aging management in the mentioned areas; the plan was set up in accordance with the TPR results and recommendations published by ENSREG in 2018 regarding good practices, areas for improvement and challenges.

The In-Service Inspection (ISI) program is carried out by the plant's specialists and subcontractors. The program is in compliance with the regulatory policy 10 CFR50.55a and ASME Code XI, the components subject to examination are Class 1, 2 and 3 pressure retaining components and their integral attachments. The US NRC Regulatory Guides are applied here as well, which may require additional examination when the component part is not covered by the ASME Section XI. The ISI program employs the examination techniques as described in ASME Section XI and ASME Section V, such as the visual examination method, the surface examination method including magnetic particle, liquid penetrant and eddy current, and the volumetric examination method including

ultrasonic, radiographic, eddy current and acoustic emission examinations. The inspection intervals last 10 years. The results of the In-Service Inspections are reviewed and evaluated after each outage. The procedure for the correction of deviations has been established.

The periodical verifications of the efficient connection of activities from different programmes is required with regard to components failure, the trends of components and systems performance, the corrective actions prioritization and the verifying of the status of long-term investment plan and maintenance activities.

The monitoring of the effectiveness of maintenance is implemented by the Maintenance Rule program. Since 2001 the Maintenance Rule Expert Panel quarterly evaluates and reports on the performance or condition of structures, systems and components. The Maintenance Rule scoping, performance criteria and implementation are performed according to the updated procedures.

With the purpose of establishing and maintaining evidence that structures, systems and components will perform their function under normal and accidental environment conditions, the "Environmental Qualification Programme" (EQ) is being developed together with appropriate procedures. In accordance with requirements from 10 CFR 50.49 and standard IEEE 323-1974, the EQ program includes safety related electrical equipment located in harsh environmental conditions. An additional scope of EQ (the so-called Equipment Survivability requirements) was added into the EQ program in 2018 in accordance with WENRA Safety Reference Levels for Existing Reactors and the IAEA Specific Safety Requirements SSR-2/1.

14.2.2 Regulatory Surveillance

The SNSA carries out its surveillance responsibilities with a combination of tasks, e.g. inspections, review of documents, approval of modifications and regular monitoring and evaluation of the NPP's performance. During the refuelling outage the technical support organizations are engaged to inspect and evaluate selected activities of plant maintenance and testing. The SNSA does not have resident inspectors on site. Inspectors, based at their headquarters in Ljubljana about 100 km from the plant, and have more than 70 inspection days yearly on site during non-outage years. Furthermore, the inspectors are present every day at the NPP during the outages.

During the plant outages the inspections of the plant staff and subcontractors' work are performed more frequently. As a result of the supervision of the plant outage, the SNSA prepares a report called "The analysis of outage at the Krško NPP", which includes a list of planned SNSA activities aimed to improve outage activities or to eliminate the deficiencies found at the Krško NPP during the outage.

The SNSA also carries out its surveillance responsibilities through the systems of safety performance indicators, the operational experience (OE) and event analyses, as described in Section 10.3: Regulatory Oversight of Licensees on Prioritization of Safety.

The SNSA has developed its own system for tracking, screening and evaluating operational experience of the nuclear installations. The SNSA staff regularly track the operating experiences throughout the world and screen them for applicability in the Slovenian nuclear facilities. The operating experiences which pass the screening are thoroughly evaluated and also the recent

operational events in these facilities are taken into account. If the analysis shows that the lessons learned are also applicable for Slovenian licensees, then more information is gathered to do the evaluation and appropriate corrective actions are considered. Recently, minor modifications of some of the Krško NPP's procedures were implemented considering the foreign operating experience, but no major corrective actions or modifications were needed regarding the international lessons learned during the last few years.

The Slovenian licensees shall submit a report to the SNSA if a situation important to safety occurs. Such a report shall include a brief description of the event, description of the state of the systems, structures and components (SSC) before the event, overview of relevant domestic and foreign operating experience, timing of the event, deviations from the expected response or measure, the probabilistic safety analysis of the event, the analysis of contributing, direct and root causes, implemented and planned measures with their time scale and potential evaluation, and the classification of the event according to the international nuclear and radiation event scale. In parallel, the SNSA has developed the internal system for event analyses. It serves for identification of shortcomings in the NPP operation and for the identification of priority areas of the SNSA operation oversight.

In the spring of 2017 the Krško NPP hosted the Operational Safety Review Team (OSART) mission. The OSART team concluded that the Krško NPP is committed to improving the operational safety and reliability of their plant. Several areas of good performance were identified as well as some recommendations were proposed. The most important of these recommendations referred to the need for improvement of the programme for managers to reinforce their expectations of plant personnel behaviour and practices, enhancement of training programme for all personnel performing tasks important to safety, and the improvement of the prioritization, implementation and monitoring of safety related activities to ensure their timely completion. The OSART Follow-up mission took place in the autumn of 2018. It was concluded that the Krško NPP has systematically analysed the OSART recommendations and suggestions and developed the adequate action plan to address the shortcomings.

In conclusion, the Slovenian regulations and practices are in compliance with the obligations of Article 14.

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.

15.1 Dose Limits and Control of Occupational Exposure

The radiation exposure of workers and the public is limited according to the Decree on dose limits, reference levels and radioactive contamination (UV-2). The regulatory approved effective dose constraint is set to 15 mSv per year for the Krško NPP workers of category A. The annual limit for equivalent dose for eye lenses has already been set by the Krško NPP to 20 mSv (the revised ICRP limit).

Individual exposures are measured monthly with passive optically stimulated luminescent dosimeters and daily with electronic alarm dosimeters. The Krško NPP has its own accredited methods of its dosimetry service, approved by the Slovenian Radiation Protection Administration (SRPA). The exposure data for plant workers also include neutron doses and internal exposures derived from the whole body counter measurements. The dose constraint for internal dose is set to 0.2 mSv per year. Table 3 shows personal dosimetry data for the past years.

Table 3: Personal dosimetry data for 2016-2018 for Krško NPP workers and contractors (outside workers).

2016			
	No. of persons	Average dose (mSv)	Maximum measured dose (mSv)
NPP personnel	407	0.33	5.66
Outside workers	895	0.43	5.60
Total	1302	0.40	
2017			
	No. of persons	Average dose (mSv)	Maximum measured dose (mSv)
NPP personnel	371	0.09	7.56
Outside workers	386	0.07	1.94
Total	757	0.08	

2018			
	No. of persons	Average dose (mSv)	Maximum measured dose (mSv)
NPP personnel	416	0.47	9.69
Outside workers	1092	0.54	6.76
Total	1508	0.52	

Radiation protection in the Krško NPP is organized and implemented by the Radiation Protection Unit (RPU). There are sixteen well-educated and trained staff members. Three of them have university degree and the others are technicians, which perform tasks based on the internal written procedures. The head of the RPU is a qualified expert in radiation protection.

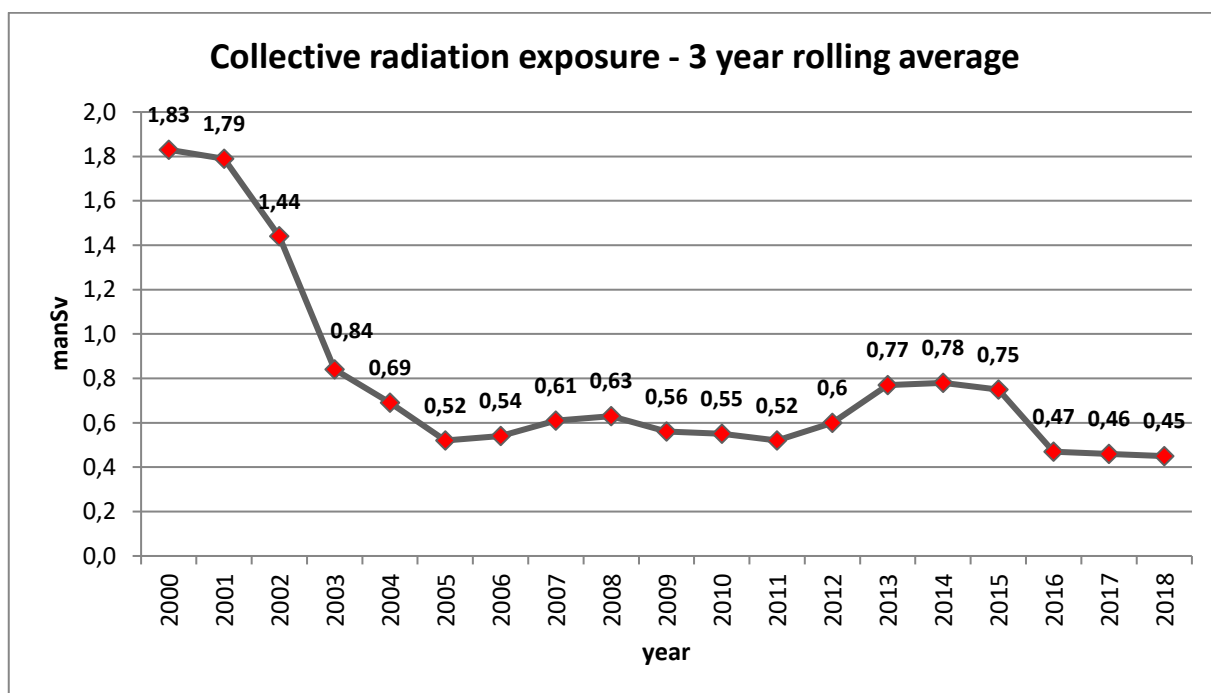


Figure 4: Collective radiation exposure in the Krško NPP

Figure 4 shows the 3-year rolling average of collective doses in the Krško NPP in the period from 2000 to 2018. After 2000, when both steam generators were replaced, the collective doses reached new lower expected values for the Krško NPP. Then the reactor vessel head replacement was performed in 2012 with new gamma and neutron shielding. In the following year resistance temperature detectors (RTD) by-pass piping was removed and these also have beneficial effect for the future maintenance activities. During the outages in 2013 and 2015, the radiation protection

staff carefully controlled the additional beta/gamma and alpha contamination due to some fuel failures caused by the rod fretting. No cases were detected of the effective dose exceeding 15 mSv or the internal dose over 0.2 mSv per year. After the work on the reactor baffle up-flow conversion in the 2015 outage the problem of fuel failures has been eliminated.

Between 2016 and 2018, the construction of the new waste manipulation building took place to improve the working conditions for the staff and to optimise the contaminated water management. The preparations required additional radioactive waste handling and drums transportation. These actions resulted in maximum individual doses of 7.56 mSv in 2017 and 9.69 mSv in 2018.

15.2 Radioactive Discharges and Environmental Monitoring

The authorised dose limit for the members of the reference group due to radioactive discharges from the Krško NPP during its normal operation was set to 50 μSv per year. This figure takes into account all the pathways of radionuclide transfer. Additionally, the limit of 200 $\mu\text{Sv}/\text{y}$ was set for external radiation from the plant facilities, controlled at the fence. Additional operative controls are set by the limitations of gaseous and liquid discharges (see Table 4). The annual limits of discharged activities into the environment are stipulated by the operation license of the Krško NPP. The limits of annual liquid releases are given for the fission and activation products and separately for ^3H . Besides the annual limits, the quarterly limit for fission and activation products (without ^3H) is also set. The annual activity releases of noble gases to the air shall be within the total dose limit ($< 50 \mu\text{Sv}$), and there are also additional radioiodine isotopes (in ^{131}I equivalent) and aerosols activity limits for a calendar year.

The environmental radioactivity monitoring of the nuclear installation is defined in the Rules on the monitoring of radioactivity (JV10) and prescribed in detail within the Plant Radioactive Effluent Technical Specifications.

The SNSA annually reports to the European Commission on the radioactive releases from nuclear installations according to the requirements of Article 37 of the Euratom Treaty.

The gaseous effluent monitoring results and the monthly modelling of the so called “ground release” in all of the wind directions from the Krško NPP showed that the annual effective dose at 500 m distance from the reactor is between 1 and 2 μSv .

The off-site radiological monitoring reports for the year 2018 showed that the conservatively estimated effective dose received by the members of the general public as a result of the Krško NPP emissions amounts to a value of less than 0.19 μSv per year including the atmospheric and liquid discharges. There is no substantial change regarding the previous years. The value 0.19 μSv per year represents 0.38 % of the authorised effective dose limit (50 μSv) which is the sum of the contributions from all exposure pathways to the member of the public at 500 m distance from the reactor or beyond. Therefore, estimated sum of all radiation contributions from the NPP to the member of the public in its vicinity is only about 0.01 % of the characteristic unavoidable natural background.

Table 4: Released activities from the Krško NPP in the period 2015-2018 and the corresponding limits

LIQUID EFFLUENTS		2015	2016	2017	2018
Fission and activation products Limit: 100 GBq	Released activity	33.6 MBq	13.8 MBq	7.2 MBq	16.9 MBq
	% of the limiting value	0.034 %	0.014 %	0.007 %	0.017 %
Tritium (H-3) Limit: 45 TBq	Released activity	16.3 TBq	19.9 TBq	8.6 TBq	10.5 TBq
	% of the limiting value	36.2%	44.2%	19.2%	23.4%

GASEOUS EFFLUENTS		2015	2016	2017	2018
Fission and activation gases Limit: dose < 50 µSv	Released activity	3.72 TBq	1.25 TBq	1.33 TBq	0.97 TBq
	% of the limiting value	0.31%	0.1%	0.09%	0.08%
Iodines (I-131 and others) Limit: 18,5 GBq (eq. ¹³¹ I)	Released activity	764 MBq	52.7 MBq	8.2 MBq	27.2 MBq
	% of the limiting value	1.19 %	0.06 %	0.015 %	0.014 %
Aerosols (cobalt, cesium ...) Limit: 18.5 GBq (eq. ¹³¹ I)	Released activity	1.33 MBq	730 kBq	1.41 kBq	5.94 kBq
	% of the limiting value	7.2E-3%	4E-3 %	7.6E-6 %	3.2E-5%
Tritium (H-3) No limit	Released activity	5.56 TBq	6.17 TBq	6.08 TBq	5.13 TBq
Carbon (C-14) No limit	Released activity	78.6 GBq	118 GBq	76.7 GBq	132 GBq

15.3 Implementation of the optimisation principle (ALARA)

Every radiation practice shall cause exposure only to the level which is as low as reasonably achievable, taking into account the economic and social factors (the principle of radiation protection optimization). The radiation protection in the NPP is effectuated by the RPU, which is separated from other organization units. The trained engineers and technicians in the unit perform the tasks based on the internal written procedures.

In addition, there is the regulatory requirement that an independent qualified expert shall prepare an overall radiation survey at the NPP site and give assessment twice a year regarding the activities of the NPP Radiation Protection Unit. In the cases of ALARA plans (e.g. during outages or during some other demanding works), when the planned collective dose is higher than 100 man-mSv or when the planned individual dose is higher than 10 mSv, the qualified expert has to control such works.

The optimisation of radiation exposure covers aspects such as the nature of a job, the configuration of the workplace, suitable tools, training, preventive measures against radiation and other risks at the workplace.

The collective doses in the Krško NPP shown in the Figure 4 were optimized by the ALARA planning.

15.4 Regulatory Control Activities

The Krško NPP applied for additional licences, other than those covered by the operating licence. In 2004 the SNSA issued the licences for internal industrial radiography, for an X-ray device used in the internal control of received goods, and for radioactive sources for the calibration of radiation measurement equipment. These radiation sources are regularly inspected by the SNSA.

The site inspections of the NPP concerning radiation protection were mostly oriented to the control of the workers' exposure. The inspections were carried out by the SRPA. They covered the external and internal exposures, the maximum individual exposures, the overview of working procedures, the classification of workers in the categories A and B, the medical surveillances of workers, the organisational scheme during the outage, and so on. In addition to the exposure of internal and outside workers during the operation period and during outages, the inspections also included a review of the ALARA programme.

The SNSA inspectors ensure oversight of the Krško NPP environmental monitoring programme, as well as they conduct joint inspections with the SRPA inspectors.

Extensive inspections were also related to the control of solid materials, which were released from the NPP site. The usage of clearance levels was inspected, as well as the process of decontamination at the site. The Krško NPP updated the clearance levels according to the legislation.

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

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.*
3. *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.*

16.1 Regulatory Requirements

The nuclear emergency preparedness and response in Slovenia is regulated with the 2017 Act and the Act on Protection against Natural and Other Disasters, which was issued in 2006. There are two responsible and competent authorities to regulate and supervise the Krško NPP emergency preparedness: the Administration of the RS for Civil Protection and Disaster Relief (ACPDR), which is responsible for the EPR and the development and implementation of emergency response plans, and the SNSA, which is responsible for on-site procedures and measures related to nuclear and radiological safety.

The Act on Protection against Natural and Other Disasters provides for general requirements for the emergency management system, including the legislative and regulatory framework for preparedness against a nuclear or radiological emergency, the risk assessment, the response planning in all levels (state, regional, local, operator's level), human, financial and other resources for adequate response, the system of alarming and notification etc.

The operator's emergency response plan is a part of the safety analysis report, which is the principal licensing document for any nuclear facility. The 2017 Act provisions mostly focus on the intervention measures in case of emergency, their planning and optimization and the dissemination of information among all the stakeholders. According to these provisions the operator needs to be capable to classify accidents, to assess the consequences of the event and to propose countermeasures. In the operator's emergency plan the intervention measures should be planned upon the emergency class declared. Based on the classification of possible emergencies, the operator shall ensure the technical and other conditions, for example a skilled team for the implementation of radiological measurements to provide during an emergency the assessment of

consequences of the emergency and to determine the extent of the necessary protective measures. The operator shall provide to the emergency planners all the requested information which is available. The operator shall maintain the emergency preparedness and provide response as stipulated by the on-site emergency plan. The emergency response plans shall be prepared with the objective to avoid deterministic effects and reduce the risk of stochastic effects, taking account of the general principles of radiation protection and the reference levels as set by in the legislation. The 2017 Act sets requirements for prior information and training for emergency workers, for information to the members of the public likely to be affected in the event of an emergency, for information to the members of the public affected in the event of an emergency as well as for international notification and cooperation.

The Decree on the content and elaboration of protection and rescue plans (i.e. emergency response plans) sets the requirements for the content of the emergency response plans on all levels, the procedure of adoption of plans, including provisions on public participation and coordination with stakeholders, maintaining and revising of plans and publicity of plans. In 2019 the Decree on the content and elaboration of protection and rescue plans was amended in order to transpose the Euratom Basic Safety Standards (BSS) Directive). The changes and additions in the decree specify additional contents of the emergency plans in case of a nuclear or radiological accident.

The last revision of the National Nuclear or Radiological Emergency Plan was adopted by the Government in 2010. The new revision is under preparation.

16.2 Implementation of Emergency Preparedness Measures

As defined in the National Emergency Response Plan the SNSA maintains the KID, a web-based communication system, used during nuclear or radiological emergencies for information and data exchange. The system is not used only at the national level but also for communication and harmonization of the cross-border protective actions with Croatia. In 2016 a new feature, StatusID was introduced in KID. StatusID is an overview of all relevant and key information on the event in a form of a summary board. StatusID is an important part of KID now and it has proven to be very useful during the last two years – it helps the users to have a better overview of the ongoing event and it offers a more structured and organized management of information. By the end of 2018 there were 34 national organizations registered as users of the system.

The process for maintaining iodine thyroid blocking preparedness started in 2009. The pre-distribution in 10 km radius around the Krško NPP and regional stock piles were established across the country in 2013. The response of the public to the pre-distribution in the 10 km zone around the Krško NPP in 2013 was below 10 %, the repeated pre-distribution in 2017 (after prolongation of the shelf life of tablets) is still low for the time being.

Throughout the reporting period the Krško NPP maintained the operability of emergency centres and equipment, regularly updated emergency documentation and performed systematic monthly communication testing and checking of emergency personnel response. The Krško NPP Emergency Plan, revision no. 35, was issued in October 2018.

16.3 Informing the Public

Based on requirements of the 2017 Act the operator of a radiation or nuclear facility shall regularly inform the public of the important facts of/for the emergency response plans and, in particular, the envisaged protection actions and how they shall be implemented. This information shall be updated at regular intervals or in case of major changes. This information shall be accessible permanently. The Krško NPP prepared the information brochure entitled “How to Act in Case of a Nuclear Emergency” for people living within the area of planned urgent protective actions. The last update of this brochure was in 2014.

16.4 Training and Exercises

In average there are around 100 emergency trainings and exercises carried out at the SNSA per year. The training and exercises are one of the major activities of the emergency preparedness process.

The Krško NPP has a long tradition in systematic training of its personnel for emergency response. Besides the regular training, they conduct annual exercises run by their full scope simulator, which are jointly organized with the SNSA.

The SNSA actively and regularly cooperates with domestic and international organizations in conducting and participating in different exercises. In this reporting period the following large exercises were conducted: regular annual NPP exercises (two in 2017 and two in 2018) and ConvEx-3, joined by ECUREX-2017 in June 2017. The main lesson learned from the ConvEx-3 exercise was an inadequate regional cooperation. Slovenia as a neighbouring state could not communicate directly with the accident country - Hungary, despite using the pre-planned communication channels. One of the solutions for this would be to upgrade the existing communication channels with proper communication protocols and to continue to promote awareness that in emergencies with cross-border impacts active cooperation of all effected countries is essential. Another lesson learned was the overflow of information on international information exchange web systems - WebECURIE and USIE. As a result, the SNSA has set the criteria for filtering the information and adjusted organizational procedures to prepare the SNSA emergency team for future situations of this kind.

In January 2019 the SNSA organized the first national exercise on cyber security at nuclear facilities KIVA2019. The exercise was attended by participants from all key stakeholders in nuclear sector: the nuclear facility operator, competent authorities, technical support organizations and suppliers of computer equipment and by external observers. The exercise has shown that the improvement of the information sharing on a national and international level and harmonization of the response arrangements for cyber-attacks by all key stakeholders in nuclear sector are needed.

During the reporting period the importance of regular and frequent trainings of the emergency personnel was recognized several times and at different levels, in particular during the exercises. Besides the regular updates of the SNSA’s emergency preparedness and response procedures, the procedure at the national level for international assistance was amended and defined in more detail (based on lessons learned during the participation in ConvEx-2b exercise in October 2018) and

the need to be better prepared for security-safety related events was identified (based on results of the KIVA2019 exercise).

16.5 International Agreements and International Projects

Slovenia is a party to the Convention on Early Notification of a Nuclear Accident and to the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency. Slovenia has bilateral agreements with Austria, Croatia, Hungary and Italy on the early exchange of information in the event of a radiological emergency. Emergency preparedness is the regular item on the agenda at bilateral meetings with Austria, Italy and Croatia and at the quadrilateral meetings of the Czech Republic, Hungary, Slovakia and Slovenia, which are held every year.

Slovenia regularly and actively participates in different consultancies and technical meetings organized by the IAEA to support the development of new documents and to strengthen its own emergency preparedness.

The SNSA also regularly and actively participates at the ECURIE meetings to support the development of WebECURIE and to strengthen its own emergency preparedness.

In November 2017 Slovenia hosted an EPREV (“Emergency Preparedness REView”) mission, designed to provide a peer review of emergency preparedness and response (EPR) arrangements in a country based on the IAEA Safety Standards.

As a part of preparation for the mission, Slovenia conducted a self-assessment, which included the preparation of a self-assessment report, the translation of all relevant documentation (legislation, regulations, plans, procedures, etc.) and a simulated EPREV mission in 2016, which revealed several possibilities for the improvement of EPR arrangements before the start of the mission.

The mission in 2017 reviewed the preparedness and response system at all levels. The mission report served as the basis for the Slovenian Action Plan for the implementation of the 19 recommendations and 12 suggestions with the aim of improving of the EPR system in the next few years. Subsequently, Slovenia will invite the IAEA for an EPREV Follow-Up Mission to review the implementation of the Action Plan.

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

ARTICLE 17. SITING

Each Contracting Party shall take the appropriate steps to ensure that appropriate procedures are established and implemented:

- (I) for evaluating all relevant site-related factors likely to affect the safety of a nuclear installation for its projected lifetime;*
- (II) for evaluating the likely safety impact of a proposed nuclear installation on individuals, society and the environment;*
- (III) for re-evaluating as necessary all relevant factors referred to in sub-paragraphs (I) and (II) so as to ensure the continued safety acceptability of the nuclear installation;*
- (IV) for consulting Contracting Parties in the vicinity of a proposed nuclear installation, insofar as they are likely to be affected by that installation and, upon request providing the necessary information to such Contracting Parties, in order to enable them to evaluate and make their own assessment of the likely safety impact on their own territory of the nuclear installation.*

17.1 Evaluation of Site Related factors

The licensing process of a nuclear facility is stipulated by the 2017 Act, the Act on Environmental Protection (Official Gazette 39/06 with subsequent amendments), the Act on Spatial Planning (Official Gazette 61/17), the Construction Act (Official Gazette 61/17 and 72/17), the Rules on radiation and nuclear safety factors (JV5), the Decree on environmental encroachments that require environmental impact assessments (consolidated text - Official Gazette 51/14, 57/15 and 26/17) and the Decree amending the Decree on the method of drafting and on the content of the report on the effects of planned activities affecting the environment (Official Gazette 40/17).

The regulations in the above paragraph provide the legal framework for the nuclear and radiation safety documentation and the documentation for an environmental impact assessment, required by a potential licensee. Also, the requirements regarding consents and licenses to be issued, as well as the participation of the public and/or the neighbouring states are laid down in those regulations.

According to the 2017 Act, the safety documentation needed to build a safety case to prove the nuclear and radiation safety during the siting and construction of a nuclear facility shall consist of three main documents:

- the Environmental Report (ER),
- the Environmental Impact Assessment, and
- the Safety Analysis Report (SAR).

The content of all three documents is similar, but their extent and scope differ, as the level of required details increases from the ER to the SAR and at each stage a re-evaluation of safety is needed.

Article 95 (the siting of a nuclear facility) of the 2017 Act determines that the selection of a site for the location of a nuclear facility shall be based on an Environmental Report (ER), of which a special part will be dedicated to the nuclear and radiation safety. This part of the ER will be used to assess all the factors at the site of the future nuclear facility which may affect the nuclear safety of the facility during its active life and the effects of the facility operation on the population and the environment.

This special part of the ER shall include:

- field investigations and analysis of characteristics of the site area (e.g. geological, seismological, seismotectonical, geotechnical, hydro-geological and meteorological investigations, the extreme impacts of human activities in the site area, demographic and socio-economic characteristics, as well as the use of terrain and water in the site area including especially protected areas, the areas of special application and ecologically sensitive zones.),
- the assessment of radiological impact of the nuclear facility on humans and environment,
- the feasibility study of the emergency plan, and
- a proposal of design bases for the nuclear facility and safety measures, that result from the analysis of characteristics of the site area and selected external design basis events.

The detailed content and scope of the part of the ER dedicated to nuclear and radiation safety are determined by the SNSA at the beginning of the siting process.

The Rules JV5 stipulate that the design bases shall take into account, besides the internal initiating events, as a minimum, the following external natural hazards together with their relevant and still probable combinations:

- geological hazards,
- seismotectonic hazards,
- meteorological hazards,
- hydrological hazards,
- biological phenomena,
- forest fire.

Besides the natural hazards, the design bases shall also take into account man-made events, such as aircraft accidents and other transportation accidents, as well as the events in other industrial facilities in the vicinity or at the site, including other units on the site, which could cause fires, explosions or other hazards that could affect the power plant.

The Rules JV5, which stipulate the design bases of the nuclear facilities, were amended in 2016, taking into account the Fukushima Daiichi accident's lessons learned and the revised WENRA Reference Levels. The Design Extension Conditions are added to external hazards through paragraph 5.6 of Appendix 1 of these Rules. When assessing the effects of the natural hazards

included in the design extension conditions analysis, and identifying reasonably practicable improvements related to such events, analysis shall, as far as practicable, include:

- demonstration of sufficient margins to avoid cases where small change of a parameter could cause extensive and unacceptable consequences, such as loss of a fundamental safety function;
- identification and assessment of the most resilient means for ensuring the fundamental safety functions;
- consideration that events could simultaneously challenge several redundant or diverse trains of a safety system, multiple SSCs or several units at multi-unit sites, site and regional infrastructure, external supplies and other countermeasures;
- demonstration that sufficient resources remain available at multi-unit sites considering the use of common equipment or services;
- on-site verification (typically by walk-down methods).

The Environmental Impact Assessment is stipulated in Article 53 of the Act on Environmental Protection and applied during the issuing of the environmental protection consent for a nuclear facility. The SNSA proposes the content of the Environmental Impact Assessment in the part related to radiation and nuclear safety. The conditions, the scope and the content of the Environmental Impact Assessment is drawn up by the Environmental Agency of the Republic of Slovenia (EARS) on the basis of the SNSA proposal.

The Safety Analysis Report is required for the approval of the construction of a facility. An investor, who intends to construct the nuclear facility, needs to submit a Safety Analysis Report together with the application for the approval and also with the project documentation along with the opinion of an authorized expert for radiation and nuclear safety. The content of the Safety Analysis Report is determined by the Rules JV5.

According to the Act on Spatial Planning and the 2017 Act the siting of the nuclear facilities and the conditions for their location in a spatially and functionally contained area is governed by the National Spatial Plan. The purpose of the National Spatial Plan is to give the holistic estimation of environmental impacts. An Environmental Report shall give sufficient information about acceptable impacts that the facility might have on the environment and members of the public. After the preparation of the Environmental Report it is the subject to public hearing and the consultation with the neighbouring states (cross-boundary impacts) and becomes a public document. The public hearing shall take at least 30 days. The competent ministries and organizations prepare their positions to the opinions and comments given by the public and the neighbouring states. When positive opinions of all competent ministries, municipalities and other organizations are given, the National Spatial Plan is adopted with a governmental decree. Together with adoption of the National Spatial Plan, the design conditions are also issued.

The procedure is similar for the Environmental Impact Assessment (EIA), which is necessary for obtaining the Environmental Protection Consent from the EARS. The investor of the sited nuclear facility needs to submit an Environmental Impact Assessment, which includes the description of the project, its impacts to the environment, the comparison with other assessed alternatives and

proposed mitigating activities. Similar to the Environmental Report in the National Spatial Plan stage, the EIA is a subject to public hearing and consultation with neighbouring states. Before issuing the environmental protection consent, the EARS shall obtain positive opinions from competent ministries and organizations and a preliminary consent on nuclear and radiation safety from the SNSA.

17.2 Impact of the Installation on Individuals, Society and Environment

As described in the previous subchapter, the special part of the Environmental Report (ER) dedicated to nuclear and radiation safety shall also present the assessment of radiological impact of the nuclear facility on humans and the environment. This part shall include the assessments of radioactive releases during normal operation and accident conditions, dispersion of the releases into the atmosphere and water (surface water and groundwater), land use and population distribution, as well as the evaluation of the effect of facility releases on the population.

The amended Rules JV5 stipulate (in line with the WENRA reference levels and requirements for new designs) that the accidents with core melt, which would lead into early or large releases, shall be practically eliminated, meaning that this kind of accidents shall be almost impossible by design. Yet for accidents that cannot be practically eliminated, solutions shall be in place to assure that only limited protective measures in area and time are needed for the public (no permanent relocation, no need for emergency evacuation outside the immediate vicinity of the plant, limited sheltering, no long-term restrictions in food consumption).

17.3 Re-Evaluation of Site Related Factors

The 2017 Act as well as the above-mentioned Rules JV5 and the Rules on operational safety of radiation and nuclear facilities (JV9) stipulate that the plant shall perform a Periodic Safety Review (PSR), which shall, besides re-evaluating design against newest standards and assessing the overall state of the power plant, also re-evaluate the natural hazards on site taking into account the latest site related data and the state-of-the-art methodologies.

The result of the first PSR for the Krško NPP (2003) was the re-evaluation of seismic and flooding hazards, which both resulted in several large improvements, such as installing the third safety related diesel generator, upgrading the flood protection dikes, etc. Some other hazards (severe winds, aircraft accidents) were reassessed and recommendation for improvements were given.

The review of the natural hazards was again part of the second PSR (2013), which again suggested some hazard re-evaluations (heavy rainfalls, floods and droughts, lightning, aircraft accidents, etc.) taking into account the latest site related data.

17.4 Consultation with other Contracting Parties Likely to be Affected by the Installation

Public involvement in the siting process is ensured through spatial conferences, public hearings, neighbouring states consultation and the public availability of the documentation. It starts with the presentation of the National Spatial Plan and the Environmental Report to the general public. Consultation with the neighbouring states takes into account the Espoo Convention in the National Spatial Plan stage of the siting. A similar procedure is followed in the process of obtaining environmental protection consent, for which the EIA is required. The documentation shall be

available to public at least 30 days, while the duration of consultation with neighbouring states is agreed upon between the states. The competent ministries and organizations prepare their positions on the opinions and comments given by the public and neighbouring states. Both, the final National Spatial Plan and the environmental protection consent, are adopted and issued respectively after positive opinions of all competent ministries, organizations and local communities have been issued.

In the last stage, the investor needs to obtain the construction license by forwarding the Safety Analysis Report, which is also a public document. There are no special provisions for the public hearing of the Safety Analysis Report. However, in accordance with the Act on General Administrative Procedure any person, who demonstrates their legal interest, has the right to participate in the licensing procedure.

In conclusion, the Slovenian regulations and practices are in compliance with the obligations of Article 17.



ARTICLE 18. DESIGN AND CONSTRUCTION

Each Contracting Party shall take the appropriate steps to ensure that:

- (I) the design and construction of a nuclear installation provides for several reliable levels and methods of protection (defense in depth) against the release of radioactive materials, with a view to preventing the occurrence of accidents and to mitigating their radiological consequences should they occur;*
- (II) the technologies incorporated in the design and construction of a nuclear installation are proven by experience or qualified by testing or analysis;*
- (III) the design of a nuclear installation allows for a reliable, stable and easily manageable operation, with specific consideration of human factors and the man-machine interface.*

18.1 Implementation of Defence in Depth

The construction license for a nuclear facility is issued by the Ministry of Infrastructure on the basis of the Construction Act (Official Gazette 61/17 and 72/17). The investor can submit the application for it only after the SNSA gives its opinion for construction (as stipulated in Article 97 of the 2017 Act). The submitted application for the opinion for construction needs to include project documentation (e.g. design for construction license), the Safety Analysis Report including relevant evaluations, the opinion of authorized expert for radiation and nuclear safety, the decommissioning programme, and other documents. The contents of the project documentation and other conditions are prescribed by the Rules on radiation and nuclear safety factors (JV5).

The 2017 Act and the Rules JV5 contain provisions for the Defence in Depth concept. According to the Rules, this concept shall be used as the basic design criteria for designing a nuclear facility and especially for designing safety systems, systems for mitigating radioactive releases and fire protection systems. Also the JV5 stipulates that external hazards must be considered in the design bases of the plant. As a minimum, the following external initiating events must be taken into account:

- extreme winds,
- extreme outside temperatures,
- extreme rainfall, extreme snowfall, flooding, extreme cooling-water temperatures and freezing,
- earthquakes,
- aircraft crashes,
- other events on nearby transport routes, in industrial facilities or within the site region that might lead to fire, explosion or other hazards to the safety of the nuclear power plant.

The Rules JV5 were revised in 2016 and took into account the amendments of the Fukushima Daïichi accident lessons learned, the revised WENRA Reference Levels of September 2014, as well as the WENRA's "Safety of New NPP Designs" report. Major changes, in particular those coming

from the revised WENRA Reference Levels, concerning the design extension for existing reactors and the area of natural hazards, which require the reasonably achievable improvements to be implemented, which would ensure the plant could withstand less frequent initiating events (internal and external) and their combinations.

The Krško NPP was designed and constructed in compliance with the US NRC "General Design Criteria (GDC) for Nuclear Power Plants", Appendix A to 10 CFR 50, thus ensuring the use of the criteria such as single failure, protection by multiple fission product barriers, redundancy, independency, diversity, fail safe failure modes, etc.

The introduction of Severe Accident Management Guides (SAMG) has been strongly encouraged by the SNSA. Thus, SAMGs were introduced at the Krško NPP in 2000. The Rules on operational safety of radiation and nuclear facilities (JV9) adopted in 2009 introduced formal requirements for SAMGs in accordance with WENRA harmonized requirements. At the same time the adopted Rules JV5 stipulated that the plant shall upgrade its systems, structures and components to enable coping with severe accidents after the plant lifetime was extended.

Due to the Fukushima accident and the progress in the licensing process for the lifetime extension, the SNSA decided to speed up the above-mentioned plant's evaluation and implementation of severe accident management measures. Thus, in September 2011 the SNSA issued a decision requiring the plant to reassess the severe accident management strategy, the existing design measures and procedures and to implement necessary safety improvements for prevention of severe accidents and mitigation of its consequences.

This evaluation was finished in January 2012. The action plan was reviewed and approved by the SNSA and should be completely implemented within the Safety Upgrade Program (SUP) by the end of the year 2021. The Krško NPP's SUP includes several large modifications, such as:

- Installation of containment filtered venting system and passive autocatalytic recombiners (PARs),
- Installation of additional pumps in the bunkered building (BB2) for injecting un-borated water into steam generators and reactor, as well as indirectly also to the containment spray system,
- Installation of additional residual heat removal pump and dedicated heat exchangers,
- Installation of additional pressurizer relieve valves qualified for severe accidents conditions,
- Acquisition of mobile heat exchanger that can be connected to the spent fuel pool,
- Installation of permanent sprays around the spent fuel pool,
- Safety upgrade of AC supply,
- Establishment of emergency control room (with provisions for long term habitability even in case of severe accidents),
- Installation of separate instrumentation and control dedicated for severe accidents,
- Establishment of new technical support facility with provisions for long term habitability even in case of severe accidents and enhancement of existing operational support centre,

- Additional flood protection of the nuclear island.

Some improvements for mitigating severe accidents were considered and implemented even before the Fukushima accident, e.g. the implementation of wet cavity design.

Other important design improvements implemented in the Krško NPP based on results of deterministic and probabilistic safety assessments were:

- Modifications based on 1995 Fire protection action plan,
- Steam generator replacement and power uprate in 2000,
- Reracking of the spent fuel pool project in 2003,
- Reactor building recirculation sump strainer replacement in 2007,
- Reactor pressure vessel head replacement in 2012,
- Installation of the 3rd safety related diesel generator in 2012,
- Upgrade of flood protection dikes in 2012.

18.2 Incorporation of Proven Technology

The Rules JV5 stipulate the use of proven technology as one of the fundamental design principles. Even before the Rules JV5 was passed, the SNSA stimulated the use of proven technologies by stressing its importance during modification licensing. The modifications, which can be demonstrated by the plant, that the technology is well proven by operating experience, testing and analysis, can get the approval of the SNSA much easier than the technology that is used for the first time and has not yet been licensed anywhere else in the world.

It is the Krško NPP's strategic approach not to introduce solutions whose supplier and equipment do not have verified references in other similar nuclear power plants in the world.

18.3 Design for Reliable, Stable and Manageable Operation

The Rules JV5 include requirements for the consideration of human factors in the design of the NPP. This includes the ergonomics of control systems, information needed for safe operation and control, as well as requirements for protection of personnel.

The Rules JV9 require from the operator to implement a plant-specific symptom-based emergency operating procedures (EOP). These assure adequate identification of the event and a reliable and efficient restoration of critical safety functions and stable state of the plant. Likewise, the Rules JV9 require from the licensee the implementation of the severe accident management guidelines (SAMG), which must be based on plant-specific analysis of severe accidents and their phenomena.

Both the EOPs and SAMGs must be validated against all possible scenarios and must be regularly used in trainings of operators with the simulation of events on the plant-specific full-scope simulator.

The Krško NPP has plant-specific EOPs as well as SAMGs in place, which are regularly updated and verified with the use during trainings and simulated exercises on their plant-specific full-scope simulator. Within the implementation of training and exercises the plant also observes the impacts

of the human factors, which are then incorporated into the changes of procedures and controls of the plant if necessary.

The main control room (MCR) of the Krško NPP has systems in place which ensure adequate working conditions for the operators, e.g. the MCR air conditioning, the MCR charcoal clean-up system and chilled water generating and distributing system. During the accident conditions the MCR is automatically isolated. The MCR clean-up system is started to keep the area habitable. The MCR air conditioning and charcoal clean-up systems are redundant, safety related, seismically qualified system energized from independent safety power buses.

In addition, in April 2018 the Krško NPP installed the emergency control room (ECR), which has its own independent power supply system and independent instrumentation and controls, qualified for severe accidents conditions. It is located in the physically separated bunkered building, meeting the Design Extension Conditions to sustain higher seismic loads, severe floods, large aircraft crashes and fires. The plant has also developed special emergency procedures to be used in the ECR. These were also validated at the full scope simulator, which also included the simulator of the ECR. Each modification of the safety related equipment (including MCR) must be reviewed and approved by the SNSA. The SNSA is also regularly informed of all changes in the EOPs and SAMGs. The SNSA inspection and other technical staff regularly oversee the regular operation, changes implemented in the plant. The SNSA staff takes part in the exercises and performs licensing the reactor operators.

In conclusion, the Slovenian regulations and practices are in compliance with the obligations of Article 18.

ARTICLE 19. OPERATION

Each Contracting Party shall take the appropriate steps to ensure that:

- (I) The initial authorisation to operate a nuclear installation is based upon an appropriate safety analysis and a commissioning program demonstrating that the installation, as constructed, is consistent with design and safety requirements;*
- (II) operational limits and conditions derived from the safety analysis, tests and operational experience are defined and revised as necessary for identifying safe boundaries for operation;*
- (III) operation, maintenance, inspection and testing of a nuclear installation are conducted in accordance with approved procedures;*
- (IV) procedures are established for responding to anticipated operational occurrences and to accidents;*
- (V) necessary engineering and technical support in all safety-related fields is available throughout the lifetime of a nuclear installation;*
- (VI) incidents significant to safety are reported in a timely manner by the holder of the relevant license to the regulatory body;*
- (VII) programs to collect and analyse operating experience are established, the results obtained and the conclusions drawn are acted upon and that existing mechanisms are used to share important experience with international bodies and with other operating organisations and regulatory bodies;*
- (VIII) the generation of radioactive waste resulting from the operation of a nuclear installation is kept to the minimum practicable for the process concerned, both in activity and in volume, and any necessary treatment and storage of spent fuel and waste directly related to the operation and on the same site as that of the nuclear installation take into consideration conditioning and disposal.*

19.1 Initial Authorization for Operation

After the construction of the facility is completed the investor applies for the license for the use of the facility, as stipulated by the Construction Act. Before such license is issued, technical check and a trial operation shall be performed. The investor shall also apply to the SNSA for the consent to start trial operation, enclosing the programme for trial operation with other documentation. After issuing such consent the Ministry of the Environment and Spatial Planning issues a decision for the start of trial operation. Note that the trial operation and the technical check represent the commissioning phase, which is a more popular term in the nuclear industry. The purpose of the technical check together with trial operation is to verify that the construction of the object was performed in line with the construction license and that the facility complies with licensed design basis. The technical check and trial operation are supervised, among others, by the SNSA. The Ministry of the Environment and Spatial Planning issues the license for the use of the facility after it verifies that parameters regarding environmental impacts from trial operation meet the prescribed limits.

The operator applies to the SNSA for an operating license after receiving the license for the use of the facility. The application for the operating license shall contain an updated Safety Analysis Report, an opinion from an approved expert for radiation and nuclear safety and other prescribed documentation. The safety report must be updated with the changes that occurred during trial operation.

19.2 Operational Limits and Conditions

In accordance with the 2017 Act, the proposed operational limits and conditions have to be submitted to the regulatory body as a part of the application for an operating license.

The Rules on radiation and nuclear safety factors (JV5) and Rules on operational safety of radiation and nuclear facilities (JV9) define the contents of the operational limits and conditions, with respect to:

- safety limits,
- limiting settings for safety systems,
- limiting conditions for normal operations,
- surveillance requirements,
- requirements for the operator of a nuclear facility related to reporting.

The Krško NPP Technical Specifications are based on NUREG-0452. The SNSA has licensed 13 changes of the Technical Specifications during the last three years that were defined as 3rd category modifications, and three changes, defined as 2nd category modifications. The description of modification categories is in Chapter 14.1.

19.3 Operation, Maintenance, Monitoring, Inspection and Testing

In accordance with Article 27 of the Rules JV5 the documentation submitted for an application for an operating license shall also contain a list of prepared operating procedures and rules together with the plant start-up report, the QA program report, the technical specifications, the Safety Analysis Report and maintenance and testing instructions.

The Safety Analysis Report (SAR) comprises the Initial Test Program, which defines Preoperational Testing and Initial Start-Up Testing. General testing and inspection requirements for systems and components, including the Technical Specifications, are described in the appropriate SAR sections. The Krško NPP developed a set of programs, including administrative and implementing procedures for maintenance, testing and inspection, which are in compliance with the SAR, the Technical Specifications, other regulatory requirements and the in-house requirements.

In the field of operation, there are the following programs and administrative procedures: Conduct of Operation, Tagging, Shutdown Safety and Temporary Modification Control and others.

In the field of maintenance, the Krško NPP has developed the following programs, such as: Preventive Maintenance (separate programs for each specific set of equipment), Predictive Maintenance, Implementation, Monitoring and Evaluation of Preventive Maintenance, Corrective Action, Surface Protection Maintenance, and Technical Surveillance of Civil Structures and Other Structures.

In the field of monitoring, inspection and testing, there are the following programs and administrative procedures, such as: Plant Performance Monitoring, Reliability of Operation and Ageing of the Equipment, System Health and Maintenance Rule, Steam Generator, Emergency Diesel Generator Reliability, Corrosion-Erosion, Fuel Integrity, Control of Civil Structures and Other Constructions, In-service Inspection – the 4th Inspection Interval; Containment Inspection Program; Snubber Program; Boric Acid Inspection Program; ASME Section XI Pump and Valve In-service Testing Documents; Containment Leakage Rate Testing Program; Motor Operated Valves Program; Pressure Vessel Inspection Program; and Fuel Integrity Program.

The activities of the Aging Management Program (AMP) are also being carried out in the Krško NPP through number of programs and procedures such as: In-service Inspection Program - The 4th Inspection Interval; Boric Acid Inspection Program; Open-Cycle Cooling Water System; Closed-Cycle Cooling Water System; Buried Piping and Tank Surveillance Program; Aboveground Steel Tanks; Reactor Vessel Irradiation Surveillance Program; One-Time Inspection Program; One-Time Inspection Program of ASME Code Class 1 Small-Bore Piping; External Surfaces Monitoring Program; Inspection of Internal Surfaces in Miscellaneous Piping and Ducting Components; Containment Inspection Program; Containment Leakage Rate Testing Program; Surveillance Program for Borated Stainless Steel Sheets; Cable Aging Management Program and others.

Existing programs were either fully or partially implemented at the time the aging management program was developed. The partially implemented programs were modified for full implementation. The programs, that were not existing have been developed with the introduction of AMP.

19.4 Anticipated Operational Occurrences and Accidents

The Krško NPP has developed and applied a full set of Abnormal Operating Procedures (AOP), Emergency Operating Procedures (EOP), Fire Response Procedures (FRP) and Severe Accident Management Guidelines (SAMG). The AOPs and EOPs have been reviewed by the SNSA and the technical support organisations. All these sets of procedures were verified during the operator's simulator training. The plant specific symptom based EOPs and SAMGs have been developed based on Westinghouse generic procedures.

19.5 Engineering and Technical Support

In-house capabilities have been developed to provide engineering and technical support at the Krško NPP. It is capable of processing minor design changes in-house. The capability of preparing purchase specifications, reviewing bids and bidder selection, quality assurance, quality control and engineering follow-up of the projects and review and/or acceptance testing of the product are available within organizational units of the Krško NPP.

Other engineering and technical support is assured through outsourcing at research and engineering organisations in Slovenia or abroad. However, major projects require an open bidding process.

The Ministry of Education, Science and Sport financially supports the research and development projects in the field of nuclear safety in the Republic of Slovenia through a research fund.

19.6 Incidents, Significant to Safety

The Article 120 of the 2017 Act (reporting on the operation of facility) stipulates that operator shall submit extraordinary reports to the SNSA with information on:

- equipment defects which could cause an emergency, emergencies and measures taken for the mitigation of the consequences of the defects or emergencies,
- errors, made by workers while handling or operating a facility, which could cause an emergency,
- deviations from operational limitations and conditions,
- all other events or operational circumstances which significantly affect the radiation or nuclear safety of the facility.

According to the Article 135 of the 2017 Act the licensee is required to report to the SNSA and to other competent authorities about the accident conditions as soon as possible.

The Rules on operational safety of radiation and nuclear facilities (JV9) prescribes detailed requirements for reporting to and notifying the regulatory body by the operator of a nuclear facility. The regulation distinguishes between routine reporting, notification and reporting in the case of an abnormal event. It specifies the time period for reporting. The reporting criteria define the set of abnormal events. In the period from 2016 to 2019 the Krško NPP reported 7 events and 2 of them caused an unplanned shutdown. The latter two events are described in the Section 6.5 of Article 6.

INES Reporting System

Slovenia is a member of the IAEA INES reporting system. Events from the Krško NPP are rated in accordance with the INES scale and reported to the IAEA. The rating is done by the INES national officer and discussed with the licensee and internally in the SNSA.

19.7 Programs to Collect and Analyse Relevant Operating Experience

In accordance with the Article 90 of the 2017 Act (the use of experiences gained during operational events), the operator of a nuclear facility shall ensure that the programs for recording and analysing operational experience at the nuclear facility are implemented.

In the assessment, the examination and improvement of the radiation and nuclear safety, the operator of the nuclear facility shall take into account the conclusions of the programs referred to in the paragraph 19.3.

At the Krško NPP, the root cause analysis of significant events is performed. The lessons learned from the analysis are followed up and training is given where appropriate. Human performance is included in the root cause analysis through the event and causal factor charting, barrier analysis and change analysis. The plant policy for a restart following a reactor trip requires that the cause of the trip is known, understood and corrected before the restart. The SNSA supervises the corrective actions defined by the facility. More complex events are also analyzed through internal SNSA investigation and the results are compared to the facility's corrective actions. If necessary additional actions are required.

The operating experience feedback program is in place, which includes the consideration of in-house as well as external operating events. This activity is performed by the Independent Safety

Engineering Group (ISEG). The program has been expanded by developing a corrective actions program including low level events and near misses, all types of deviations, failures, malfunctions, and deficiencies.

The off-site event reports safety screening is part of the Krško NPP operating experience assessment program. The off-site event reports are provided by the SNSA, IAEA, INPO, NRC, WANO, NUMEX, Westinghouse and PWROG. In the period from 2016 to 2018 the plant evaluated 537 potentially interesting events for potential applicability and analyzed 20 events in detail.

The Krško NPP shares on-site events for which investigation was performed with industry. These events are significant occurrences which affect the plant safety or reliability (e.g. transients, redundant safety system malfunctions, events involving nuclear safety, fuel handling and storage, excessive radiation exposure or personnel injury, excessive discharge of radioactivity etc.), personal safety and conditions which affect the quality of process. The technical director confirms the suitability of information for reporting, which is prepared according to the World Association of Nuclear Operators (WANO) operating experience program guideline.

The SNSA has also created the system for screening and analysing all kinds of operating experiences, not only incidents. It covers two types of events. (i) in the Krško NPP, as well as (ii) international operating experiences, which are screened and analysed for their applicability to nuclear safety in Slovenia. The results of such screening and analyses are communicated internationally either through formal channels like the International Reporting System on Operating Experience (IRS) or at different international meetings and conferences. In the period from 2016 to 2018, 125 potentially interesting events were evaluated by the SNSA.

The plant performance monitoring program covers more than 100 indicators. The Krško NPP has been collecting performance indicators for many years and includes them into the annual reports. The plant performance monitoring program comprises also the international performance indicators defined by the WANO, which are regularly reported to this organization

Besides the Krško NPP set of indicators, the SNSA developed an internal set of indicators. The SNSA monitors a set of 37 safety and performance indicators, which help to recognise the problems, which may affect nuclear safety, when they are still in the early stage. The set of performance indicators includes thresholds for warnings and alarms, which have been devised to allow the Krško NPP enough time for implementing corrective actions, which prevent further deterioration. With respect to the Krško NPP indicators and their yearly reporting, some SNSA indicators are evaluated through monthly or quarterly periods. In the last three years, the indicators have not shown significant negative trends. Some warnings or alarms have been associated with limiting conditions for operation entries, fire safety, analysed foreign events, temporary modifications and corrective work orders performance indicators.

19.8 Radioactive Waste Resulting from Operation

All operational radioactive waste from Krško NPP is stored within the plant area. The plant is responsible for radioactive waste management at the site.

During the operation of the Krško NPP various radioactive substances in liquid, gaseous and solid form are generated. The Krško radioactive waste management system is constructed to collect, process, store and package waste in a suitable form and minimise releases into the environment. Three fundamental systems are used for radioactive waste management, namely for liquid, solid and gaseous radioactive waste.

Numerous program improvements, design changes and work practice improvements have been pursued at the plant with a purpose to decrease the generation rate of radioactive wastes of different types (e.g. super-compaction campaigns, introduction of In-Drum Drying System). With the introduction of 18-month fuel cycle the generation of radioactive waste was additionally reduced. The plant uses an external service for the incineration of combustible waste and melting of metal radioactive waste material.

To reduce the volume of solid radioactive waste to be stored, super-compaction campaigns have been carried out. The original Westinghouse procedure for evaporator bottoms and spent resins treatment was replaced with a treatment called the In-Drum Drying System. Tube-type containers (TTC) are used as an over-pack for the storage of standard 200 liter drums and products of super-compaction in the plant radioactive waste storage facility. In 2006 the Krško NPP started continuous compression of radioactive waste with their super-compactor installed in the storage facility. The total volume of waste accumulated by the end of 2018 amounted to 2,271 m³. The total gamma and alpha activity of the stored waste were 1.59E+13 Bq and 2.47E+10 Bq, respectively. In 2018, 350 drums of combustible waste were sent to Sweden for incineration.

Based on the SNSA decision regarding the prevention of severe accidents and mitigation of their consequence issued in 2011, the Krško NPP assessed the options to reduce risk associated with spent fuel which is currently stored in the spent fuel pool. Due to the fact that the plant is firmly on the road to long term operation until 2043, the current wet storage capacity is not adequate. The Krško NPP proposed the new spent fuel management strategy to store the spent fuel in a new spent fuel dry storage on the site with a possibility of later reprocessing. From the technical point of view, this option is the best storage strategy for spent fuel for the time being. To ensure uninterrupted operation and sufficient storage capacity in the spent fuel pool, a new dry storage facility should be operational in 2021 (see also subchapter A. Challenges in Appendix II).

The Resolution on the 2016-2025 National Programme for Managing Radioactive Waste and Spent Nuclear Fuel takes into consideration the results of stress tests and all the various solutions, which should include the options of long-term storage and different options for fuel reprocessing and final disposal in a geological repository (national, regional and multinational).

In 2018 the Krško NPP waste manipulation building was built and licensed. With the construction of the new facility, the plant has been provided with new premises for drums storage in the process of manipulation and the preparation for transport, collection, and sorting of radioactive waste. There will also be space provided for different activities such as packing, compaction, super-compaction, radiological measurements and radiological monitoring of shipments, a mobile unit for drying the concentrate, storage of scaffolding, maintenance of shock-absorbers, workshops and warehouses for maintenance staff, and improved processing and reuse of primary water.

The NPP has established a system and procedures for clearance of radioactive waste and material from the controlled area. All procedures are in accordance with legislative criteria. The SNSA issues an approval prior each clearance.

In 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 Relations Regarding the Investment, Exploitation and Decommissioning of the Krško NPP (hereinafter the Agreement), the following policy was adopted:

- The contracting parties shall in equal shares assure funds for the preparation and execution of the decommissioning programme and the funds for the preparation of the programme for the disposal of radioactive waste and spent fuel. If the contracting parties agree on a joint solution for the disposal of radioactive waste and spent fuel, they shall finance it in equal shares or they shall finance their shares of activities,
- The Republic of Slovenia and the Republic of Croatia shall jointly prepare and approve a new plan for decommissioning of the Krško NPP and disposal of low and intermediate level and high-level waste (hereinafter the Decommissioning Plan),
- The Croatian party shall, according to the Agreement, establish its own fund for the management and collection of financial resources for its share of decommissioning and radioactive waste disposal costs.

The Decommissioning Programme was prepared in 2005 by the Agency for Radioactive Waste Management (ARAO) from Slovenia and the Agency for Special Waste (APO) from Croatia and needs to be revised at least every five years. The preparation of the next revision of the programme began in 2008, but since the Intergovernmental Commission had not met from May 2010 to July 2015, the discussion and endorsement of next revision have been delayed. The Intergovernmental Commission met in July 2015 and examined the status of the programme and decided to stop all the activities for the preparation of this version of the document and addressed the need for creating a new version of the programme. In 2017 the Intergovernmental Commission ordered both waste management organizations ARAO from Slovenia and APO from Croatia to prepare together with the NPP the third revision of the Decommissioning Programme. In 2018 additional studies for new programme were tendered. It is expected that new revision of the Decommissioning Programme will be finished in 2019.

Slovenia has already in 2009 selected the site for low and intermediate radioactive waste disposal facility in Vrbina near Krško NPP. Site investigation was finished and Environmental Impact Assessment Report as well as safety related documentation was prepared by the Agency for Radwaste Management in Slovenia (ARAO) and submitted to the authorities for review. Administrative process for environmental consent is ongoing. The draft preliminary consent on the nuclear safety and radiation safety was issued in April 2019 and it is expected that public consultations as well as consultations on transboundary impacts will be concluded in 2019.

In 2017 the preparatory works for the LILW repository were carried out at the site where a reinforcement dyke was created, which is the basis for the construction of the plateau to the final level of the repository.

In 2017 the SNSA issued the decision to distribute the content necessary to prove compliance with the conditions for obtaining consent to the construction of a radioactive waste repository as regards the individual content-based thematic sections. By this decision the content necessary to prove the fulfilment of the conditions was divided into individual thematic sections, which will be reviewed by the SNSA and separate opinions will be issued on the basis thereof thus reduce the total time required to approve the construction of a nuclear facility.

Slovenia invited the Republic of Croatia to participate in the project for the disposal of low and intermediate radioactive waste in the Vrbinja disposal site. The Intergovernmental Commission established a negotiating team to find a common solution for the disposal of radioactive waste on the basis of joint ownership and joint responsibility for the management of radioactive waste from the Krško NPP. The common solution has not yet been reached.

In conclusion, the Slovenian regulations and practices are in compliance with the obligations of Article 19.

APPENDICES

APPENDIX I: LIST OF LEGAL DOCUMENTS IN FORCE IN SLOVENIA (AS OF 30 APRIL 2019)

A. National legal frame

A.1 Resolutions and Acts

- Resolution on Nuclear and Radiation Safety in the Republic of Slovenia - for the period 2013-2023 (Off. Gaz. RS, 56/2013),
- Resolution on the National Programme for Managing Radioactive Waste and Spent Nuclear Fuel 2016-2025 (Off. Gaz. RS, No. 31/16),
- Act on Protection against Ionizing Radiation and Nuclear Safety – ZVISJV-1 (Off. Gaz. RS, 76/17 and 26/19),

A.2 Governmental decrees and ministerial regulations issued on the basis of 2017 Act (Act on Protection against Ionizing Radiation and Nuclear Safety – ZVISJV-1 (Off. Gaz. RS, 76/17))

- Decree on radiation activities - UV1 (Off. Gaz. RS, No. 19/18),
- Decree on dose limit, reference levels and radioactive contamination - UV2 (Off. Gaz. RS, No. 18/18),
- Decree on the areas of limited use of space due to a nuclear facility and the conditions of facility construction in these areas - UV3 (Off. Gaz. RS, No. 36/04, 103/06, 92/14 and 76/17 – ZVISJV-1),
- Decree on national radon programme - UV4 (Off. Gaz. RS, No. 18/18 and 86/18),
- Decree on the reduction of exposure due to natural radionuclides and existing exposure situations – UV5 (Off. Gaz. RS, No. 38/18),
- Decree on safeguarding of nuclear materials - UV6 (Off. Gaz. RS, No. 34/08 and 76/17 – ZVISJV-1),
- Decree on the criteria for determining the compensation rate due to the restricted use of areas and intervention measures in nuclear facility areas - UV8 (Off. Gaz. RS, No. 92/14, 46/15 and 76/17 – ZVISJV-1),
- Decree on checking of the radioactivity of consignments that could contain the orphan sources - UV11 (Off. Gaz. RS, No. 10/19),
- Decree on the implementation of Council Regulations (EC) and Commission Regulations (EC) on the radioactive contamination of foodstuffs and feedstuffs (Off. Gaz. RS, No. 52/06 and 76/17 – ZVISJV-1),

- Decree on the implementation of Council Regulations (EC) and Commission Regulations (EC) on the radioactive contamination of foodstuffs and feedstuffs (Off. Gaz. RS, No. 52/06, 38/10 and 76/17 – ZVISJV-1),
- Decree on the method, subject of and conditions for performing a compulsory public utility service of long-term surveillance and maintenance of landfill of mining and hydrometallurgical tailings resulting from extraction of and exploiting of nuclear mineral raw materials (Off. Gaz. RS, No. 76/15),
- Rules on the specialist council on radiation and nuclear safety - JV1 (Off. Gaz. RS, No. 35/03 and 76/17 – ZVISJV-1),
- Rules on the use of radiation sources and on activities involving radiation - JV/SV2 (Off. Gaz. RS, No. 27/18),
- Rules on authorised experts on radiation and nuclear safety - JV3 (Off. Gaz. RS, No. 50/16 and 76/17 – ZVISJV-1),
- Rules on providing qualification for workers in radiation and nuclear facilities – JV4 (Off. Gaz. RS, No. 32/11 and 76/17 – ZVISJV-1),
- Rules on radiation and nuclear safety factors - JV5 (Off. Gaz. RS, No. 74/16 and 76/17 – ZVISJV-1),
- Rules on radioactive waste and spent fuel management - JV7 (Off. Gaz. RS, No. 49/06 and 76/17 – ZVISJV-1),
- Rules on operational safety of radiation and nuclear facilities - JV9 (Off. Gaz. RS, No. 81/16 and 76/17 – ZVISJV-1),
- Rules on the monitoring of radioactivity - JV10 (Off. Gaz. RS, No. 27/18),
- Rules on transboundary shipments of radioactive waste and spent fuel - JV11 (Off. Gaz. RS, No. 22/09),
- Rules on the transboundary shipment of nuclear and radioactive substances - JV12 (Off. Gaz. RS, No. 75/08, 41/14 and 76/17 – ZVISJV-1),
- Rules on functioning of the Expert Council for the issues of ionizing radiation protection, radiological activities, and the use of radiation sources in human and veterinary medicine - SV1 (Off. Gaz. RS, No. 62/03 and 76/17 – ZVISJV-1),
- Rules on the criteria for using ionising radiation sources for medical purposes and for the deliberate exposure of individuals for non-medical purposes - SV3 (Off. Gaz. RS, No. 33/18),
- Rules on special radiation protection requirements and the method of dose assessment - SV5 (Off. Gaz. RS, No. 47/18),
- Rules on health surveillance of exposed workers - SV6 (Off. Gaz. RS, No. 2/04 and 76/17 – ZVISJV-1),
- Rules on authorising ionising radiation protection practitioners - SV7 (Off. Gaz. RS, No. 39/18),
- Rules on authorising ionising radiation protection experts - SV7A (Off. Gaz. RS, No. 47/18),
- Rules on the obligations of persons performing radiation practices and holders of ionizing radiation sources - SV8 (Off. Gaz. RS, No. 43/18),

- Rules on radiation protection measures in controlled and monitored areas - SV8A (Off. Gaz. RS, No. 47/18),
- Rules on the use of potassium iodide - SV9 (Off. Gaz. RS, No. 59/10 and 17/14 – ZZdr-2)
- Rules on implementation of national screening programmes for the early detection of precancerous changes and cancer (Off. Gaz. RS, No. 57/18),
- Rules on monitoring radioactivity in drinking water (Off. Gaz. RS, No. 74/15 and 76/17 – ZVISJV-1),
- Rules on physical protection of nuclear facilities, nuclear and radioactive materials and transport of nuclear materials (Off. Gaz. RS, No. 17/13 and 76/17 – ZVISJV-1),
- Rule by low program initial professional training and program periodic professional training security staff, when performing works physical protection nuclear facility and nuclear and radioactive material (Off. Gaz. RS, No. 12/13 and 76/17 – ZVISJV-1),
- Rules on the equipment for inspectors carrying out inspection on physical protection of nuclear and radioactive materials and facilities (Off. Gaz. RS, No. 42/15 and 76/17 – ZVISJV-1).

A.3 Other legislation

Third Party Nuclear Liability

- Act on Liability for Nuclear Damage (Off. Gaz. RS, 77/2010),
- Decree on determining the persons to whom the insurance of liability for nuclear damage is not mandatory (Off. Gaz. RS, 110/2010).

Decommissioning of the Nuclear Power Plant Krško

- Act on the Fund for Financing Decommissioning of the Krško NPP and Disposal of Radioactive Waste from the Krško NPP (Off. Gaz. RS, 75/1994 and subsequent amendments),
- Instruction on the method of charging and payment to the Fund for Financing Decommissioning of the Krško Nuclear Power Plant Krško and Disposal of Radioactive Waste from the Krško NPP (Off. Gaz. RS, No. 53/96),

Radioactive Waste

- Act on Cessation of Exploration of the Uranium Mine (Off. Gaz. RS, 36/92, 28/00 and 121/05),
- Act on Mining (Off. Gaz. RS, 56/99 and subsequent modifications),
- Decree on the transformation of the public company for the closure of uranium mine Rudnik Žirovski vrh, javno podjetje za zapiranje rudnika urana p.o., into Rudnik Žirovski vrh, javno podjetje za zapiranje rudnika urana d.o.o. (Off. Gaz. RS, No. 79/01),

- Decree determining the area and of the compensatory amount due to the limited use of the environment in the area of Rudnik urana Žirovski vrh (Off. Gaz. RS, No. 22/08 and 50/09),
- Decree on Establishment of a Public Agency for Radwaste Management (Off. Gaz. RS, No. 45/96, 32/99, 38/01),
- Decree on the method and subject of and conditions for performing a public utility service of radioactive waste management (Off. Gaz. RS, No. 32/99, 41/04 – ZVO-1 and 76/17 – ZVISJV-1),
- Ordinance on transformation of the public company Agencija za radioaktivne odpadke p.o., Hajdrihova 2, Ljubljana into public service institute (Off. Gaz. RS, No. 45/96, 32/99, 38/01, 41/04 – ZVO-1 and 113/09),
- Price list of public service of radioactive waste management (Off. Gaz. RS, No. 102/00).

Civil Protection and Disaster Relief

- Act on Protection against Natural and Other Disasters (Off. Gaz. RS, 51/2006 – Official Consolidated Text and subsequent amendments),
- Decree on the content and elaboration of protection and rescue plans (Off. Gaz. RS, No. 24/12, 78/16 and 26/19).

Administrative

- State Administration Act (Off. Gaz. RS, No. 113/05 – Official Consolidated Text, 89/07 – odl. US, 126/07 – ZUP-E, 48/09, 8/10 – ZUP-G, 8/12 – ZVRS-F, 21/12, 47/13, 12/14, 90/14 and 51/16),
- Inspection Act (Off. Gaz. RS, No. 43/07 – Official Consolidated Text and 40/14),
- Act on General Administrative Procedure (Off. Gaz. RS, No. 24/06 – Official Consolidated Text and 105/06 – ZUS-1, 126/07, 65/08, 8/10 in 82/13),
- Act on Administrative Fees (Off. Gaz. RS, No. 106/10 – Official Consolidated Text, 14/15 – ZUUJFO, 84/15 – ZZelP-J, 32/16 and 30/18 – ZKZaš),
- Decree on Administrative Authorities within Ministries (Off. Gaz. RS, No. 35/15, 62/15, 84/16, 41/17, 53/17, 52/18, 84/18 and 10/19).

Energy

- Energy Act – EZ-1 (Off. Gaz. RS, 17/14 and 81/15),
- Decree on the Transformation of the NEK p.o. into the Public Company Krško NPP, d.o.o. (Off. Gaz. RS, 54/1998 and subsequent amendments).

Environment

- Act on Environmental Protection (Off. Gaz. RS, No. 39/06 – Official Consolidated Text, 49/06 – ZMetD, 66/06 – odl. US, 33/07 – ZPNačrt, 57/08 – ZFO-1A, 70/08, 108/09, 108/09 – ZPNačrt-A, 48/12, 57/12, 92/13, 56/15, 102/15, 30/16, 61/17 – GZ, 21/18 – ZNOrg and 84/18 – ZIURKOE),
- Act on Spatial Planning (Off. Gaz. RS, No. 61/17),
- Construction Act (Off. Gaz. RS, No. 61/17 and 72/17 – corr.),
- Decree on environmental encroachments that require environmental impact assessments (Off. Gaz. RS, No. 51/14, 57/15 and 26/17),
- Decree on the method of drafting and on the content of the report on the effects of planned activities affecting the environment (Off. Gaz. RS, No. 36/09 and 40/17).

General

- Penal Code (Off. Gaz. RS, No. 50/12 – Official Consolidated Text, 6/16 – corr., 54/15, 38/16 and 27/17),
- Criminal Procedure Act (Off. Gaz. RS, No. 32/12 – Official Consolidated Text, 47/13, 87/14, 8/16 – odl. US, 64/16 – odl. US, 65/16 – odl. US, 66/17 – ORZKP153,154 and 1/19 – skl. US),
- Act on Minor Offences (Off. Gaz. RS, No. 29/11 – Official Consolidated Text, 21/13, 111/13, 74/14 – odl. US, 92/14 – odl. US, 32/16 in 15/17 – odl. US),
- Maritime Code (Off. Gaz. RS, No. 62/16 – Official Consolidated Text, 41/17, 21/18 – ZNOrg and 31/18 – ZPVZRZECEP),
- Act on Transport of Dangerous Goods (Off. Gaz. RS, No. 33/06 – Official Consolidated Text, 41/09, 97/10 and 56/15),
- Act on Export of Dual Use Goods (Off. Gaz. RS, No. 37/04 and 8/10),
- Order on application of measuring units other than those accepted for use in the Nuclear Power Plant Krško (Off. Gaz. RS, No. 26/01),
- Decree on procedures for issuing authorisations and certificates and on competence of the Commission for the Control of Exports of Dual-Use Items (Off. Gaz. RS, No. 53/05 and 4/06).

B. International instruments to which Slovenia is a party

By the Slovenian Constitution all published and ratified international treaties also constitute an integral part of the Slovenian legislation and can be applied directly. The following international instruments, to which Slovenia is a party, should be mentioned:

B.1 Multilateral agreements

- Statute of the International Atomic Energy Agency (including its Amendment of Articles VI and XIV),
- Agreement on the Privileges and Immunities of the International Atomic Energy Agency,
- Convention on the Physical Protection of Nuclear Material (including the 2005 Amendments),
- Convention on Early Notification of a Nuclear Accident,
- Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency,
- Convention on Nuclear Safety,
- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management,
- Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water,
- Treaty on the Non-Proliferation of Nuclear Weapons,
- Treaty on the Prohibition of the Emplacement of Nuclear Weapons and other Weapons of Mass Destruction in the Sea-Bed and the Ocean Floor,
- European Agreement Concerning the International Carriage of Dangerous goods by Road (ADR),
- Convention on International Railway Carriage (COTIF) including Appendix B (RID),
- Comprehensive Nuclear-Test-Ban Treaty,
- Convention on Third Party Liability in the Field of Nuclear Energy of 29 July 1960, as Amended by the Additional Protocol of 28 January 1964 and by the Protocol of 16 November 1982 (including the 2004 Protocol),
- Convention of the 31 January 1963 Supplementary to the Paris Convention of 29 July 1960, as Amended by the Additional Protocol of 28 January 1964 and by the Protocol of 16 November 1982 (including the 2004 Protocol),
- Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention,
- Act on ratification of 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 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,
- Law on ratification of the Additional Protocol to the Agreement between the Republic of Austria, the Kingdom of Belgium, Kingdom of Denmark, Finland, Federal Republic of Germany, the Hellenic Republic, Ireland, the Italian Republic, the Grand Duchy of Luxembourg, the Kingdom of the Netherlands, the Portuguese Republic, the Kingdom of Spain, Kingdom of Sweden, the European Community 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.

B.2 Bilateral agreements

- Agreement between the US NRC and the SNSA on Exchange of Technical Information and Co-operation in the Nuclear Safety Matters,
- Agreement between the Government of the Republic of Slovenia and the Government of Canada on Co-operation in the Peaceful Uses of Nuclear Energy with an Arrangement between the SNSA and AECB,
- Agreement between the Governments of the Republic of Slovenia and the Republic of Hungary on Early Exchange of Information in the Event of a Radiological Emergency,
- Agreement between the Governments of the Republic of Slovenia and the Republic of Austria on Early Exchange of Information in the Event of a Radiological Emergency and on Questions of Mutual Interest in the Field of Nuclear Safety and Radiation Protection,
- Agreement between the Governments of the Republic of Slovenia and the Republic of Croatia on Early Exchange of Information in the Event of a Radiological Emergency,
- Agreement between the Government of the Republic of Slovenia and the Government of the Slovak Republic for the Exchange of Information in the Field of Nuclear Safety,
- Arrangement between the Nuclear Safety Administration of the Republic of Slovenia and the Council for Nuclear Safety of South Africa for the Exchange of Technical Information and Co-operation in the Regulation of Nuclear Safety,
- Arrangement between the Nuclear Safety Administration of the Republic of Slovenia and the Ministry of Science and Technology of the Republic of Korea for the Exchange of Information and Co-operation in the Field of Nuclear Safety,
- Arrangement between the Nuclear Safety Administration of the Republic of Slovenia and the Nuclear Installations Safety Directorate of the Republic of France for the Exchange of Technical Information and Co-operation in the Regulation of Nuclear Safety,
- Treaty 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 relations regarding investment, exploitation and decommissioning of the Krško Nuclear Plant,
- Memorandum of Understanding between the Slovenian Nuclear Safety Administration and the State Office for Nuclear Safety of the Czech Republic on the Exchange of Information on Nuclear and Radiation Safety Matters (as non- treaty type of bilateral arrangement),
- Memorandum of Understanding between the Slovenian Nuclear Safety Administration and Radiation Safety Directorate of Macedonia on the exchange of information on matters of nuclear and radiation safety (as non-treaty type of bilateral arrangement),
- Memorandum of Understanding between the Slovenian Nuclear Safety Administration and the Agency for Radiation and Nuclear Safety of Bosnia and Herzegovina on the exchange of information on matters of nuclear and radiation safety (as non-treaty type of bilateral arrangement),
- Memorandum of Understanding between the Slovenian Nuclear Safety Administration and the National Nuclear Agency of the Republic of Albania on the exchange of information on matters of nuclear and radiation safety (as non-treaty type of bilateral arrangement),

- Memorandum of Understanding between the European Nuclear Safety Regulators Group and the International Atomic Energy Agency for International Peer Review Missions to the EU Member States (as non- treaty type of bilateral arrangement),
- Memorandum of Understanding between the Slovenian Nuclear Safety Administration and the Ministry for Emergency Situations of the Republic of Belarus on the Exchange of Information on Nuclear and Radiation Safety Matters (as non-treaty type of bilateral arrangement).

APPENDIX II: CHALLENGES AND SPECIAL TOPICS

This chapter addresses the challenges and planned actions to improve the safety which were listed in the rapporteur's report for Slovenia during the last (7th) CNS review meeting.

A. Challenges

i. Completion of the Safety Upgrade Program by 2021 (Challenge 2017-SI-1)

In September 2011 the SNSA issued a decision requiring from the Krško NPP to reassess the severe accident management strategy, existing design measures and procedures and to implement necessary safety improvements for prevention of severe accidents and mitigation of its consequences. These requirements were based on Slovenian legislation and lessons learned from the Fukushima Daiichi accident in March 2011.

This evaluation was finished in January 2012. The action plan was reviewed and approved by the SNSA and should have been completely implemented within the Safety Upgrade Program (SUP) by the end of the year 2016. However, the Krško NPP applied for the extension of the deadline for the implementation of the SUP, first to December 2018 and later to December 2021. The reasons for the extensions were in detailed described in the previous Slovenia's CNS report.

The SUP is divided into three phases:

Phase I, which was implemented in 2013:

- installation of passive autocatalytic recombiners (PARs),
- installation of a passive containment filtered vent system.

Phase II, which is underway and is to be implemented by end of 2019, includes:

- Additional flood protection of the nuclear island and all the new systems, structures and components (implemented in 2015/2016),
- Installation of pressurizer bypass relief valves, qualified for severe accidents (implemented in 2018),
- Acquisition of a mobile heat exchanger, which will be located outside the nuclear island and feature provisions for quick connections to the spent fuel pool (underway),
- Installation of a fixed spray system on the spent fuel pool with provisions to use mobile equipment (underway),
- Installation of an additional heat removal pump with a dedicated heat exchanger (which will be cooled by water from the Sava River through mobile equipment) capable of removing heat from the primary system and the containment (underway),
- An upgrade of the Bunkered Building 1 (BB1) electrical power supply (with provisions to connect an additional mobile 2 MW diesel generator, seismic requalification of the 3rd emergency bus, an upgrade of the connection between the 400 V safety buses and mobile diesel generators, etc.) (implemented in 2018),
- Replacement of the existing remote shutdown panels with the installation of an emergency control room (ECR) with capabilities to shut down the reactor and maintain the long-term

- safe shutdown state (the greater part of the upgrade was implemented in outage 2018, while its completion is planned for outage 2019),
- Installation of additional instrumentation intended for severe accidents and featuring an independent power supply (implemented in 2018),
 - The above-mentioned ECR will include habitability systems for ensuring a safe long-term environment for operators even in the event of severe accidents (underway),
 - And an upgrade of the operational support centre and technical support centre (emergency centres) to ensure a safe long-term environment for operators even in the event of severe accidents (underway).

Phase III, which shall be implemented by the end of 2021:

- Installation of additional injection systems for the reactor cooling system/containment and steam generators with dedicated reservoirs for cooling water (also borated) capable of being replenished with water from underground wells – the Bunkered Building 2 (BB2) project (underway),
- Construction of the spent fuel dry storage facility (underway).

Additional systems, structures and components, which will be implemented within the SUP, will be designed and structured in accordance with the design extension conditions (DEC) requirements specific for the Krško NPP design and site location. A set of DEC is derived on the basis of engineering judgment, deterministic assessment and probabilistic assessment based on the IAEA methodology defined in SSR-2/1, Safety of Nuclear Power Plants: Design Specific Safety Requirements, the Krško NPP's Individual Plan Examination and the Krško NPP Analyses of Potential Safety Improvements. For more details regarding the SUP see Part IV, Chapter 2 and 5.2.1 of the Update of the Slovenian National Action Plan, available at:

http://www.ursjv.gov.si/fileadmin/ujv.gov.si/pageuploads/Info_sredisce/Porocila/Slovenian_NAcP-December_2018.pdf

As it can be seen from the last update of the Slovenian National Action Plan prepared in December 2018, approximately 80% of the SUP improvements were completed by the end of the year 2018. All Phase II improvements are on schedule to be completed by the end of 2019. Likewise, the implementation of Phase III projects i.e. the BB2 project and the construction of the spent fuel dry storage (SFDS) has started, is well underway and is on schedule to be completed by the end of 2021, which is the deadline for Phase III improvements.

The Krško NPP's SUP, which was approved by the SNSA, also includes detailed time schedules of the improvements. The planned time schedule for the construction of SFDS is the end of 2020 (see in Table A-1, item No. 12). Due to the requirement of the Ministry of the Environment and Spatial Planning to perform the strategic environmental assessment as well as the environmental impact assessment the planned schedule for SFDS construction will have to be extended beyond 2020, but the SFDS project is still planned to be finished by the end of 2021, which is the final deadline for the Phase III of the Krško NPP's SUP.

The Table A-1 shows the activities within the Slovenian National Action Plan including their status of implementation.

Table A-1: The Slovenian National Action Plan as of December 2018; NAcP implementation was 87% completed.³;

No.	Future action / activity	Area	Status	Finish	Level
1	SUP SUP comprises of a set of modifications/ improvements (see numbers 1.1 to 1.10) that will be implemented in steps until the end of 2021. Some of the discussed recommendations (see related recommendations) are to be verified within the licensing and implementation of the SUP. (for SUP details see chapter 2 in Part IV)	SUP	in progress 80%	2021	site
1.1	Safety upgrade of AC power supply	SUP, Phase II	implemented	2018	site
1.2	New pump for supplying SGs; in a bunkered building, with a dedicated water supply	SUP, Phase III	in progress 38%	2021	site
1.3	Installation of alternative ultimate heat sink – revised into alternate long-term heat sink using SGs and underground well water (see 1.2 and Chapter 5.2.1)	SUP, Phase III	in progress 38%	2021	site
1.4	Additional pump for injecting into the reactor primary system, in a bunkered building, with a dedicated (borated) water supply	SUP, Phase III	in progress 72%	2021	site
1.5	Containment integrity safety upgrades including containment filtered vent systems and PARs	SUP, Phase I	implemented	2013	site
1.6	Establishment of emergency control room	SUP, Phase II	in progress 90%	2019	site
1.7	Installation of fixed spray system around the SFP with provisions for quick connection from different sources of water.	SUP, Phase II	in progress 80%	2020	site
1.8	Mobile heat exchanger with provisions to quick connect to SFP	SUP, Phase II	in progress 80%	2019	site
1.9	Flood protection upgrade (additional protection of nuclear island and bunkered buildings)	SUP, Phase II	implemented	2015	site
1.10	Establishment of new technical support centre and upgrade of existing operational support centre (emergency operating facilities)	SUP, Phase II	in progress 80%	2019	site

³ The actions from this table represent the initial post-Fukushima Action Plan as developed in December 2012 (http://www.ursjv.gov.si/fileadmin/ujv.gov.si/pageuploads/si/Porocila/NacionalnaPorocila/Slovenian_National_Post_Fukushima_Action_Plan_01.pdf)

No.	Future action / activity	Area	Status	Finish	Level
2.1	<p>SNSA shall amend its legislation to include:</p> <ul style="list-style-type: none"> • requirements regarding the use of advanced deteriorating weather warning systems • requirements regarding the use of seismic monitoring systems • PSA Level 3 requirements (at least for new NPPs) • requirements for Beyond Design Basis Accidents I&C for Spent Fuel Pool • emergency planning requirements for prolonged SBO in the areas of communications capability (onsite, e.g., radios for response teams and between facilities, and offsite, e.g., cellular telephones, satellite telephones), ERDS capability, training and exercises, and equipment and facilities 	legislation	implemented	2016	national
2.2	<p>The SNSA shall consider amending its regulation for the design basis by more stringent safety objectives for:</p> <ul style="list-style-type: none"> • Prevention and mitigation of core-melt accident in reactor and in spent fuel storage to avoid off-site long-term contamination • Large or early release to be practically eliminated (for new NPPs) • Increase robustness of NPPs to be able to face natural hazards more severe than the ones considered in the design basis (DEC); this should also include requirements for test and maintenance of equipment, training ,... <p>This will be done mainly by following WENRA/ENSREG new initiatives, updated RL...</p> <p>The SNSA shall also examine whether more detailed requirements are needed regarding LOOP, SBO and loss of UHS</p>	legislation	implemented	2016	national
3	<p>In January 2012 SNSA issued the third decision regarding the Fukushima event requiring from the Krško NPP to review the basis and assumptions for the Radiological Emergency Response Plan. This is to be finished by March 2013. The results of the review, possible proposals for improvements of the Radiological Emergency Response Plan, shall be implemented as appropriate.</p> <p>In addition, the SNSA (together with other appropriate stakeholders) shall give further consideration to:</p> <ul style="list-style-type: none"> • supplementing the national radiological emergency response plan with provisions for off-site support regarding to the long-term fuel supply and also some additional pieces of mobile equipment in case of widespread disruption of plant's infrastructure • within the supplementing of national radiological emergency response plan further 	emergency response	in progress 90%	2019	national

No.	Future action / activity	Area	Status	Finish	Level
	<p>consideration shall be given to:</p> <ul style="list-style-type: none"> - Reference levels for importing food, - Trans-boundary processing of goods and services such as container transport - Approach / philosophy and associated limits and criterion to govern the 'remediation' phase of the event - Return to evacuated area criteria and criteria for return to normal from the emergency state - Establishing contamination monitoring protocols and locations during the recovery phase <ul style="list-style-type: none"> • preparing national strategy (also amending legislation if needed) regarding solutions for post-accident contamination and the treatment of potentially large volumes of contaminated water • enhancement of intervention personnel training, trans-boundary arrangements and education of the public and media • enhancing cooperation with neighbouring countries (especially Croatia), including mutual exercises • enhancing exercises by including all interface points (National, Regional, Municipal...), performing longer term exercises for better reflection of the extreme events challenges, and incorporating failure of communication systems and radiation data availability into drill programs • enhancement of national radiological monitoring system 				
4	<p>SNSA shall assign dedicated inspections to:</p> <ul style="list-style-type: none"> • verify the external hazard protection equipment; • systematically review and inspect SAME equipment, SAMGs, test and maintenance procedures, as well as full scale training events at the Krško NPP with the emphasis on how the limited number of staff are able to cope with equipment deployment and transfer of additional fuel to the users, what are the available and needed times, are there enough resources (human and equipment) available. • check what are plant's capabilities to power communications equipment needed to communicate onsite (e.g., radios for response teams and between facilities) and offsite (e.g., cellular telephones, satellite telephones) during a prolonged SBO; • additional inspection on radiological protection equipment, procedures for radiological mapping in case of an accident, staff training (added from action #5, additional studies) 	Inspection	implemented	2017	site

No.	Future action / activity	Area	Status	Finish	Level
5	<p>The SNSA shall consider requiring the plant to perform additional studies regarding:</p> <ul style="list-style-type: none"> • accident timing, including core melt, reactor pressure vessel (RPV) failure, basemat melt-through, SFP fuel uncover, etc., using different computer codes • radiological protection equipment for SA response • analysis and identification of situations that would prevent performance of work for radiological reasons; • the question of stress on staff behaviour including emotional, psychological and cultural aspects associated with emergency response and associated training and support 	additional studies	implemented	2017	site
6	<p>Nuclear safety infrastructure in Slovenia needs more political support. Only in such environment the human resource capacity and competence across all organizations in the field of nuclear safety can be further developed. SNSA shall organize a meeting, where this topic shall be brainstormed by all involved parties (the utility, the regulatory body, TSOs...). Special action plan shall be prepared and executed to enhance political support to nuclear safety infrastructure.</p>	nuclear safety infrastructure	implemented	2016	national
7	<p>To enhance its processes SNSA shall:</p> <ul style="list-style-type: none"> • reconsider, which of the international meetings/groups are of outmost importance, since the decreasing number of staff and increasing number of international activities the quality of regular work may start to suffer • review its capability for evaluating defense-in-depth to see whether and how it could be further enhanced • enhance its staff training on severe accidents and SAMGs 	SNSA processes	implemented	2017	national
8	<p>The SNSA shall consider inviting the following peer review missions:</p> <ul style="list-style-type: none"> • additional RAMP mission (best after completion of SUP) to again properly and independently validate the SAMGs. Likewise, consideration shall be given to inviting peer review missions to reassess the external hazards • a follow-up IRRS mission in 2014, and next IRRS mission in the next 5-6 years • OSART mission to review plant design safety features and related modifications (in next 3 years) • EPREV (Emergency Preparedness Review) mission <p>(All missions except RAMP were already implemented)</p>	peer reviews	in progress 75%	2022	site

No.	Future action / activity	Area	Status	Finish	Level
9	SA plant parameters are being transferred to regulator premises. Still, this system needs a revision to include all needed SA parameters, increase reliability of the system...	ERDS	implemented	2015	site
10	A full scope PSA (including Level 2) for low power and shutdown modes shall be implemented for the Krško NPP by the end of 2015. SNSA shall consider requiring a PSA for the Krško's Spent Fuel Pool.	PSA	in progress 80%	2019	site
11	SNSA shall (together with the operator) analyse how the following topics are taken into account, maintained and improved: <ul style="list-style-type: none"> • Transparency; public discussion of safety issues • An open and trustful relationship between regulators, operators and the public with keeping in mind their respective roles and functions • Define appropriate actions to ensure that the desired safety culture characteristics are achieved in the regulatory and operational organizations • Methods to evaluate and detect degraded safety culture 	safety culture	implemented	2014	national
12	Within the reassessment of its severe accident management strategy, existing design measures and procedures, the operator has also reassessed its possibilities for alternative spent fuel strategy [16]. The results showed that best strategy would be storing the spent fuel in dry cask storage with a possibility to combine it with later reprocessing. In accordance with the latest study further actions shall be implemented on the national level to change the national strategy and to enable licensing of the modification.	reviews and NPP improvements	in progress 50%	2020	national + site

ii. Completion of the Spent Fuel Dry Storage and the LILW Repository (Challenge 2017-SI-02)

The current solution for storing of spent fuel at the Krško NPP is a wet spent fuel storage. After an increase of storage capacity of the Krško NPP spent fuel pool in 2003, a total of 1694 storage locations are available. In response to the Fukushima accident, the Krško NPP performed a Special Safety Review in line with the ENSREG specifications for EU Stress Tests for NPPs. Based on the stress tests' results the NPP defined more demanding criteria for the storage of spent fuel assemblies. The available number of storage locations in the spent fuel pool is estimated to be sufficient by 2021. The operator has also reassessed the possibilities for the alternative spent fuel management strategy and decided that the best strategy would be storing the spent fuel in a dry cask storage with a possibility to combine it with the reprocessing later.

The construction of the new Spent Fuel Dry Storage (SFDS) is included in the Krško NPP Safety Upgrade Program, which is part of the NAcP. This new building with the belonging systems and components shall fulfil design extension conditions (DEC) in accordance with DEC requirements. The new storage system will contain the storage building, constructed within the Krško NPP perimeter with a capacity of up to 2,590 spent fuel assemblies in 70 casks, type Holtec HI-STORM FW MPC Storage System for dry storage of spent nuclear fuel.

The principle in designing the SFDS is that the basic safety functions sub-criticality, heat removal and confining radioactive material shall be fulfilled during the operational states, design basis accident and DEC. The natural hazards are considered an integral part of the SFDS safety demonstration. The impacts of various natural hazards on SFDS were evaluated. Possible sources of natural hazards are earthquakes, strong wind, rain, snow, ice, thunder/lighting, river (flood) and extreme temperatures. The site of the Krško NPP is located in the area of moderate seismic activity, therefore seismic safety is one of the main concerns to be considered in the design of the new SFDS building and its systems, structures and components. The regulatory requirements for dose restrictions are set very strictly. The boundaries for the dose rate on the NPP site boundary shall remain unchanged despite the new SFDS will be located within the site.

The SFDS is designed for a minimum operation of 60 years. The analyses were made to prove the stability of materials for this period or still longer. A preliminary decommissioning plan for the decommissioning of the facility was prepared, which foresees that the spent fuel will be transported to the final spent fuel disposal, while the remaining material will be disposed of in the national radwaste repository.

The transfer of spent fuel assemblies from the spent fuel pool into the SFDS is expected to be done in four campaigns. The first campaign transferring 16 overpacks (up to 592 spent fuel assemblies) is planned for the year 2021. The second campaign transferring 16 overpacks (up to 592 spent fuel assemblies) is planned for the year 2028. The third campaign transferring 12 overpacks (up to 444 spent fuel assemblies) is planned for the year 2038 and the fourth campaign transferring rest of spent fuel assemblies is planned for the year 2048.

The licensing process for the SFDS is ongoing. In 2017 the SNSA issued the design conditions for the dry storage facility which were prepared in accordance with new DEC requirements and international standards for spent fuel storage facilities. After the regulatory review of the SFDS design concept, the SNSA issued the positive opinion for the SFDS construction license in June 2018. Based on the proposed redesign the SNSA reviewed and assessed the proposed changes of the SFDS project and in January 2019 issued the positive opinion for the construction license. Additionally, the implementation of the strategic environmental assessment as well as the environmental impact assessment were required by the Ministry of the Environment and Spatial Planning. The envisaged commencement of transfers of spent nuclear fuel from the spent fuel pool into the SFDS is planned for 2021.

In accordance with the DEC approach, the new SFDS design is based on the regulatory requirements while some of the design basis conditions are defined beyond these requirements by the operator. The DEC for the long term spent fuel storage will be implemented in the Krško NPP

for the first time. The design and construction of the new SFDS are a challenge for both the manufacturer and the operator. The SFDS licensing is also a challenge for the Slovenian regulator. The regulatory experience shows that in this novel work the regulator and the operator could not rely on international practice and were therefore forced to define and approve original solutions.

In the beginning of April 2019 the SNSA issued the draft preliminary consent on nuclear and radiation safety for the low and intermediate level waste (LILW) repository in Vrbina in the Krško municipality.

The procedure for obtaining an environmental consent is a relatively time-consuming process which already began in 2017 when the Agency for Radwaste Management (ARAO) delivered an application to the Slovenian Environment Agency (ARSO). In the framework of this process the ARSO delivered an application to the SNSA in May 2018 for the issue of a draft preliminary consent on the nuclear and radiation safety. The SNSA reviewed the extensive documentation covering the Environmental Impact Report, the Draft Safety Analysis Report, the Concept Design, the Project Basics, the expert opinion of the authorised expert on nuclear and radiation safety and the reference documentation. In July 2018 the comments and the request for additional information were given by the SNSA. After several revisions of licensing documentation and explanations provided by the ARAO all issues were resolved at the end of March 2019 and the SNSA was able to issue the draft preliminary consent. With this action the conditions for the beginning of public hearing and consultations on the transboundary impacts were fulfilled.

iii. Harmonizing emergency response with neighbouring countries (Challenge 2017-SI- 3)

In October 2018 the SNSA participated in the IAEA consultancy meeting discussing the approaches for harmonization of the implementation of transboundary protective actions in response to a nuclear or radiological emergency. The result of this meeting is a table-top exercise conducted in June 2019 and participated by three out of four Slovenia's neighbouring countries (Croatia, Italy and Austria). In this exercise the draft agreement for nuclear or radiological EPR between Slovenia and Croatia was tested and its concept discussed also among the other participating countries.

B. Special Topics

The topics in this chapter address the issues which were considered in the Summary Report and the President's Report of the 7th Review Meeting of the Contracting Parties to the Convention on Nuclear Safety finished in April 2017. The implementation of the Vienna Declaration on Nuclear Safety, adopted on 9th February 2015, is also described in this chapter.

i. Safety Culture

Referring to the 7th Review Meeting Summary Report:

“Systematic approaches to oversight of licensee safety culture, and to the embedding of processes to promote and sustain the safety culture of the regulatory body itself, are not widely adopted and further strengthening of the guidance may be needed; Contracting Parties were encouraged to contribute to the development of this guidance and to apply it; drawing on the IAEA support to advise and inform the development of Contracting Party processes.”

In 2012, the SNSA adopted the first guideline for the assessment and supervision of safety culture in nuclear facilities. Further revisions were made in 2014, 2017 and 2019. The guideline requires to collect observations during the inspections, communications with the licensee, administration procedure process, reviewing of the licensee self-assessment report, reviewing of the NPP root cause analysis reports. All the gathered observations are analysed and categorized into the safety culture's characteristics and attributes according to the IAEA SCART Guidelines. The results are compared with the results from the previous years. In the end, the report is written by the SNSA and send to the Krško NPP. Those results are, among other, discussed during the annual meeting among the SNSA and NPP management.

Furthermore, the SNSA performs the oversight of licensees' safety culture through permanent assessment of the licensees' safety culture, at reviewing periodic safety review - PSR (every ten years) and also during the inspections dedicated to safety culture. The inspections of safety culture are planned annually or every two years. Three inspections related to the safety culture in Krško NPP have been carried out (2014, 2016, 2017).

The SNSA has also started to collect the safety culture's observations at the licensees who are undertaking the radiation practice. Those observations were introduced in the Radiation News in 2018.

Safety culture is a combination of values, competences, perceptions and patterns of behaviour. Safety culture reflects the way how the organization and individuals behave, when one does not control or observe them. A positive safety culture is characterized by communication based on mutual trust. Good safety culture is reflected in the values which are based on the belief that safety is important and that everybody is responsible for safety.

The SNSA ensures a high level of safety culture by:

- Regularly familiarizing the SNSA employees with the mission, vision, values and quality policy,
- Regularly communicating with employees in all working areas of the SNSA as well as solving any problems that might occur,
- Regularly monitoring and continuous improvement of its safety culture, supporting open communication, constructive doubt during the decision-making process and decision making based on the known and verified facts,
- Ensuring that the authorities and responsibilities are set, recorded and made known to the employees,
- Ensuring staff competence by transmission of information, knowledge, expertise, established methods and the creation of a learning organization, and ongoing training, improving skills and professional education of the staff,
- Ensuring that each employee is aware that for providing safety everyone has an important role and that he/she is also responsible for it,
- Job coaching for new member of staff to their work,
- Careful consideration of the expressed interests of customers, public and other parties, involved at decision making.

The description of the licensee safety culture and the regulatory requirements are in the subchapter 10.2 Implementation of Regulatory Requirements for Priority to Safety.

ii. Knowledge Management

Referring to the 7th Review Meeting Summary Report:

“Difficulties, facing regulatory bodies and operators in finding suitably qualified and experienced persons, were also reported, and in some countries these are exacerbated by the demographic challenge, whereby significant numbers of experienced personnel are approaching retirement age. Measures taken to establish a robust knowledge management process which contributes to mitigating the impact of loss of experience.”

In the SNSA special attention is paid to training in the field of nuclear safety and radiation protection. A large number of employees (including all the inspectors) have completed a special training course and examination which is organized and run by the US Nuclear Regulatory Commission Training Centre in Chattanooga, as well as training and examination at the appropriate simulator.

The SNSA and TSO staff receives training and education also in foreign countries since this is the only way that the SNSA can professionally cover the area that is constantly evolving. SNSA's civil servants attend numerous training courses organized by the IAEA, OECD/NEA and the EU.

To obtain specific skills and additional training in specialized fields of work, the SNSA organized and carried out also the, so called, internal trainings. These trainings are tailored to the particular demands and needs of the SNSA. Most of the time the training is carried out in the SNSA premises, which also allows larger number of participants to take part. The SNSA carries out more than 50 different training events yearly, most of them in the area of emergency preparedness.

The SNSA continues with the development of the systematic approach to training and optimization of the SNSA's internal organization based on the recommendations of the International Atomic Energy Agency. A system to ensure competence and to optimize the internal organization of the SNSA was designed and built primarily on the basis of the IAEA TECDOC 1254. During the development the concept was adapted to the needs of the SNSA and named SAT-SNSA. This system includes SNSA organizational structures and all key processes. All job positions, all work tasks and competencies are also defined. A regular update is achieved through the annual career planning interviews. The SAT- SNSA is still under development and during 2019 the system will be improved with better definition of the training needs. The initial and the refreshment training will be added for each job position. Currently the training needs are based on the competencies and gap analysis for the job positions. With some improvements more effective training plans could be prepared.

Concerning the Krško NPP it uses various approaches to ensure that appropriately qualified workforce is being attracted, employed and retained. Human resources activities are planned several years in advance to predict future workforce needs from the aspects of plant technology and processes development and due to retirements. The workforce needs are publicly announced over Slovene and Croatian employment agencies and very good responses are received with the appropriate candidates applying for the job. The Krško NPP uses scholarships to maintain good connection with university programs and to be able to employ young engineers on regular basis. The workforce aging is being continuously monitored and retirements are planned several years in advance. New employees are attracted and employed in appropriate timeframe to enable initial

training and transfer of knowledge to take place to enable takeover of duties from retiring workers to be completed in time.

Knowledge management at the Krško NPP takes place through different processes and covers the areas such as professional training, management of documentation and operating procedures, preparation for different activities, the use of information technology and human resource management. All these activities are implemented through regular working processes. Managers at all levels of organization support and ensure that knowledge transfer and retention is implemented while all employees are obliged to play active role in the process.

iii. International Peer Reviews

Referring to the 7th Review Meeting Summary Report:

“The reviews, based on existing peer review mechanisms, have covered regulators, plant operators, designers and other organizations. Contracting Parties noted that these reviews, although of significant benefit, can be resource-intensive and need to be coordinated to ensure that they do not detract from the continuing attention that the regulatory body and operator must give to operational nuclear safety.”

As a part of the post-Fukushima National Action Plan, the Republic of Slovenia invited the OSART mission to carry out a review of the operational safety of the Krško NPP.

A review of the operational safety of the Krško NPP within the framework of the OSART mission took place between 15 May and 1 June 2017. It reviewed all aspects of the operational safety of the Krško NPP, divided into thirteen different thematic areas. The final report of the OSART mission contained four recommendations, sixteen suggestions for improvement, and three examples of good practice.

The OSART Follow-Up Mission was conducted between 15 and 19 October 2018. Most of the actions from the Krško NPP’s OSART action plan had been completed. As of writing this report (April 2019) only two recommendations remained open and are due to be closed by the mid-2019.

The OSART Follow-Up Mission concluded that all levels of organization were involved in and committed to improving overall performance of the plant as well as processes and human behaviour. Visible progress has been made in all recognized areas. The Follow-Up confirmed that all plant actions helped to improve operational safety or were headed in the right direction.

More information on the OSART and OSART Follow-Up Missions can be found in Article 6.3.

Several other peer review missions are planned in next years, such as the, IRRS mission, already scheduled for 2021, the SALTO mission and the RAMP mission after the completion of the Krško NPP’s Safety Upgrade Program.

iv. Managing the Safety of Ageing Nuclear Facilities and Plants Life Extension

Referring to the 7th Review Meeting Summary Report:

“The challenges relating to the establishment of ageing management programmes. This includes the identification and implementation of reasonably practicable safety improvements and the definition of technical assessment and regulatory requirements supporting decisions on continued operation. Issues include determining the scope of necessary upgrades

(recognising different technologies and situations including strategic factors); maintaining the design and licensing knowledge-base during extended plant lifetimes.”

The Krško NPP intends to extend its operation beyond its original design life to 60 years based on the established aging management program (AMP), which is one of the prerequisites for lifetime extension. After developing the AMP has been reviewed independently by the international group of experts at the end of 2010. Based on this review the Krško NPP updated its AMP and applied for 20-year lifetime extension, which was approved by the SNSA in 2012. Furthermore, operating license is in fact subject to successfully completed periodic safety review, which is used for checking the safety and to extend the license every 10 years.

The Krško NPP approach to long term operation is in compliance with the U.S. NRC regulations, industry practices and the Slovenian legislation. The methodology is similar to the IAEA standards and guidelines for ageing management. The AMP fully meets the requirements of NUREG-1801 – GALL. The Krško NPP developed and implemented appropriate programs and procedures according to GALL, including methods for the identification and monitoring of the effects of ageing and requirements for the implementation of preventive and corrective measures. The AMP is a living program constantly being improved based on internal and external operating experiences and results of R&D activities in the world. It fully complies with the Slovenian regulations.

There are also several challenges and areas for improvement in the future. The most challenging and interesting areas for R&D are electrical cables and the impact of the reactor vessel irradiation on the Krško NPP lifetime. Systematic monitoring and addressing foreign operational experience in the field of ageing as well as current issues or events in other countries are one of the key elements for safe long-term operation. Also, appropriate preventive measures related to ageing management shall be implemented. The Krško NPP has already implemented important and comprehensive preventive measures in the past, such as the replacement of the reactor vessel head and pressurizer structural weld overlays.

v. Implementation of VDNS (Vienna Declaration on Nuclear Safety)

VDNS Principle 1 (new power plant design, siting and construction) states:

“New nuclear power plants are to be designed, sited, and constructed, consistent with the objective of preventing accidents in the commissioning and operation and, should an accident occur, mitigating possible releases of radionuclides causing long-term off site contamination and avoiding early radioactive releases or radioactive releases large enough to require long-term protective measures and actions.”

The Principle 1 of the VDNS has been incorporated into the Slovenian legislation. Namely, the last amendment of the Rules on radiation and nuclear safety factors (JV5) in December 2016 has added also the new requirements for new NPPs, which are in line with the WENRA Safety Objectives for new NPPs. These require that the core damage accidents with core melt, which would lead to early or large releases are practically eliminated. For core damage accidents, which cannot be practically eliminated, practical solutions shall be available, which shall ensure that only limited protective measures are needed for public (no permanent relocation, no need for evacuation

immediate vicinity of the plant, limited sheltering and long-term food restrictions) and that enough time is available to implement these measures.

The VDNS Principle 2 (safety assessments and implementation of safety improvements) states:

“Comprehensive and systematic safety assessments are to be carried out periodically and regularly for existing installations throughout their lifetime in order to identify safety improvements that are oriented to meet the above objective. Reasonably practicable or achievable safety improvements are to be implemented in a timely manner.”

The basics of this principle were already incorporated into the requirements for performing Periodic Safety Reviews, within which the nuclear facility shall, besides verifying overall impacts of ageing of the facility, effects of modifications of the facility, operational experiences, technical progress, changes at the site and other possible impacts, also verify its compliance with applicable current international safety standards and international practice and take all reasonably practicable improvement measures indicated by the results of the PSR.

The Krško NPP conducted two PSRs up to now, which both resulted in many important improvements, some of which had major impact on risk reduction (e.g. installation of the third safety related diesel generator and flood protection dikes upgrade).

In addition, in Slovenia this principle (in connection with Principle 1) was directly incorporated to the legislation through the amendment of Rules JV5 in December 2016. The Krško NPP, as the plant already in operation, shall through the means of PSRs regularly carry out safety assessments to identify additional reasonably practicable safety improvements towards further lowering the risk of severe accidents and off-site releases.

The VDNS Principle 3 (taking into account IAEA Safety Standards and other good practices identified in the CNS review meetings) states:

“National requirements and regulations for addressing this objective throughout the lifetime of nuclear power plants are to take into account the relevant IAEA Safety Standards and, as appropriate, other good practices as identified inter alia in the Review Meetings of the CNS.”

The Slovenian legislation requires that within PSR the existing nuclear facilities verify their compliance with applicable current international safety standards and international practice and take all reasonably practicable improvement measures indicated by the results of the PSRs.

Although the IAEA Safety Standards and review meetings of the CNS are not explicitly mentioned in the Slovenian legislation, these are regularly considered when dealing with the possible improvements for the existing NPP. The IAEA standards are one of the inputs for performing the PSRs – the IAEA requirements and guidelines on design, operation, safety analyses, performance and feedback of experience, and also other areas are all one of the main documents against which the nuclear facilities and their operation are reviewed against.

There have also been examples where the conclusions from the CNS review meetings have directly been incorporated into the requirements for improvements. One such example was the 2nd

Extraordinary CNS meeting after the Fukushima accident, when the conclusions from the meeting were fed into the development of the Slovenian post-Fukushima National Action Plan.

The SNSA systematically reviews the relevance of the IAEA Standards and their impact on potential legislation changes. In 2018 the SNSA started producing tables of concordance to verify compliance of domestic legislation and practices with the IAEA standards.