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MINISTRY OF THE ENVIRONMENT AND SPATIAL PLANNING

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Slovenian Report on Nuclear Safety

Slovenian 9th National Report as Referred in Article 5 of the Convention on Nuclear Safety

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EXTENDED SUMMARY

The ninth Slovenian Report on Nuclear Safety covers the period since submitting the last national report, i.e. from 2019 to 2022. 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. It is necessary to highlight for this reporting period, that the implementation of the post-Fukushima National Action Plan (NAcP) with the Krško NPP Safety Upgrade Programme (SUP) is basically finished. Completion of SUP has also been identified as one of the three challenges during the Seventh Review Meeting, besides the construction of dry spent fuel storage and low-level waste repository 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 as already indicated consists of the SUP, which has been divided into three phases. The original deadline for the implementation was 2016 but was later extended to December 2021 and by then all the originally planned SUP improvements have been successfully completed. In addition, the Krško NPP implemented a few more, such as replacing the reactor coolant pump seals with the high temperature seals and constructing the spent fuel dry storage (SFDS), which is still ongoing. Design with additional safety analyses, licensing and the construction of the main concrete slab and walls have been completed. The dry storage building with external arrangements and all the necessary infrastructure is expected to be completed in the second half of 2022. Additional systems, structures and components implemented within the SUP are designed and structured in accordance with the design extension conditions (DEC) requirements specific for the Krško NPP design and site location. The SUP improvements have drastically decreased risk and improve the robustness of the Krško NPP. This is best seen from the PSA results, where core damage frequency has been reduced by around 75%. With SUP implementation unfiltered releases are reduced by about 70% mainly due to the filtering effect of the passive containment filtering vent system (PCFVS) and additional preventive DEC A systems, such as alternate injection and heat removal systems.

The second part of the Slovenian NAcP form the so called "soft" improvements. based on additional documents reviewed by the SNSA in the aftermath of Fukushima Daiichi accident, which are part of the continuous improvement process (for example, legislation is currently being revised again, to include some newest IAEA design requirements; in April 2022 the SNSA has been again reviewed by the IAEA IRRS mission, and then again in 10 years, etc.).

Challenges

Besides the implementation of the NAcP, as mentioned two other challenges were identified during the last review meeting held and these are the completion of the spent fuel dry storage

(SFDS) beside low and intermediate level waste (LILW) repository and also 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 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 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 has started in March 2021 and will be completed in 2022. The first campaign of the spent fuel transfer is planned for the year 2023.

In addition, the site for LILW disposal facility in Vrbina near Krško NPP has been selected already in 2009. The draft preliminary consent on the nuclear safety and radiation safety was issued in 2019 and public consultations as well as consultations on transboundary impacts were then concluded in 2021, when environmental consent was issued. The preparatory works for the LILW repository were carried out in 2017 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. The consent for construction as well as decision on the status of nuclear facility and on the facility of national importance were issued in January 2022. As far as the building permit is concerned, it is still in preparation and foreseen to be issued soon.

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 Arrangements for nuclear or radiological Emergency Preparedness and Response (EPR) between Slovenia and Croatia were tested and their 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, especially those being recalled within Organizational Meeting of the Joint Eighth and Ninth Review Meeting, as well as the implementation of the Vienna Declaration on Nuclear Safety.

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. In recent years, the AMP has been checked within the scope of IAEA missions (OSART, pre-SALTO) to verify the preparedness of the Krško NPP on its long-term operation. The Krško NPP has also established the Department of engineering support for long-term operation and beside upgrading the existing corrective action programme for better

ageing management, developed new long-term operation programme, as well as new programmes for ageing management of active components and technological obsolescence. In addition the third PSR underway is performed at the time of the transition of the Krško NPP to long-term operation and a special emphasis is therefore devoted to inspections of plant conditions, the preparedness for extending plant operation, as well as adherence to modern requirements, standards, and good practices for long-term operation.

Since 2012, the SNSA assess the **safety culture** in the Krško NPP. The SNSA collects the observations on safety culture at the Krško NPP. from inspections, communications with the licensee, licensing process and reviewing of the NPP 's events analysis reports. Positive or negative observations are divided into one of five safety culture characteristics according to the IAEA standards. After each fuel cycle the report is written, where the results are compared to the previous reports and the report is sent to the Krško NPP. Working group which consists of the NPP's and SNSA's safety culture experts will discuss about the SNSA's findings on the NPP's safety culture in order to unify their interpretation.

In 2020, the SNSA performed its's first safety culture self-assessment. All the SNSA employees had an opportunity to participate in the survey. The survey results were presented in the report and the action plan was prepared. One of the suggestions in the action plan was to conduct interviews for the statements at which more than 20 % employees did not agree with them. The areas for which interviews will be conducted with in order to obtain additional information and suggestions for improvement are: decision-making, competence and allocation of resources, leadership skills, reporting of the errors/mistakes and corrective actions. The interviews will be completed in 2022 and the report on the safety culture self-assessment will be revised.

During this reporting period, in the area of **the international peer reviews**, pre-SALTO mission to the Krško NPP was conducted in October 2021 before moving to the long-term operation. The implementation of the following SALTO mission is expected after the implementation of the action plan for the ageing safety factor within the PSR3. Furthermore, the IRRS mission took place in April 2022 to review the Slovenian governmental, legal and regulatory framework for nuclear and radiation safety including overview of the organization and functioning of both two relevant regulatory authorities in this area, the Slovenian Nuclear Safety Administration (SNSA) and the Slovenian Radiation Protection Administration (SRPA). The mission was organized back-to-back to an ARTEMIS mission conducted in May 2022. The IRRS and ARTEMIS follow-up missions are expected to be invited in three or four years to verify the progress. Also some other peer review missions are planned. Slovenia invited the IAEA for an EPREV follow-up mission, which is planned in October 2022. In the upcoming years also IAEA Severe accident peer review mission is planned after the completion of the SUP.

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**.

Experience from the response to the Covid-19 pandemic.

Coping with the Covid-19 pandemic has certainly been a major topic through the recent reporting period. Even before first cases were discovered in Slovenia, the Krško NPP started intensive and proactive preparations of safety measures. The goal was to protect the health of all workers on the plant, preventing the spread of the virus and to sustain safe and reliable plant

operation in all conditions. Introduction of measures was gradual, in dependency of situation in the country and on site. Special challenge for the plant was the outage, which was conducted in April 2021. There was a very good collaboration between the Krško NPP and the SNSA in preparing measures in case that regulatory requirement activities could not be performed. Even though the outage was performed in the peak of the third pandemic wave in which there were numerous cases of infection, spreading of virus among workers was prevented, so it didn't have a negative impact of performing all planned outage activities.

Lessons Learned from Emergency Exercises

In the past two years regular annual Krško NPP exercise (in 2020 cancelled due to Covid-19 pandemic restrictions, and in 2021 conducted as repetition with personnel attending the exercise in smaller groups, again adapting to Covid-19 pandemic), ConvEx-3, co-joined by ECUREX-2021, and ConvEx-2b were conducted. The main lesson learned from the ConvEx-3 and ConvEx-2b exercises was the need to improve our national procedures for providing or requesting the international assistance through RANET (Response and Assistance Network). Therefore, the SNSA revised procedures with more detailed information on the process itself, the responsibilities of the involved organizations, and also revised the assistance capabilities, registered in the RANET database.

Based on results of the KIVA[2019], the first national exercise on cyber security at nuclear facilities, the SNSA has identified the need to be better prepared for cyber security initiated events. The SNSA therefore adopted in 2022 procedures for emergency response team to respond in such cases. With this regard new expert group, namely the Cyber security expert group was introduced to the SNSA emergency response team. The key task of this group during an emergency caused by a cyber-attack is to connect key domestic and foreign stakeholders, to cooperate with other emergency response team expert groups.

Even more comprehensive and wider-scale KIVA[2022] exercise took place in May 2022. In addition to the focus of the exercise on responding to cyber threats, the scenario also included aspects of nuclear security and nuclear safety at a fictitious nuclear facility. Besides, it was carried out using specially designed exercise information and process equipment models used by nuclear facilities, as well as software and hardware used by cyber attackers. The numerous participation (70 experts in total) and active involvement of both domestic and foreign representatives confirms the high awareness of the importance of ensuring cyber security in nuclear facilities. By carrying out this exercise, Slovenia has once again shown its enviable preparedness for emergencies, including those caused by cyber-attacks, as well as strong connections between national and international stakeholders.

Operating Experience

At the Krško NPP the root cause analysis of significant events is 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 period of 2019-2022 the Krško NPP made screening for about 7000 documents. Among them 518 records were created in Corrective Action Program. This results in 177 direct assignments and 10 in-depth analyses with 94 actions. 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 2019 till the end of 2021, 92 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. Main tool in public communication is the Krško NPP web page as well, where general information on a nuclear power plant, electricity, nuclear technology, and nuclear and radiation safety can be obtained. Furthermore, the plant makes actual data available on the local television and local environmental data display boards.

The SNSA informs interested parties through the SNSA's website and through press releases. Regarding the decisions taken in the administrative procedures and inspection control the SNSA reports to the public in the annual report, which incorporates all data relevant for safety regarding operation, important events, radioactivity status, etc. 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 once 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.

For informing the public SNSA has adopted a Public Communication Strategy, setting the basic principles, authority, and responsibility for communication, defining interested parties and in particular setting different means of communication with the public. The strategy considers also the SNSA's timely and transparent communication during a nuclear or radiological accident, which is further specified in several specialized organizational procedures, cared for by the Emergency Preparedness Division at the SNSA.

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, 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 completely refurbished and re-published in 2017 (hereinafter "the 2017 Act") and it introduced provisions to align the Slovenian legislation with the Euratom Basic Safety Standards (BSS) Directive. The 2017 act was then in 2019 amended with some changes related mostly to the field of security clearance and for the second time in 2021 to eliminate some inconsistencies in the transposition of BSS Directive into Slovenian legislation.

In 2021 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 0.18 μSv per year due to atmospheric and liquid discharges. The value represents 0.36% of the authorized 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.

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, although some of them were cancelled in 2020 due to Covid-19. 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.

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 (Slovenian nuclear safety administration).

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

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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 2019 to 2022 is evaluated in this ninth 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, 26/19 and 172/21; 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). 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 that last review meeting rapporteur's report, as the Eighth Review Meeting was then cancelled. In addition, it addresses those areas being recalled within Organizational Meeting of the Joint Eighth and Ninth Review Meeting, including experience from the response to the Covid-19 pandemic and especially Ageing Management and Safety Culture in Topical Sessions. 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). The environmental consent was then issued in 2021. The consent for construction as well as decision on the status of nuclear facility and on the facility of national importance were issued in January 2022 and also the building permit is foreseen in the short term.

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 now finalized with all of the original SUP improvements completed by the end of 2021. The SUP includes modifications such as the alternative design of spent fuel pool cooling, the Operations 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 an extended SUP item and the construction is ongoing and expected to be completed in the second half of 2022. 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 for some time. Second Periodic Safety Review is in progress, and it operates without any significant issues.

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, with a total activity of 48.8 TBq. Closure works at the Jazbec disposal site have been completed and the Agency for Radwaste Management (ARAO) started the long-term surveillance and maintenance of the site in 2015. The closure of

the Boršt disposal facility has been delayed due to the activation of a landslide and the required additional remediation works. 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. The Krško NPP developed and implemented appropriate programs and procedures and in recent years also IAEA missions verified the preparedness of the Krško NPP on its long-term operation. During 2021, the Krško NPP carried out some additional activities within preparations for the long-term operation. Amongst the conditions to extend its operational life span, the Krško NPP finalized the planned safety upgrades, regularly implements periodic safety reviews in ten-year cycles and maintains 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 2019 to 2022 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 2019. 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 and approved by the SNSA in February 2012. The original deadline for the SUP implementation was December 2016, but was later extended, first to December 2018, and again to December 2021. Then all of the original SUP improvements have been successfully completed by the end of 2021. In addition, the Krško NPP implemented a few more, such as replacing the reactor coolant pump seals with the high temperature seals and constructing the spent fuel dry storage (SFDS), which is still ongoing. Design with additional safety analyses, licensing and the construction of the main concrete slab and walls have been completed. The dry storage building with external arrangements and all the necessary infrastructure is expected to be completed in the second half of 2022. The SFDS project with first transfer of spent fuel shall be completed by the end of 2023. The SUP improvements have drastically decreased risk and improve the robustness of the Krško NPP. For more information on the Krško NPP's SUP see Appendix II, chapter A: Challenges.

6.2 Topical Peer Review (TPR) – ageing management

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.

The second phase started in January 2018 when the NARs were made available for questions and comments from stakeholders. 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.

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 (NAcP) on the implementation of their Country Specific Findings was prepared and submitted to ENSREG in September 2019. The Action Plan defines the scope and time frame of the necessary improvements and actions to be implemented, which were identified during the TPR process. SNSA defined nine actions in the national TPR Action Plan from the areas of electrical cables, concealed pipework, reactor pressure vessel, concrete containment structure and general Ageing Management Programme (AMP) of the Krško NPP.

In the area of ageing management of electrical cables two actions were carried out that referred to the checking of suitability of the AMP documentation and testing of electrical cables. In this regard, the SNSA conducted a special thematic inspection in July 2020. The inspection revealed that the Krško NPP consistently carries out visual supervision in the area including diagnostic testing, while the situation is effectively monitored through a special computer database Comsy. The results of the latest cable testing were examined as well and no new degradations were detected. Some minor additions to the AMP and procedures of the Krško NPP were required during the thematic inspection that pertain mainly to the testing of spare cables.

An examination of those pipe sections of the essential water system and diesel fuel storage that are located in the concrete wall penetrations was carried out within the scope of the ageing management of concealed pipework. A non-destructive examination method of guided ultrasonic waves was used for this purpose. The analysis of the examination results showed that there were no degradations in the mentioned parts of pipe sections in penetrations that would require corrective actions.

The SNSA also conducted an extensive thematic inspection on the ageing management of the reactor pressure vessel of the Krško NPP in November 2020. Activities of the Krško NPP for ensuring the integrity of the reactor pressure vessel were checked in accordance with the requirements of the international standards, recommendations and good practices. Apart from that, the survey of the base material of the reactor pressure vessel and particularities pertaining to the insurance of its integrity during the long-term operation (LTO) of the Krško NPP after 2023 were checked within the thematic inspection. Results of the inspection led to the conclusion that there were no active degradation processes in the reactor pressure vessel, which confirms the high integrity of the pressure boundary. This conclusion was further backed up by a special report from the Westinghouse; the report states that the integrity of the reactor pressure vessel of

the Krško NPP is not compromised due to potential defects in the base material that may have occurred during the manufacturing process.

A thematic inspection was carried out by the SNSA on concrete structures important to safety in March 2021 that included the concrete containment. In accordance with the TPR NAcP, the inspection found out that the Krško NPP adequately follows the international development for non-destructive examination (NDE) methods and uses NDE methods regularly.

One of the TPR NAcP actions regarding the general AMP was the review of scope of the programme and its potential upgrade in accordance with IAEA standards, including IAEA SSG-48; this is going to be done in the frame of the third Periodic Safety Review (PSR3) that is currently under way. SNSA has already approved the PSR3 programme, which is based on the IAEA SSG-25 and upgraded with requirements from national legislation.

SNSA submitted a status report on the implementation of the TPR NAcP to ENSREG in May 2021. Apart from two actions(amendment of the legislation for extended NPP shutdowns and revision of the Krško NPP's Structures Monitoring Programme), all other actions from the TPR NAcP were completed in time. Next reporting on the TPR NAcP implementation status is scheduled for 2023.

Second Topical Peer Review (TPRII) – fire protection

On 10 November 2020, at its 41st Plenary Meeting, ENSREG decided that the topic of the second Topical Peer Review (TPR II) would be "Fire Protection". In 2021, the preparation of the Technical Specification began. The technical specification is being prepared by the WGTPRII Working Group (subgroup of the WENRA/RHWG group). Slovenia is actively participating in the WGTPRII. The technical specifications is foreseen to be approved by ENSREG in the first half of 2022. For Slovenia the following installations will be taken into consideration in the National Assessment Report (NAR): the Krško NPP, Dry cask storage facility (SFDS) under construction and Radioactive waste storage facility both located in Krško NPP site. In the second phase, EU countries will start preparing national reports in accordance with the Technical Specifications (from 1 July 2022 to 31 October 2023).

6.3 Second Periodic Safety Review (PSR2)

On 30 May 2014, the SNSA approved the Second Periodic Safety Review (PSR2) and the resulting implementation plan, which included 225 improvements. Altogether 220 actions were completed in the 5 years period determined for the PSR2 action plan completion. The action plan completion period can be extended by up to 3 additional years in case of complex actions. There were 5 remaining actions that extended their implementation for additional 2 and half years. All PSR2 actions were completed by January 2022.

6.4 Third Periodic Safety Review (PSR3)

On 23 December 2020, the SNSA approved the programme for the PSR3 of the Krško NPP, in which the scope, content and timeline for the review were determined. PSR3 shall be completed in 2023 with the PSR report, which will contain the global safety assessment of the facility and the plan for changes and improvements based on the review findings.

According to Article 112 of the *Ionising Radiation Protection and Nuclear Safety Act*, the Krško NPP must ensure the regular, comprehensive, and systematic evaluation and verification of the radiation and nuclear safety of the facility. This is performed by periodic safety reviews. Approval

of the PSR report is a condition for the extension of the operating license for the next ten years. The requirements for the programme and the performance of the PSR are defined in more detail in the *Rules on operational safety of radiation and nuclear facilities*. The SNSA issued in 2020 a new revision of practical guideline PS 1.01, which explains in detail the contents of the PSR. The requirements for the PSR of nuclear facilities and the review methodology are based on the EU Nuclear Safety Directive, the International Atomic Energy Agency (IAEA) safety standards, and the recommendations of the Western European Nuclear Regulators Association (WENRA).

The third PSR is performed at the time of the transition of the Krško NPP to long-term operation and a special emphasis is therefore devoted to inspections of plant conditions, the preparedness for extending plant operation, as well as adherence to modern requirements, standards, and good practices for long-term operation. Altogether, the operator reviewed 18 safety factors, of which three are new: radioactive waste and spent fuel; security; and radiation protection. The review of the safety factor *security* is performed as a separate process as appropriate protection of security related information has to be ensured. In February 2022 the operator completed the review process and submitted topical reports to the regulator for review and comments. These comments will be incorporated into final revision of topical reports. The PSR3 report is to be completed by end of June 2023.

6.5 Pre-SALTO in the Krško NPP

Prior to the start of the long-term operation of the Krško NPP, Slovenia wanted to invite the IAEA pre-SALTO mission to check the effectiveness and adequacy of the aging management program and the Krško NPP's programs and procedures, which is crucial for safe long-term operation. The SNSA suggested that the pre-SALTO mission to the Krško NPP could be carried out as part of the PSR3 in order to optimize the necessary resources; this would cover part of the PSR3 safety factors by the mission. Thus, the results of the mission will be used as input data for the review of safety factor 4 (ageing) in the PSR3, and the findings of the pre-SALTO mission will be discussed in the process of ranking PSR3 findings.

Even before the implementation of the pre-SALTO mission, the Krško NPP carried out some additional activities as part of preparations for the long-term operation of the power plant. Among the most important are the establishment of an engineering support department for long-term operation, a new program for long-term operation, upgrading the program of corrective actions for better aging management in terms of operational experience and a new program for managing aging of active components and technological obsolescence.

The pre-SALTO mission took place at the Krško NPP between 5 and 14 October 2021. Representatives of the SNSA were present at the mission three times, at an introductory meeting, a conversation with the Head of Mission after its completion and an exit meeting. The mission's findings were 9 good performance, 9 suggestions and 5 recommendations. The SNSA and the Krško NPP received a preliminary draft report from the IAEA with the findings of the mission for review and possible comments. The final report of the mission was prepared by the IAEA at the end of January 2022. An action plan is being prepared at the Krško NPP, with which the findings of the pre-SALTO mission will be properly addressed and resolved. The implementation of the SALTO mission, which is to follow the pre-SALTO mission at the Krško NPP, is expected after the implementation of the action plan for safety factor 4 within the PSR3.

6.4 Events in the Krško NPP

In the period from 2019 to 2021, the following events occurred in the Krško NPP:

- Failure of more safety and non-safety components due to lightning strikes near Krško NPP – 22 June 2019,
- Loss of the containment penetration closure during the 2019 outage – 5 October 2019,
- Impact of the coronavirus (disease covid-19) on the Krško NPP – 4 March 2020,
- Earthquake in Zagreb – 22 March 2020,
- Inoperable diesel generator no. 2; fault on circuit breaker MD2-DG2 – 8 April 2020,
- Automatic shutdown of diesel generator no. 1 due to high cooling water temperature – 20 August 2020,
- Automatic shutdown of the power plant due to the earthquake in Petrinja, Croatia – 29 December 2020,
- Starting engine air leak when starting diesel generator no. 2 – 11 February 2021.

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

Automatic shutdown of the power plant due to the earthquake in Petrinja, Croatia

On December 29, 2020, at 12.20 local time (11.20 UTC), the seismic instrumentation of the Krško NPP recorded an earthquake. According to seismograph measurements from the national network of seismic observatories, the epicenter was 39 km south of Zagreb and 149 km southeast of Ljubljana. According to the ARSO, the estimated magnitude of the earthquake is 6.1. The Croatian Seismological Service reported a slightly higher estimated magnitude of 6.2. Numerous aftershocks followed, which were not recorded by the seismic instrumentation of the Krško NPP.

Prior to the event, the power plant was operating at full capacity. Immediately after the activation of the seismic instrumentation, the reactor was automatically shut down (at the signal "NIS HI FLUX RATE POWER RANGE REACTOR TRIP"). On the out-of-centre instrumentation, a high change in neutron flux occurred, resulting in reactor and turbine shutdown. In accordance with procedures, the power plant was stabilized and visual inspection of buildings, components and systems after the seismic event were performed. Inspections confirmed that the power plant had not suffered any damage that would affect safety or prevent its continued operation.

The maximum ground accelerations did not exceed the design values for safe shutdown of the power plant (Safe Shutdown Earthquake = 0.3 g) at the Krško NPP site. The Operational Basis Earthquake limit = 0.15 g, which includes a combination of the limits of the acceleration response spectra, velocity response spectra and cumulative absolute velocity, was also not exceeded.

The cause of the event with the shutdown of the power plant is an earthquake. This caused various effects with shocks, such as the movement of nuclear instrumentation detectors relative to the core, the movement of parts of the reactor and the core, and minor reactivity effects. The

combination of these effects resulted in changes in neutron flux indication on the off-centre instrumentation that were sufficient to trigger automatic reactor shutdown (greater than 8% / 2 sec).

The Krško NPP and the SNSA examined the event and performed a detailed 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 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. 76/17 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. 26/19 on 26 April 2019 and entered into force 15 days after its publication, i.e. on 11 May 2019.

The National Assembly of the Republic of Slovenia adopted another Act Amending the Ionizing Radiation Protection and Nuclear Safety Act (ZVISJV-1B). The reason for amending the 2017 Act for the second time in a relatively short period of time after its adoption is the letter of formal notice of the European Commission, which called on the Republic of Slovenia to eliminate inconsistencies in the transposition of Council Directive 2013/59/Euratom on Basic Safety Standards for radiation protection into Slovenian legislation. This amendments to the 2017 Act thus include amendments to Article 3 (with a new definition of the term radiological facility),

Article 42 (with cooperation between authorized radiation protection experts and authorized medical physics experts), Article 49. (by supplementing the content of the data contained in the database on personal doses of exposed workers), Article 54 (with mandatory data on received radiation doses in the current calendar year and in the last five calendar years which external contractor has to send to the facility operator or radiation contractor before starting work in the controlled area) and Article 137 (with the added content of the permit for the use of the radiation source, which must also contain minimum criteria for the efficiency of the source, source container and additional equipment regarding operating conditions and restrictions on highly active radiation sources).

The amendments to the 2017 Act were published in the Official Gazette of the Republic of Slovenia, No. 172/21 on 29 October 2021, and entered into force on 13 November 2021.

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, two Rules of the Minister responsible for the Environment and six Rules of the Minister responsible for Health were adopted.

Since our last report (8th National Report) in April 2019, the following by-laws have been adopted on the basis of the 2017 Act, i.e. Governmental Decrees and Rules of the minister responsible for the environment and / or the minister responsible for health:

- Decree on areas of restricted use due to nuclear facilities and on the conditions for construction in these areas (Official Gazette of the Republic of Slovenia, No.78/19),
- Amendments to the Decree on the criteria for determining the compensation rate due to the restricted use of areas and intervention measures in nuclear facility areas (Official Gazette of the Republic of Slovenia, No. 8/20),
- Amendments to the Decree on the national radon programme (Official Gazette of the Republic of Slovenia, No. 152/20),
- Amendments to the Rules on monitoring radioactivity in drinking water (Official Gazette of the Republic of Slovenia, No. 104/20),
- Rules on providing qualification for workers in radiation and nuclear facilities (Official Gazette of the Republic of Slovenia, No. 162/20),
- Amendments to the Rules on special radiation protection requirements and the method of dose assessment (Official Gazette of the Republic of Slovenia, No. 30/21)
- Rules on radioactive waste and spent fuel management (Official Gazette of the Republic of Slovenia, No. 125/21) and
- Rules on requirements for new constructions and interventions in the existing buildings in order to protect human health from the harmful effects of radon (Official Gazette of the Republic of Slovenia, No. 14/22).

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. Both resolutions, as umbrella documents in their respective fields, are in the process of being amended and supplemented and are expected to be adopted in a year or two for the next programming period.

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 piece of legislation 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; 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 determines the criteria for the classification of radiation facilities and less important radiation facilities.

The competencies in nuclear and radiation safety 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:

- 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,
- the license to construct a facility – the competent body is the Ministry of the Environment and Spatial Planning, with an approval from the SNSA,
- the license for trial operation – the competent body is the Ministry of the Environment and Spatial Planning, with an approval from the SNSA,
- license for the operation and 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 despite 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.*

In 1987, the Republic Administration of Nuclear Safety (RUJV) was established as an independent administrative body by the Organization and Work Area of the Republican Administrative Bodies and Republican Organizations Act. The RUJV was responsible for matters relating to the safety of nuclear facilities and the inspection of the implementation of Acts and other regulations governing the safety of nuclear facilities.

Until 1987, the Republic Committee for Energy, Industry and Construction was responsible for matters relating to the safety of nuclear facilities and inspections of the implementation of laws, other regulations and general acts of national jurisdiction governing the safety of nuclear facilities. In 1982, the Committee for Energy, Industry and Construction issued a permit for the commercial operation of the Krško Nuclear Power Plant.

With the Act on the Organization and Work of Ministries, adopted in November 1994, the RUJV was renamed as the Slovenian Nuclear Safety Administration (SNSA) and included in the Ministry of the Environment and Spatial Planning (MESP) as its constituent body. This Act also partially extended its competences to the field of radiological safety of nuclear facilities and to the physical protection of nuclear materials and nuclear facilities. The competence and scope of work of the SNSA has then further expanded several times, especially with the provisions of the Act governing the field of nuclear safety and radiation protection.

The Ministry of Infrastructure is responsible for the field of energy (and thus also the production of nuclear energy). According to the current act regulating nuclear and radiation safety (2017 Act), it has no tasks and competencies in this area and is thus completely separated from the SNSA in terms of legislation, administration, and organization.

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 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 Management Manual, as the key document of the internal Management System of the SNSA, define its mission and vision:

Mission

We ensure that the harmful effects of ionizing radiation on people and the environment are prevented or limited, and that sources of ionizing radiation are used only for peaceful purposes.

Vision

The highest level of radiation and nuclear safety, the lowest possible radiation exposure for humans and the environment, and the use of ionizing radiation sources only for peaceful purposes.

Due to our professionalism, independence, and attitude towards clients, we are a highly respected administrative body at home and abroad and a role model for other administrative bodies.

The detailed scope of competencies of the SNSA and other relevant administrations, entrusted with the implementation of the legislative framework in radiation protection and nuclear safety, are prescribed primarily in the 2017 Act and in the other pieces of legislation, which 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 Manager is attached directly to the Director. The current organisational chart is shown in the Figure 1.

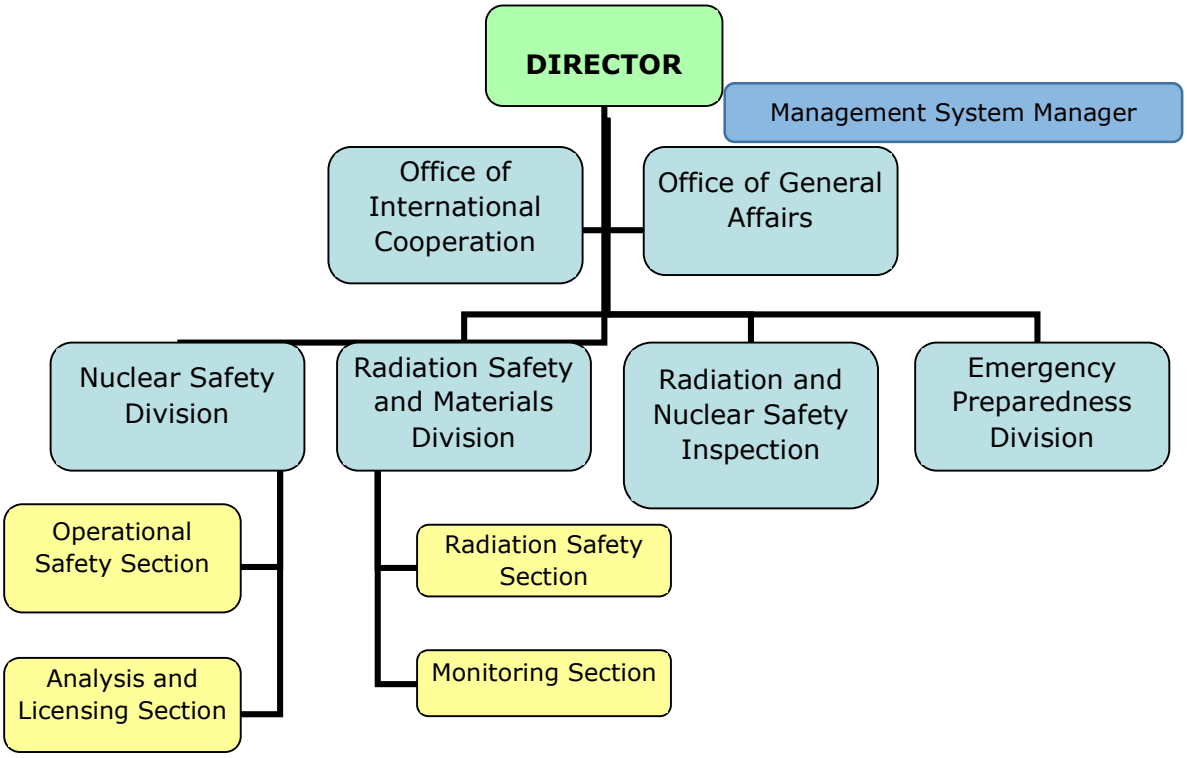

Figure 1: Organizational Chart of the SNSA

Each position in the SNSA organizational 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 must pass the state exam for the public servants, which mostly covers general topics.

The individual program for acquirement of the necessary competences is a part of SNSA »Systematic Approach to Training. 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) organized by the IAEA. Also, many of the SNSA staff attended courses on Westinghouse Technology organized in the US NRC Training Centre in Chattanooga. The training needs are defined for groups of job position and are divided on the initial and the refreshment training.

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 "Systematic Approach to Training" has been finalized and it is used for the training planning for the SNSA staff. (See more on the SNSA SAT under Article 11 of this Report). Also, for this purpose the SNSA Management System prescribes the preparation and adoption of so-called Organizational Regulations OP 1.60: Management of Employees' Competences and Conduct of Annual Interviews.

From our last report in 2019 several new employments have been approved to the SNSA; in fact, most of these newcomers represent so called substitute employments (but full-time jobs),

whether for colleagues who have been retired, found another job or are on maternity leave. Some of them were previously employed on the SNSA's projects, so they are rather familiar with the work conducted at the SNSA. For them new employment represents change from fixed contract to full-time/permanent employment where the post is financed from the integral state budget.

According to the MESP personnel/staffing plan for 2021 and 2022 the personnel policy for the SNSA is unchanged and sets a quota of 41 employees.

The SNSA continues to address the staff shortage through short-term project employment.

At the beginning of 2021, the SNSA employed 43 civil servants, and in the middle of the year and at the end of the year 46 civil servants. During the year, 3 civil servants left, of which 1 civil servant retired. The number of employees includes all employees who are employed for a definite and indefinite period of time, regardless of the source of funding.

As of 31 December 2021, 3 civil servants were financed from project employment, 1 was employed because of a temporary increase in the volume of work, and 1 is employed for the time of replacement of another colleague, i.e. a total of 5 fixed-term employment.

Out of 46 employees, 5 are not included in the personnel/staffing plan, so at the end of 2021 the SNSA consistently met a certain quota (41) of employment.

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 2020, 2021 and 2022 is shown in Table 1. 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 2021, when the reallocation of funds to the SNSA from the MESP budget provided funds to pay for a larger share of probes supplied as part of a project to modernize the Early Warning Network.

Table 1: The SNSA Budget for 2020, 2021 and 2022 (in EUR)

STRUCTURE		2020 (€)	2021 (€)	2022 (€)
Salaries/wages		**1.638.856,58**	**1.764.029,00**	**1.682.000,00**
Material expenditures		**86.240,67**	**113.680,98**	**136.432,79**
Investments and maintenance costs		**46.268,93**	**496.224,88**	**127.018,66**
International projects		**158.772,00**	**131.500,00**	**171.500,25**
Membership fees: **(IAEA, OECD/NEA membership, USNRC programs)**		**536.102,00**	**380.000,00**	**410.000,00**
Outsourcing	Nuclear safety	29,444,56	82.349,40	230.000,00
	Radiation safety & monitoring	164.331,54	182.672,80	237.062,00
Total		**2.659.645,92**	**3.150.457,06**	**2.994.013,70**

In 2001, the SNSA started to develop and introduce the management system. Now, the SNSA management system is established, applied, and sustained in accordance with the IAEA Standard GSR Part 2 "Leadership and Management for Safety ". The SNSA management system is an integrated management system based on the process approach. It is described in more detail under the Article 13. Quality assurance.

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 above-mentioned 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.

Furthermore, in the area of emergency preparedness and response, the 2017 Act gives the competence to the Administration for Civil Protection and Disaster Relief (within the Ministry of Defence). Their responsibilities and competencies are also generally defined in the above-mentioned Decree on Administrative Authorities within Ministries. It performs administrative and professional protection, rescue and relief tasks, as well as other tasks regarding protection

against natural and other disasters. In more detail, the tasks and responsibilities of the Administration for Civil Protection and Disaster Relief are defined in the Act on Protection against Natural and Other Disasters and Decree on the content and elaboration of protection and rescue plans.

Besides the SNSA, the SRPA and the Administration for Civil Protection and Disaster Relief, 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:

- 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 for Civil Protection and Disaster Relief and Ministry of Interior in the governmental structure is shown in the Figure 2.

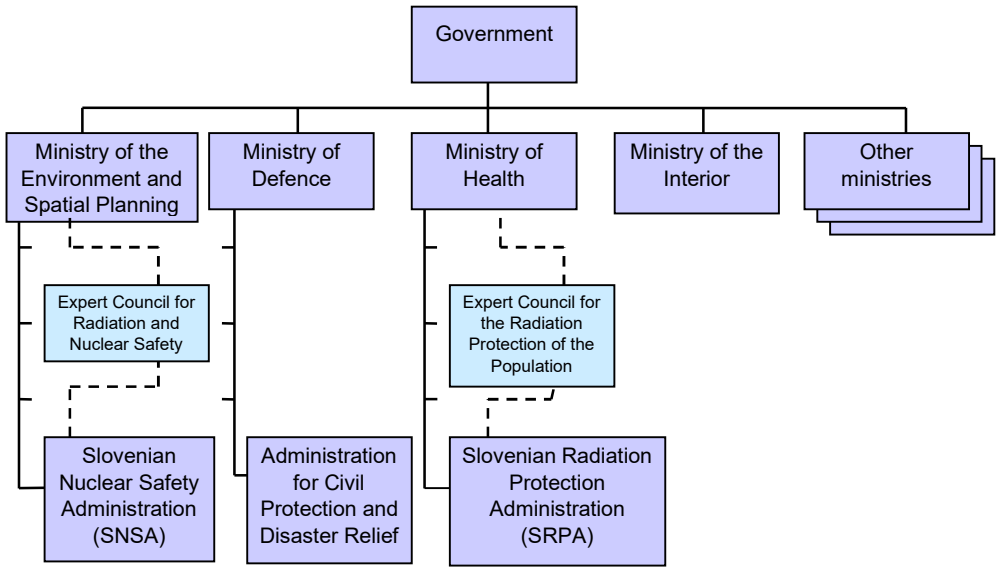

Figure 2: The SNSA and SRPA within the governmental structure

As mentioned above, one of the key actors in the implementation of powers and tasks arising from legislation in the field of nuclear and radiation safety, is also so-called authorized expert organizations (TSOs). Current legislation stipulates that the operators of radiation and nuclear facilities must obtain expert opinions provided by the TSO related to specific interventions in facilities. The 2017 Act specifies the cases when the operator must attach the opinion of the authorized organization to his application (for obtaining a permit or other administrative act of the SNSA). The 2017 Act also sets out the basic conditions for obtaining an authorization issued for a limited period of time (five years, which can be renewed and extended) by the SNSA, while

the program for verifying compliance with the conditions for carrying out the work of an authorized expert, the register of authorized experts. the manner and scope of regular reporting, the form and content of the expert opinion and other conditions that must be met by the authorized experts in connection with the assessment of radiation and nuclear safety are specified in Rules on authorized experts on radiation and nuclear safety.

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.

With regards to openness and transparency of regulatory activities of the SNSA it should be noted that in addition to general legislation that binds all administrative bodies (ministries and their constituent bodies) to public and transparent work, the 2017 Act also contains such provisions: the general principle of publicity (Article 4, paragraph 11); Article 8 (publicity of data) and in the provisions (Articles 168 and 169), which determine the preparation of the annual report on ionizing radiation protection and nuclear safety for the previous year and also determines the type and scope of data to be included in the report.

In addition to the annual report adopted by the Government and considered by Parliament (National Assembly), which the SNSA publishes also on its public relations website, the SNSA uses methods and tools that are otherwise common and known, such as statements to the public, press releases/conferences, website information, printed materials and brochures, regular periodic meetings with NGO representatives, etc.

Based on Slovenian legislation (general as well as legislation in the field of nuclear and radiation safety) the SNSA authorizations, approvals, permits, licenses, and other administrative decisions is not requested or envisaged to be publicly available. The same is valid also for inspection reports.

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 seventh 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, enough 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 and Rules on operational safety of radiation and nuclear facilities include provisions for the implementation of "prime responsibility" for nuclear safety of the operator in day-to-day activities.

Let us briefly mention also the open and transparent communication of the license holder with the public. The requirement for informing the public about the conditions under normal operation is stipulated in in Article 8 of the 2017 Act and for information on emergencies at the facility, the provisions are laid in Article 134 and 135. There are several methods by which the NPP Krško maintains the open and transparent communication with the public by: press releases/conferences, printed materials and brochures, day of the »Open Doors«, etc. More than 5000 visitors from Slovenia and abroad take plant tours every year. Main tool in public communication is also web page, where general information on a nuclear power plant, electricity, nuclear technology, and nuclear and radiation safety can be obtained. A special section of the

website is dedicated to "Current Information", while in the "News Center" visitors can get acquainted with news and various reports, such as monthly operation reports, annual radioactivity measurements reports, business reports years). Furthermore, the plant makes actual data available on the local television and local environmental data display boards.

With regards to the functions and responsibilities, including adequate resources and powers for effective on-site management of an accident and mitigation of its consequences by the license holder of the nuclear installation (and response organizations) let us state only the most essential: they are assigned by the 2017 Act, Rules on operational safety of radiation and nuclear facilities, Rules on radiation and nuclear safety factors, Protection Against Natural and Other Disasters Act and with secondary legislation for implementing this act.

The SNSA verifies the compliance of the on-site emergency arrangements of license holder of the nuclear installation against the regulatory requirements before commencement of operation of the facility and during the lifetime of the facility (as prescribed in the 2017 Act and the Decree on the content and elaboration of protection and rescue plans). The license holder of the nuclear installation needs to prepare an on-site emergency plan of the facility and ensure the necessary organizational structure for clear allocation of responsibilities, authorities, and arrangements to emergency workers. This plan is reviewed in the licensing process in the framework of safety analysis report review and assessment.

Inspections of emergency response arrangements in the nuclear facilities are regularly planned and conducted according to the respective SNSA Annual Inspection Plan. Next to inspections the analyses of exercises are also extremely important, as they show, if there is a need to make some further improvements of different emergency response elements, either regarding management, equipment, trainings etc. Therefore, one of the important parts of emergency response inspections at the Krško NPP is also the review of the action plans conducted after the exercises and the improvements/changes that were adopted after the exercises.

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 and the Rules on operational safety of radiation and nuclear facilities further define the Act provisions and they were revised in 2016 according to the new WENRA safety reference levels of 2014. The Rules on radiation and nuclear safety factors gives a detailed definition of safety culture. Chapter V (Management system) of the Rules on radiation and nuclear safety factors 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 Rules on operational safety of radiation and nuclear facilities further 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. Krško NPP is planning to perform Safety Culture Self-Assessment in the year 2022.

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 2020 the Program for Third Periodic Safety Review (PSR3) was approved.

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. Team for Monitoring Safety Culture and Human Behaviour regularly meets a few times per year. Approximately 400 examples were prepared and evaluated yearly by team members. Some of them identified possible

improvements and some recognized good practices. The most common reasons for deviations were from areas of industrial safety, foreign materials intrusion and shortcomings/inconsistency in the implementation of activities. 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). All Safety Culture Performance Indicators are in green zone except for the indicator »Number of Human Related Events«, which is in warning yellow zone due to changed expectance levels and prolongation of trending period. The assessment of the indicator condition and proposing of appropriate corrective actions is in progress.

According to the 2017 Act and the Rules on operational safety of radiation and nuclear facilities 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 (SUP) aim is to improve the plant safety against extreme external hazards and to increase plant capabilities for the prevention or mitigation of severe accidents.

The implementation of the Krško NPP's SUP was completed with all off the original SUP improvements being realized by the end of 2021.

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 workplace 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. 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 some reportable events, all of them with low safety significance. One of these events were rated as INES level 1 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 (e.g primary system leakage, number of corrective maintenance work order, number of events, number of safety system failures, violation of regulation and TS, fire safety, etc.) that are collected based on weekly, monthly, quarterly or annual reports of the Krško NPP. Each indicator could be in one of the following states: normal, warning or alarm. 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 covering the safety culture and another thematic inspection covering the human and organizational factors on annually basis. 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 regularly 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.

Since 2012, the SNSA assess the safety culture in the Krško NPP. The SNSA collects the observations on safety culture at the Krško NPP. from inspections, communications with the licensee, licensing process and reviewing of the NPP 's events analysis reports. After each fuel cycle the report is written. Working group which consists of the NPP's and SNSA's safety culture experts will discuss about the SNSA's findings on the NPP's safety culture in order to unify their interpretation.

In 2020, the SNSA performed safety culture self-assessment. The results of the survey were presented to all the employees. According to the results it was decided to obtain more comprehensive information on certain areas (decision-making, competence and allocation of resources, leadership skills, reporting of the errors/mistakes and corrective actions) by conducting the interviews with the employees. The interviews will be completed in 2022 and the report on the safety culture self-assessment will be revised.

10.5 Voluntary Activities

On the SNSA's web site (Slovenian nuclear safety administration), 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 published on the web site. On its website the SNSA also publishes additional information and reports on special issues, because of the war in Ukraine since February 2022 the status of Ukrainian nuclear facilities and answers to frequently asked questions (FAQs) received from the public about the events in Ukraine, 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 three EU assistance projects, all aimed at enhancing the capabilities of the Iranian, BOH and Ghana 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):

The 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 owners 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. 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 by the Slovenian owner GEN energija. 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 were deposited in mid-December 2021 in Paris by all signatories to both Protocols and both Protocols entered into force on 1.1.2022 by prior agreement between the contracting parties.

11.2 Human Resources, Training and Qualification

11.2.1 The Krško NPP

At the end of 2021 there were 644 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,
- 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 training and Radiation Protection training and specific Work practices. The Systematic Approach to Training principles, including Job and Task Analyses, are applied for developing technical training programs.

The training program for a licensed operator and shift engineer is completely implemented in-house. The continuous 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 licenses 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 organizations, 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, ARP, 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 (6 senior reactor operators and 2 shift engineers) successfully completed training in 2021. There were 64 licensed reactor operators, senior reactor operators and shift engineers at the end of 2021.

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 has a human resource management called SAT-URSJV. It systematically determines the necessary competencies for individual job position. Competencies are made on the basis of work tasks, which are also determined for an individual job. The work tasks are determined by analyses, where the basis is the Management Manual, where the processes are determined, and on the basis of the processes, the tasks are then defined in more detail. There are also goals assigned for particular job position that are used to monitor the success of the process in particular. In

addition, success is checked at annual interviews, where the competencies of employees are also checked. Based on this, the annual training plan is prepared.

Within the SAT-URSJV, also the necessary training for each process and the specifics trainings for particular job position are determined. Special attention is given to newly employed colleagues for whom a special training plan has been prepared. The SNSA usually recruits new employees without prior expertise in the field of nuclear and radiation safety, thus training programme with on-the-job trainings for SNSA new employees, which is tailored for particular job position in accordance with SAT-URSJV, is paramount to achieve adequate level of competence.

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 further elaborate these requirements.

The Rules on radiation and nuclear safety factors comprises basic human factors requirements in the nuclear installations design. The Rules Amending the Rules on operational safety of radiation and nuclear facilities 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 organization 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. In 2020 the Program for Third Periodic Safety Review (PSR3) was approved. One of the safety factors is also Human Factor.

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.

Internal procedure ADP-1.0.050 "Monitoring of Safety Culture and Human Factors" is also in place.

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
- Number of Unplanned Personnel Contamination
- Number of Unplanned Personnel Internal-External Exposure
- Number of Human Related Events
- Number of Registered Industrial Safety Events
- Number of Near Miss Industrial Safety Events
- Percentage of Overdue Corrective Actions (the indicator is stable in excellent green zone)
- Percentage of Overdue Analyses
- Number of Procedures with Expired Review Date
- Workforce Engagement Indicator
- Number of Recurrences (the indicator is now stable in acceptable white operating zone).

At the end of the year 2019 Krško NPP introduces new software which is now on the Krško NPP internal portal. Software allows easy access and editing particular indicator (entering data, analysis, visual presentation, hierarchic arrangement, aggregation etc.).

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.

Based on the 2019 WANO peer review, 2021 WANO peer review follow-up and 2021 WANO Corporate peer review, some improvements in the areas of human performance and meeting plant management expectations have been implemented. The Krško NPP has a strong safety culture with a deep understanding of nuclear safety concept. The overall organization is based on

trust, at all levels within the organization. The workforce is treated with respect. Individuals communicate openly. Anyone who recognized any deviation is encourage by managers to issue condition report. The site has a no-blame culture, which is well understood at all levels. Safety Culture principles and Human Performance including Tools for prevention of Events became regular part of training programs for organizational units. Deviations and events connected with human behaviour are regularly presented at operational staff meeting. Some improvements were identified/done in the areas of observation, coaching, communication between departments and vertical communication among organization.

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.

The modification provided centralized capabilities to remote safety shutdown and cooldown of the plant as well as for the supervision and control of the new Design Extension Systems.

A complete Human Factors Engineering (HFE) analysis was implemented at design phase of modification, supported by a deep and comprehensive Instrumentation & Control design, endorsing controls inventory, indications and alarms.

For conducting Human Factor Engineering activities during execution of the design, NUREG 0711, Rev. 3 has been used as the main reference. The primary goal of the HFE program for the ECR Construction design modification was to provide a "human-cantered" approach for plant operators and rest of plant personnel to control plant processes and equipment in efficient and safe way.

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 licenses 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 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 IAEA Standards GSR Part 2 "Leadership and Management for Safety" and to the ISO 9001:2015 standard.

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

The processes are documented at five levels of the management system 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 gained in 2007 at the end of 2013 due to austerity measures, SNSA continues to carry out all its activities in accordance with the requirements of this standard and the IAEA safety standard GSR Part 2 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,
- Self-assessments performed in accordance with the IAEA SARIS tool,
- Self-assessments of the SNSA safety culture.

Internal audits are conducted in accordance with the SNSA procedure "Conduct of Audits". Internal audits of the management system are conducted only by trained and independent auditors. According to the internal audit annual plans each SNSA process has been audited once per year till 2019. At the internal audit in 2019 it was decided that the audits for each process will be performed once per two years due to the higher maturity of the processes. Because of the Covid-19 pandemic, the SNSA performed internal audits in 2020 and in 2021 virtually.

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.

The SNSA management is responsible for setting long-term / strategic goals, strategies, plans and short-term goals which are described in the SNSA Annual plan. The goals are based on management policy, are measurable, time-defined and have their designated owner. The realization of the goals is monitored every four months when the owners of goals report about the status of achievement of the goal. The management system manager reviews the status of each goal and informs the director about the status. The SNSA management annually reviews the long-term strategic goals, plans and short-term goals in the management review.

The SNSA management performs self-assessment of the management system in order to permanently improve the management system. SNSA activities are compared with activities of administrative bodies worldwide. Process owners implement self-assessment of their processes and describe the self-assessment findings in the report for the management system review. In 2020, the SNSA performed the self-assessment of its management system according to SARIS methodology.

In 2020, the SNSA conducted safety culture self-assessment through the questionnaire (on-line survey with 42 statements; answers from strongly disagree to strongly agree). After the survey, the report was written, and the action plan was established. One of the steps in the action plan was to conduct interviews for the statements at which more than 20 % employees did not agree with them. Interviews will be completed in 2022 and the report on the safety culture self-assessment will be revised.

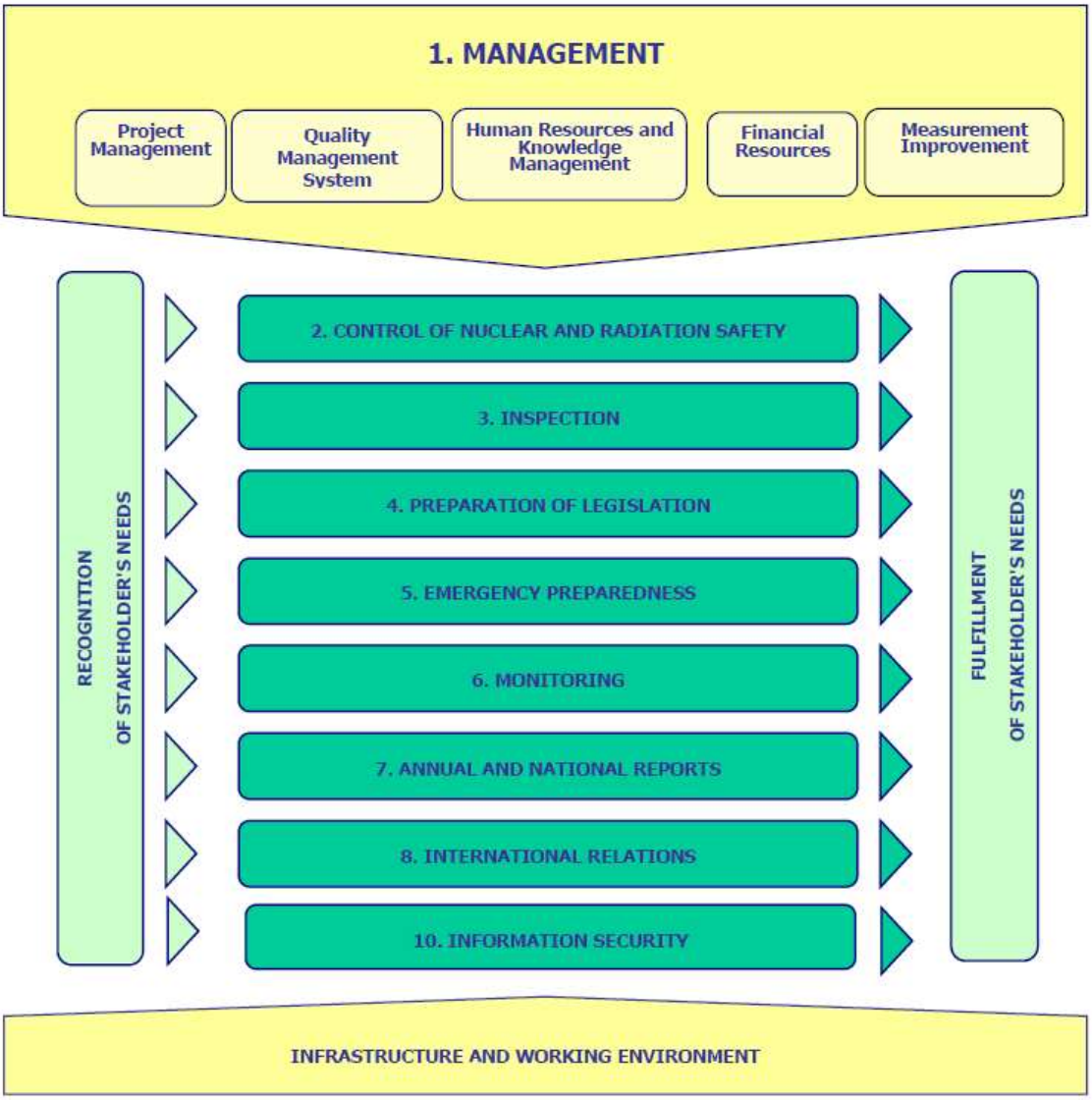

Figure 3: The SNSA Management System Processes

The SNSA processes are described in the Management System Manual as well as in the pertinent procedures. The new revision of the "SNSA Management Manual" is in line with all the 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 (with amendments in 2019 in 2021), 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 Chapter 5 - Management System.

The Article 93 of the 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 management systems is the Rules on radiation and nuclear safety factors. The fifth chapter of the Rules (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. In 2021, the SNSA prepared a new revision of the Rules on radiation and nuclear safety factors which is completely in line with the requirements of the GSR Part 2. The Rules will be adopted in 2022.

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 (ZVISJV-1, Rules on radiation and nuclear safety factors, Rules on operational safety of radiation and nuclear facilities), international standards (IAEA GSR Part 2, ISO 14001, ISO 17025, ISO 45001, 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 (qualification) 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.

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.

The SNSA regularly performs inspections on the Krško NPP Management System. In the period between the two reports there was one inspection dedicated to the safety culture and two inspections on the human and organizational factor.

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

In 2022, the SNSA will review the Safety Factor Organization and the Management and Safety Factor Safety Culture of the third Periodic Safety Review (PSR3). All the issues from the PSR2 are 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. It 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, revised in 2016, 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 Rules on radiation and nuclear safety factors stipulates that the safety analysis report shall provide sufficient information about the facility allowing an independent assessment of the safety of the facility. Detailed information about the content of the safety analysis report is laid down in the Practical Guidelines 1.04: Content of the radiation or nuclear facility safety report.

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, revised in 2016.

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; these modifications do not change the facility as described in the Updated Safety Analysis Report (USAR) or reference documentation,
- 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 Guidelines: 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. It provides instructions that can help the licensee to fulfil the requirements in the 2017 Act and the above-mentioned Rules with regard to modifications. Implementation of this guideline by the licensee significantly facilitates the decision making process of the SNSA.

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 on operational safety of radiation and nuclear facilities and in the Practical Guidelines: PS 1.01 Content and scope of the safety review of a radiation or nuclear facility 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 on operational safety of radiation and nuclear facilities.

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 on operational safety of radiation and nuclear facilities and the Practical Guidelines 1.02: Addressing modifications of the radiation or nuclear facility.

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 and in May 2014, the SNSA further approved the PSR2 and the resulting implementation plan. There were two additional areas that were 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 currently in progress. The licensee has submitted the application for PSR3 and SNSA approved the PSR3 program in December 2020. The program of PSR3 follows closely the national requirements from the Rules on operational safety of radiation and nuclear facilities and the recommendations of IAEA SSG-25. There are 18 safety factors included in the program scope, since Safety culture, Radioactive waste and spent fuel and Radiation protection are separate safety factors in comparison to IAEA SSG-25. Apart from that, a new safety factor (Physical security) is introduced. The PSR3 is particularly important, since it will be the last PSR before the planned extension of the Krško NPP's operational life. Among others, it also reviews the majority of implementations of the Krško NPP's Safety Upgrade Program (SUP), which includes several post-Fukushima improvements. 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 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 was 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 was completed by the end of 2021; it comprised the flood protection of the nuclear island, the installation of the pressurizer PORV bypass, the upgrade of the bunkered building 1 electrical power supply, 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. The third phase of the SUP is almost accomplished as well, with the bunkered building 2 that houses additional sources of borated and un-borated water with injection systems to the RCS and steam generators already completed. The only part of this phase that still remains unfinished, i.e. the new dry spent fuel storage facility, is in the licensing process.

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. Current status of this TPR and its national action plan is described in Section 6.2: Topical Peer Review (TPR).

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 CFR 50.55a 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. This program follows closely the US NRC document 10 CFR 50.65 and states that the licensee shall monitor the performance or condition of structures, systems, or components (SSC) against licensee-established goals, in a manner sufficient to provide reasonable assurance that these SSCs are capable of fulfilling their intended functions. 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. The Krško NPP also has a set of procedures that cover the support of PSA to on-line maintenance program, PSA support to on-line modification and corrective maintenance activities as well as the evaluation procedure for outages.

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 (TSOs) are engaged to inspect and evaluate selected activities of plant maintenance and testing that are important for safety, i.e. equipment inspection and surveillance tests, execution of plant modifications, and changing of fuel. These activities are selected and approved by the NPP, TSOs and SNSA several months before the planned outage. Members of TSOs are present daily in the NPP during outages and conduct either technical or administrative inspections and/or surveillance in situ. TSOs report once a week to the representatives of the NPP and SNSA about their work and potential findings. They are contracted for the duration of the outage but are also obliged to issue the Collective Expert Assessment of the Outage and Fuel Change in the Krško NPP in 45 days after the outage (according to Rules on operational safety of radiation and nuclear facilities). Before a reactor becomes critical after an outage, the NPP must obtain the so-called Summary Report of Authorized Organizations for Resumed Criticality; this statement is also provided by the TSOs and is based on evaluations of the activities from nuclear and radiological safety point of view. Apart from that, the TSOs also provide the second Summary Report that NPP could operate safely after the outage based on the above-mentioned evaluation.

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. Considering the foreign operating experience, a few minor modifications of some of the Krško NPP's procedures were implemented as well as some major corrective actions and modifications were carried out at the Krško NPP in recent years, such as the installation of Permanent Magnetic Sludge Removal Structure in main condensers, application of Film Form Amine for secondary systems surface area protection, and the recalculation of LOCA DBA doses for actual unfiltered in-leakage.

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 SSCs 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 this way, it enables to independently evaluate the analyses and corrective actions taken by the licensee. SNSA can therefore determine priority areas of increased surveillance over the nuclear facility. Apart from that, the system helps SNSA to decide on potential targeted inspections that can in turn pose additional requirements to the licensee in order to cope with the events in question and their potential consequences.

In the spring of 2017, the Krško NPP hosted the Operational Safety Review Team (OSART) mission. Several areas of good performance were identified as well as some recommendations were proposed. 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 October 2021, a pre-SALTO mission took place at the Krško NPP. The mission was expected primarily to verify the quality and adequacy of the ageing management programme with subject programmes and procedures of the Krško NPP, since these are key factors for safe long-term

operation. Findings of the pre-SALTO mission included 5 recommendations, 9 suggestions and 9 good performances. IAEA issued the final report of the pre-SALTO mission at the beginning of 2021; this report will also serve as a backup for the PSR3 report in areas that concern the Krško NPP's long-term operation and ageing management of systems, structures and components.

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. 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. All doses are recorded in the national exposure register, maintained by Slovenian Radiation Protection Administration. The dose constraint for internal dose is set to 0.2 mSv per year. Table 2 shows personal dosimetry data for the past 3 years.

Table 2: Personal dosimetry data for 2019-2021 for Krško NPP workers and contractors (outside workers).

2019			
	No. of persons	Average dose (mSv)	Maximum measured dose (mSv)
NPP personnel	431	0.35	6.68
Outside workers	953	0.54	4.42
Total	**1384**	**0.48**	
2020			
	No. of persons	Average dose (mSv)	Maximum measured dose (mSv)
NPP personnel	366	0.21	6.31
Outside workers	416	0.13	1.39
Total	**782**	**0.17**	
2021			

	No. of persons	Average dose (mSv)	Maximum measured dose (mSv)
NPP personnel	433	0.50	9.25
Outside workers	900	0.79	8.77
Total	**1333**	**0.69**	

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.

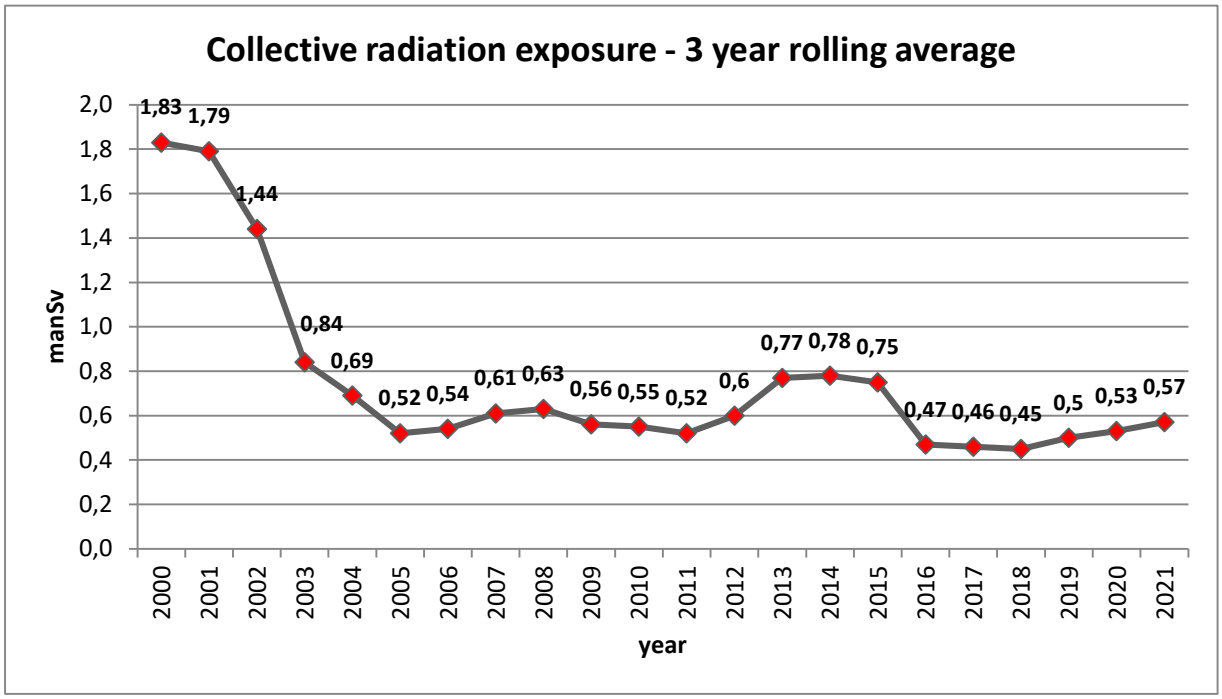

Figure 4: Collective radiation exposure in the Krško NPP

Figure 4 shows the 3-year rolling average of collective doses in the Krško NPP in the period from 2000 to 2021. 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 optimize 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.

In the years 2019 to 2021, the slight elevation in the collective dose was mostly due works connected to radioactive waste management, as well as some major modifications e.g. Auxiliary Residual Heat Removal system. Maximal individual doses were in line with the values recorded in the past.

15.2 Radioactive Discharges and Environmental Monitoring

The authorized 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 μSv/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 ^{3}H. Besides the annual limits, the quarterly limit for fission and activation products (without ^{3}H) is also set. The annual activity limits for releases of radioiodine isotopes (in ^{131}I equivalent) and aerosols are also set. There is no limit for each and every nuclide or group of nuclides, since they are accounted for through their contribution to the overall dose. Due to historical reasons, some are still separately reported (e.g. H-3 and C-14), order to follow long term trends.

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

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 off-site radiological monitoring reports for the year 2021 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 0.18 μSv per year due to atmospheric and liquid discharges. The value represents 0.36% of the authorized 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. There is no substantial change regarding the previous years and the variations are a consequence of the 18 months fuel cycle. Typically, smaller values are recorded in the years without the outage (e.g. 2020).

Table 3: Released activities from the Krško NPP in the period 2019-2021 and the corresponding limits

LIQUID EFFLUENTS	2019	2020	2021

Fission and activation products	Released activity	25.1 MBq	11.2 MBq	35.6 MBq
Limit: 100 GBq	% of the limiting value	**0.025 %**	**0.011 %**	**0.04 %**
Tritium (H-3)	Released activity	13.6 TBq	2.9 TBq	16.1 TBq
Limit: 45 TBq	% of the limiting value	**30.2%**	**6.6%**	**35.9%**

GASEOUS EFFLUENTS		**2019**	**2020**	**2021**
Fission and activation gases	Dose to the public	0.068 µSv	0.078 µSv	0.068 µSv
Within general limit 50 µSv	% of the limiting value	**0.31%**	**0.07%**	**0.06%**
Iodines (I-131 and others)	Released activity	34 MBq	0 MBq	0.18 MBq
Limit: 18,5 GBq (eq. ^{131}I)	% of the limiting value	**0.013 %**	**0 %**	**0.001 %**
Aerosols (cobalt, cesium …)	Released activity	0.002 MBq	0.001 MBq	1.4 MBq
Limit: 18.5 GBq (eq. ^{131}I)	% of the limiting value	**9E-6%**	**7E-6 %**	**7.5E-3 %**
Tritium (H-3) No limit	Released activity	2.8 TBq	3.5 TBq	6.7 TBq
Carbon (C-14) No limit	Released activity	75 GBq	198 GBq	103 GBq

15.3 Implementation of the optimization 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 optimization 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 licenses, other than those covered by the operating license. In 2004 the SNSA issued the licenses 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 organizational 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. The Decree also specifies 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 2013. A new revision, mainly considering the EU BSS Directive and the GSR Part 7 requirements, is under preparation.

16.2 Implementation of Emergency Preparedness Measures

The SNSA maintains the KID, a web-based communication system, used during nuclear or radiological emergencies for information and data exchange on the proposed protection measures. The system is not used only at the national level but also for information exchange with Croatia, since one of the key elements of the coordinated implementation of protective actions is regular communication between involved countries, which includes both timely reporting and the ability to obtain information from the accident state. Currently, only Croatia has access to the system since its territory is the closest to the Krško NPP. After the completion of the ongoing KID upgrade project by the end of 2022, other interested neighbouring countries will also be able to have access if they request it.

One of the still ongoing issues is the process for maintaining iodine thyroid blocking preparedness, which started in 2009. The pre-distribution in 10 km radius around the Krško NPP and regional stockpiles 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 very low. And it was low also in 2017 during the repeated pre-distribution. Currently, residents in the 10 km zone around the Krško NPP can collect potassium iodide tablets (free of charge) at the pharmacies with their health insurance card and a prescription, prescribed by their doctor. In order to pre-distribute the tablets more efficiently there is ongoing consultation on finding a more efficient way to distribute the tablets, e.g. the distribution by mail is considered and simplification of distribution process.

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. 38, was issued in June 2021.

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, 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 residents living within the 10 km UPZ - urgent protective action planning zone. 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 past two years the following large exercises were conducted: regular annual Krško NPP exercises (in 2020 cancelled due to Covid-19 pandemic restrictions, and in 2021 conducted as repetition with personnel attending the exercise in smaller groups, again adapting to Covid-19 pandemic), ConvEx-3, co-joined by ECUREX-2021, and ConvEx-2b. The main lesson learned from the ConvEx-3 and ConvEx-2b exercises was the need to improve our national procedures for providing or requesting the international assistance through RANET (Response and Assistance Network). Therefore, the SNSA have revised procedures with more detailed information on the process itself, the responsibilities of the involved organizations, and also revised the assistance capabilities, registered in the RANET database.

Based on results of the KIVA^{2019}, the first national exercise on cyber security at nuclear facilities, the SNSA has identified the need to be better prepared for cyber security-initiated events. The SNSA therefore adopted in 2022 procedures for emergency response team to respond in such cases. With this regard new expert group, namely the Cyber security expert group was introduced to the SNSA emergency response team. The key task of this group during an emergency caused by a cyber-attack is to connect key domestic and foreign stakeholders, to cooperate with other emergency response team expert groups.

Even more comprehensive and wider-scale KIVA^{2022} exercise took place in May 2022. In addition to the focus of the exercise on responding to cyber threats, the scenario also included aspects of nuclear security and nuclear safety at a fictitious nuclear facility. Besides, it was carried out using specially designed exercise information and process equipment models used by nuclear facilities, as well as software and hardware used by cyber attackers. The numerous participation (70 experts in total) and active involvement of both domestic and foreign representatives confirms the high awareness of the importance of ensuring cyber security in nuclear facilities. By carrying out this exercise, Slovenia has once again shown its enviable preparedness for emergencies, including those caused by cyber-attacks, as well as strong connections between national and international stakeholders.

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. Nuclear safety administrations of Slovenia and Croatia have drafted a proposal for the document Arrangements for nuclear or radiological emergency preparedness and response. The next foreseen step is to coordinate the draft with civil protection authorities from both countries.

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. In the past two years this participation was mostly conducted as a virtual participation due to Covid-19 pandemic restrictions.

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. The mission 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.

The actions, implemented by Slovenia since then include the preparation of the protection strategy (including a monitoring strategy) as a single, overarching document, adopted by the Government in July 2021; development of decontamination procedures, published in February 2022; update of evacuation time estimates in the UPZ around NPP Krško, concluded in January 2020; posters to provide just-in-time training to non-designated emergency workers, prepared and published in 2019; guidelines for practitioners, healthcare facilities and first responders on transport and treatment of contaminated patients, prepared and published in 2019; procedure for returns to a restricted area during a nuclear or radiological emergency in 2019; rumour control mechanism, established in 2019; strategy for the management of large volumes of radioactive waste, developed 2021; arrangements to mitigate the non-radiological consequences of a nuclear or radiological emergency in 2018; procedure for harmonization of two international assistance networks IAEA RANET and EU ERCC in 2018; procedures for termination of the emergency (still in coordination); developments of training programmes and exercises involving all response organizations (ongoing), and amendments of national emergency plan (still in coordination).

Subsequently, Slovenia invited the IAEA for an EPREV Follow-Up Mission to review the implementation of the Action Plan. The Follow-Up Mission is to take place in October 2022.

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, Environmental Protection Act, Spatial Management Act, the Rules on radiation and nuclear safety factors, the Decree on activities affecting the environment that require an environmental impact assessment and the Decree on the method of drafting and on the content of the report on the effects of planned activities affecting the environment.

At the end of the year 2021 new revisions of Spatial Management Act (ZUreP-3) and the Building Act (GZ-1) entered into force with starting date of their use set at the end of June 2022.

The greatest novelty of the ZUreP-3 is that spatial planning bodies will no longer provide written concrete guidelines for individual spatial plans but should provide available data from their areas of competence that are needed for spatial planning.

Another important change introduced by the ZUreP-3 is the formation of a project team with representatives of different spatial planning bodies. Such project team is responsible for the preparation of the spatial act. The project team operates according to the principle of project management, and all its members have the task of contributing responsibly to the preparation of appropriate spatial arrangements. As members of the project team, spatial planning bodies shall be always actively involved in the preparation of the spatial plan, so the approvals in individual phases of spatial plan preparation are prepared by the project team.

In the GZ-1 the provisions relating to the preparation of an integrated permit have been partially amended, as practice has shown the possibility of optimizing this procedure. The building permit for a facility with environmental impact is now clearly named as an integral permit, which means that a decision on the construction itself and assurance that the construction will not have significant adverse effects on the environment is made at the same time.

In preparation is a new revision of the Environmental Protection Act, which will mostly introduce changes in the field of waste management.

The legislation listed above provides the legal framework for the nuclear and radiation safety documentation and the documentation for an environmental impact assessment, required by an investor in a new radiation or nuclear facility. Also, the participation of the public and/or the neighbouring countries in the siting process are laid down in those regulations.

National spatial planning procedure begins with an initiative of the investor delivered to the Ministry of Infrastructure (MzI) which then presents the application to the Ministry of the Environment and Spatial Planning (MESP). Members of the project team formed by different spatial planning bodies should provide all necessary data from their areas of competence related to the spatial plan in preparation.

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

- the Environmental Report (ER),
- the Environmental Impact Assessment Report (EIAR), 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.

Based on Rules on radiation and nuclear safety factors 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 on radiation and nuclear safety factors 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 on radiation and nuclear safety factors, 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 Rules on radiation and nuclear safety factors. 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 54 of the Environmental Protection Act 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 and then the Ministry of the Environment and Spatial Planning (MESP) determines the conditions, the scope and the content of the Environmental Impact Assessment.

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 building permit and also with the project documentation. To the application is attached an opinion of an authorized expert for radiation and nuclear safety. The content of the Safety Analysis Report is determined by the Rules on radiation and nuclear safety factors.

According to the ZUreP-3 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 countries (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 Consent from the MESP. 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 phase, the EIA is a subject to public hearing and consultation with neighbouring countries. Before issuing the environmental consent, the MESP 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 population 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 Rules on radiation and nuclear safety factors 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 on radiation and nuclear safety factors and the Rules on operational safety of radiation and nuclear stipulate that the plant shall perform a Periodic Safety Review (PSR) every 10 years, 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.

One of most important results 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 an important part of the second PSR (2013), which again suggested some hazard re-evaluations (heavy rainfalls, floods and droughts, lighting, aircraft accidents, etc.) taking into account the latest site related data.

The third PSR is performed at the time of the transition of the Krško NPP to long-term operation and a special emphasis is therefore devoted to inspections of plant conditions, the preparation for extending plant operation beyond the original lifetime of 40 years, as well as adherence to modern requirements, standards, and good practices for long-term operation. New requirements were introduced in the period since the second PSR, such as WENRA reference levels on natural hazards.

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 countries 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 countries 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 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 countries is agreed upon between the countries. The competent ministries and organizations prepare their positions on the opinions and comments given by the public and neighbouring countries. Both, the final National Spatial Plan and the environmental consent, are adopted and issued respectively after positive opinions of all competent ministries and organizations has been issued. Final decision (agreement or disagreement on siting) must also take into account opinions given by local communities and other involved parties.

We have bilateral agreements with all neighbouring countries on the early exchange of information in the event of a radiological emergency. More about international agreements is written in Article 16 and all bilateral agreements are listed in Appendix I, B.2.

In the last stage, the investor needs to obtain the building permit by preparing the Safety Analysis Report, which is also a public document and is the basis of the application for the building permit. There are no special provisions for the public hearing of the Safety Analysis Report. However, in accordance with the General Administrative Procedure Act any person, who demonstrates his/her 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 (defence 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 building license for a nuclear facility is issued by the Ministry of the Environment and Spatial Planning on the basis of the Building Act. In the process of obtaining the building license, the SNSA gives its opinion for building (as stipulated in Article 97 of the 2017 Act). The submitted application for the SNSA's opinion must include relevant design documentation like 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 design documentation and other conditions are prescribed by the Rules on radiation and nuclear safety factors.

The 2017 Act and the Rules on radiation and nuclear safety factors contain provisions for the Defence in Depth concept. According to the Rules, this concept shall be used as the basic design criterion for designing a nuclear facility and especially for designing safety systems, systems for mitigating radioactive releases and fire protection systems. Also the Rules on radiation and nuclear safety factors 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 on radiation and nuclear safety factors were revised in 2016 and took into account the amendments of the Fukushima Daiichi accident lessons learned, the revised WENRA Reference Levels of September 2014, as well as the WENRA report "Safety of New NPP Designs". Major changes, in particular those coming from the revised WENRA Reference Levels, concerning the design extension conditions 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 low probability 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 Rules on radiation and nuclear safety factors stipulated that the plant shall upgrade its systems, structures and components to enable coping with severe accidents. This was required after the plant lifetime was extended.

Soon after the Fukushima accident the Krško NPP already implemented safety improvements for accidents caused by extreme natural events (and their combinations) and loss of electric power by introducing a large set of mobile equipment that included diesel generators, various pumps, compressors, transformers and other equipment. Quick connection points for this equipment were installed. All these activities were concluded by June 2011, prior to the start of the EU stress tests. In 2012, based on the findings of first periodic safety review, two important safety improvements against external hazards were implemented. The third diesel generator was installed as an improvement against the seismic hazard. The flood protection dikes were upgraded to improve safety against external flooding, including the probable maximum flood. 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. Based on the stress tests results and the deterministic and probabilistic analysis of potential safety improvements, the Krško NPP prepared the Safety Upgrade Program in 2012.

The action plan was reviewed and approved by the SNSA and was completely implemented within the Safety Upgrade Program (SUP) by the end of the year 2021. The 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 water to steam generators and borated water to reactor,
- Installation of additional residual heat removal pump and dedicated heat exchangers, with provision of containment sump water to containment spray system,
- Installation of additional pressurizer relieve valves qualified for severe accidents conditions,
- Acquirement 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,
- Installation of high temperature seals for reactor coolant pumps,
- Establishment of new technical support facility with provisions for long term habitability even in case of severe accidents and enhancement of existing operations support centre,
- Additional flood protection of the buildings within the nuclear island.

In addition to the originally planned SUP improvements, the Krško NPP began construction of a dry spent fuel storage facility that is still ongoing in 2022.

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

- Reactor Vessel Closure Head replacement and upgrade with Simplified Head Assembly in 2012,
- Turbine Control System Replacement, Turbine Emergency Trip System and Moisture Separator Super Heater Control in 2012,
- Resistance temperature detectors bypass elimination (RTDBE) in 2013,
- Up flow conversion modification in 2015,
- Upgrade of NEK river dam and essential service water system to mitigate the impact of hydro power plant Brežice construction in 2016.

The application of defence in depth concept in the design is verified mostly during licensing of plant design modifications. Implementation of the defence in depth is regularly checked by the SNSA inspections. In 2022, the Third Periodic Safety Review (PSR) of the Krško NPP began. It will also include review of the application of the concept of defence in depth.

18.2 Incorporation of Proven Technology

The Rules on radiation and nuclear safety factors stipulate the use of proven technology as one of the fundamental design principles and requires ensuring the system reliability through the application of proven components. Proven components shall mean components that have demonstrated their adequacy in similar operational conditions or are appropriately tested and qualified. The SNSA stimulates the use of proven technologies by stressing its importance during licensing of design modifications. 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 and requires proof that nuclear design standards have been properly applied in design and manufacturing of such equipment.

The design requirements for instrumentation and control in the Rules on radiation and nuclear safety factors define that appropriate standards shall be applied in the design, installation and testing of software and hardware of computer-supported systems relevant to safety. Software for digital instrumentation and control shall be verified, validated and tested. Due to the integral nature of computer-supported systems, an additional degree of conservatism is necessary in their analyses.

It is the Krško NPP's strategic approach not to introduce solutions whose supplier and equipment do not a have verified references in other similar nuclear power plants in the world. The Krško NPP maintains the approved suppliers list and verifies regularly the performance of suppliers on this list, e.g. by audits.

18.3 Design for Reliable, Stable and Manageable Operation

The Rules on radiation and nuclear safety factors 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 on radiation and nuclear safety factors are in revision process in 2022 and will be amended with requirements for human factor engineering and human-machine interface.

The Rules on radiation and nuclear safety factors require that the design shall ensure that the plant operator has a period of 30 minutes from reception of the first characteristic information on an event to the time when the first action to prevent or mitigate the consequences of the event is required. In the meantime, the activations and control of the safety functions shall be automated or accomplished by passive means.

The Rules on operational safety of radiation and nuclear facilities 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 conditions of the plant. Likewise, the Rules on operational safety of radiation and nuclear facilities 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 EOP and SAMG 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 which is capable of simulating severe accidents.

The Krško NPP has plant-specific EOP as well as SAMG in place, which are regularly updated and verified during trainings and simulated exercises on their plant-specific full-scope simulator. Within the implementation of training and exercises the NEK 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 1, meeting the Design Extension Conditions to sustain higher seismic loads, severe floods, severe weather, large aircraft crashes and fires. For the operators in the emergency control room (ECR), a set of Evacuation Emergency Operating Procedures (EEOP) was developed. The EEOP were also validated at the full scope simulator, which also contains an ECR simulator.

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 with support of other SNSA technical staff oversee the regular operation and changes implemented in the plant. The SNSA staff takes part in the emergency exercises. The SNSA performs licensing of 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 (MESP) 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 and Rules on operational safety of radiation and nuclear facilities 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 8 changes of the Technical Specifications during the last three years that were defined as 3rd category modifications, and 2 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 on radiation and nuclear safety factors 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.

All procedures are developed and written by experienced personnel. Before approval the procedures are reviewed and commented by author's coworkers, author's department superintendent and involved personnel and/or superintendents from other departments. All the procedures are subjected to independent verification of the Licensing department and QA team. If the procedure is related to safety, it has to be reviewed by the Krško Operating Committee. For some operational procedures also the verification on the Krško NPP full scope simulator applies. Finally, procedures are approved and signed by affected members of management.

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.

Design changes in the Krško NPP categorized in the category 2 (Safety analyses report changes) or category 3 (Technical specifications changes) are subject to licensing procedure of the SNSA in accordance with 2017 Act. That includes all the work done by the Krško NPP staff or by research and engineering organizations in Slovenia or abroad through outsourcing. At licensing

category 3 modifications the technical support organization assessment is mandatory. SNSA uses its own technical support within outage supervision, design modification licensing through expert opinions prepared by technical support organizations, research projects, etc.. Technical support organizations must be authorized by the SNSA according to Rules on authorized experts on radiation and nuclear safety.

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 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 2019 to 2021 the Krško NPP reported 8 events and 1 of them caused an unplanned shutdown. 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 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. 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. Regarding Industry Operating Experience in period of 2019-2022 Krško NPP made screening for about 7000 documents. Among them 518 records were created in Corrective Action Program. This results in 177 direct assignments and 10 in-depth analysis with 94 actions. The other records were distributed to appropriate departments as interesting for their further use. Based on industry experience Krško NPP installed Permanent Magnetic Sludge Removal Structure in main condensers, it used Film Form Amine application for secondary systems surface area protection, the recalculation of LOCA DBA doses were performed for actual (measured) unfiltered in-leakage etc.

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 2019 till the end of 2021, 92 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 39 safety and performance indicators, which help to recognize 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, radiological waste 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 minimize 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 2021 amounted to 2,332 m^3. The total gamma and alpha activity of the stored waste were 1.85E+13 Bq and 2.69E+10 Bq, respectively.

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 is under construction and should be operational in 2023 (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. 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. In 2020, the Intergovernmental Commission adopted a revision of the programmes for the decommissioning of the Krško NPP and the disposal of radioactive waste and spent fuel from the Krško NPP. The newly adopted programmes are the basis for determining the contributions that GEN Energija and Hrvatska elektroprivreda, as owners, must each pay into their own fund for financing the decommissioning and disposal of radioactive waste and spent fuel. The Government of the Republic of Slovenia has increased the amount of the contribution for the Slovenian Fund and imposed on the company GEN energija, d.o.o., the obligation that from August 2020 onwards, it would pay into the Fund EUR 4.8 for each MWh of electricity obtained from the Krško NPP. This rate was changed in January 2022 with decision of the Slovenian government, that GEN energija, d.o.o. should contribute payment 1.20 euro cents per kWhe starting 1 January 2022. The Intergovernmental Commission has on its 15th session in October 2021, appointed the Coordination Committee for Monitoring the Acceptance of Low- and Intermediate-Level Radioactive Waste from the Krško NPP in 2023-2025 by ARAO and the Krško NPP Fund from Croatia, and instructed the Coordination Committee to coordinate the agreement on servicing of take over the LILW waste from Krško NPP in an appropriate form on the costs of the one or other or both parties. ARAO and the Krško NPP Fund from Croatia cooperated with NEK d.o.o. and, in coordination with the Coordinating Committee of the Intergovernmental Commission, prepared project assignments for the fourth revision of the Krško NPP Decommissioning Program and the RAW and IG Disposal Program from the Krško NPP. At its 16th session in April 2022, the International Commission confirmed the need to revise the study Proposal for Division and Takeover or operational LILW that was prepared in 2018. The Krško NPP Fund and ARAO are committed to revising this study by the end of the 2022. However, the Coordinating Committee is responsible for continuing to monitor the implementation of the third revision of the above mentioned documents and the preparation of this study. The Intergovernmental Commission also instructs the Krško

> NPP Fund and ARAO to prepare the fourth revision of the RAW and IG Disposal Program from the Krško NPP by the end of April 2024 and instructs the Krško NPP to prepare the fourth revision of the Krško NPP Decommissioning Program by April 2024 in cooperation with ARAO and the Krško NPP Fund. The Coordinating Committee is required to follow up and coordinate the preparation of the fourth revisions of both programs.

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. The draft preliminary consent on the nuclear safety and radiation safety was issued in April 2019 and public consultations as well as consultations on transboundary impacts were then concluded in 2021, when environmental consent was issued.

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. The decision was amended in 2019.

In July 2019, the ARAO submitted an application for a construction consent by submitting documentation for the first thematic sections. The SNSA also appointed an expert in the field of the use of concrete to carry out an additional expert examination. In 2020 and 2021, the documentation submitted for all thematic sections was intensively reviewed and supplemented. The SNSA expert in the field of concrete application actively monitored the preparation of the Study of the Production, Install ability and Characteristics of Final Concrete Mixtures for the Implementation of the Secondary Reinforced Concrete Lining of the LILW Silo and participated in the review of documentation for the construction consent related to the concrete structures and their characteristics and processes, which affect the long-term safety of the repository. The consent for construction as well as decision on the status of nuclear facility and on the facility of national importance were issued in January 2022. As far as the building permit is concerned, it is still in preparation and foreseen to be issued soon.

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 MARCH 1, 2022)

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, 26/19 and 172/21).

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, No. 76/17, 26/19 and 172/21)]

- 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.78/19),
- Decree on national radon programme - UV4 (Off. Gaz. RS, No. 18/18, 86/18 and 152/20),
- 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, 76/17 – ZVISJV-1 and 8/20),
- 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, 38/10 and 76/17 – ZVISJV-1),
- 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.162/20),
- 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.125/21),
- 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 and 76/17 – ZVISJV-1),
- 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 requirements for new constructions and interventions in the existing buildings in order to protect human health from the harmful effects of radon (Off. Gaz. RS, No.14/22),
- 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 and 30/21),
- 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 and 68/19),
- Rules on monitoring radioactivity in drinking water (Off. Gaz. RS, No. 74/15, 76/17 – ZVISJV-1 and 104/20),
- 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.8/22),
- Ordinance establishing public service for radioactive waste management - Agencija za radioaktivne odpadke (Off. Gaz. RS, No.8/22),
- 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, 51/16, 26/21, 82/21 and 189/21),
- Inspection Act (Off. Gaz. RS, No. 43/07 – Official Consolidated Text and 40/14),
- General Administrative Procedure Act (Off. Gaz. RS, No. 24/06 – Official Consolidated Text and 105/06 – ZUS-1, 126/07, 65/08, 8/10, 82/13, 175/20 – ZIVOPDVE in 3/22 – ZDeb),
- Act on Administrative Fees (Off. Gaz. RS, No. 106/10 – Official Consolidated Text, 14/15 – ZUUJFO, 84/15 – ZZelP-J, 32/16, 30/18 – ZKZaš and 189/20 - ZFRO),
- Decree on Administrative Authorities within Ministries (Off. Gaz. RS, No. 35/15, 62/15, 84/16, 41/17, 53/17, 52/18, 84/18, 10/19, 64/19, 64/21, 90/21, 101/21 and 117/21).

Energy

- Energy Act – EZ-1 (Off. Gaz. RS, 60/19 – Official Consolidated Text, 65/20, 158/20 – ZURE, 121/21 – ZSROVE, 172/21 – ZOEE and 204/21 – ZOP),
- Decree on the Transformation of the NEK p.o. into the Public Company Krško NPP, d.o.o. (Off. Gaz. RS, No. 54/98, and subsequent amendments).

Environment

- Environmental Protection Act (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, 84/18 – ZIURKOE and 158/20),
- Spatial Management Act (Off. Gaz. RS, No. 33/07, 70/08 – ZVO-1B, 108/09, 80/10 – ZUPUDPP, 43/11 – ZKZ-C, 57/12, 57/12 – ZUPUDPP-A, 109/12, 76/14 – odl. US, 14/15 – ZUUJFO, 61/17 – ZUreP-2 and 199/21 – ZUreP-3),
- Building Act (Off. Gaz. RS, No. 61/17, 72/17 – corr., 65/20, 15/21 – ZDUOP and 199/21 – GZ-1),
- Decree on activities affecting the environment that require an environmental impact assessment (Off. Gaz. RS, No. 51/14, 57/15, 26/17 and 105/20),
- 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, 27/17, 23/20, 91/20, 95/21 and 186/21),
- Criminal Procedure Act (Off. Gaz. RS, No.176/21 - Official Consolidated Text),
- 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, 15/17 – odl. US, 73/19 – odl. US, 175/20 – ZIUOPDVE and 5/21 – odl. US),
- Maritime Code (Off. Gaz. RS, No. 62/16 – Official Consolidated Text, 41/17, 21/18 – ZNOrg, 31/18 – ZPVZRZECEP, 18/21 and 21/21 – corr.),

- Act on Transport of Dangerous Goods (Off. Gaz. RS, No. 33/06 – Official Consolidated Text, 41/09, 97/10 and 56/15),
- Act on Control of 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 progress made on challenges, including those that are considered being closed 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. Most delays of the SUP improvements completion were caused by the public procurement process due to which most of the projects' biddings had to be repeated. Additional delay was caused by the owners of the plant, which at one point were considering the financial viability of the plant's lifetime extension and also implementation of the SUP itself.

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, was to be implemented by the end of 2019, yet some parts of it were delayed. It was completed by the end of 2021. It 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 with provisions for quick connections to the spent fuel pool (implemented in 2020),
- Installation of a fixed spray system on the spent fuel pool with provisions to use mobile equipment (implemented in 2020),
- 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 (implemented in 2021),
- 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) in the BB1 protected against external hazards and severe accident's radiation with capabilities to shut down the reactor and maintain the long-term safe shutdown state. This improvement also includes installation of severe accident instrumentation (implemented in 2018/2019),
- And an upgrade of the operations support centre and technical support centre (emergency centres) to ensure a safe long-term environment for operators even in the event of severe accidents (implementation finalized in 2021).

Phase III, underway with originally planned improvements 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 (implemented in 2021),
- Construction of the spent fuel dry storage facility (underway). The dry storage building and all the necessary infrastructure is expected to be completed in the second half of 2022.

Additional systems, structures and components implemented within the SUP are 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 the closure report on implementation of the Slovenian stress test National Action Plan (NAcP), which has been published in December 2021.

https://www.ensreg.eu/sites/default/files/attachments/stress_test_nacp_slovenia_2021.pdf

As it can be seen from the Table A-1, all of the original SUP improvements have been completed by the end of 2021. In addition, the Krško NPP implemented additional improvements, such as installing high temperature RCP seals and constructing the spent fuel dry storage (SFDS).

Table A-1: The hardcore improvements part of the NAcP comprised of the SUP as of December 2021

No.	Action / activity	Area	Status	Finalization
1	SUP SUP comprises of a set of modifications/ improvements (see numbers 1.1 to 1.10) that were to be implemented in steps until the end of 2021.	SUP	implemented	2021
1.1	Safety upgrade of AC power supply	SUP, Phase II	implemented	2018
1.2	New pump for supplying SGs; in a bunkered building, with a dedicated water supply	SUP, Phase III	implemented	2021
1.3	Installation of alternative ultimate heat sink – revised into alternate long-term heat sink using SGs and underground well water (see 1.2)	SUP, Phase III	implemented	2021

No.	Action / activity	Area	Status	Finalization
1.4	Additional pump for injecting into the reactor primary system, in a bunkered building, with a dedicated (borated) water supply	SUP, Phase III	implemented	2021
1.5	Containment integrity safety upgrades including containment filtered vent systems and PARs	SUP, Phase I	implemented	2013
1.6	Establishment of emergency control room	SUP, Phase II	implemented	2019
1.7	Installation of fixed spray system around the SFP with provisions for quick connection from different sources of water.	SUP, Phase II	Implemented	2020
1.8	Mobile heat exchanger with provisions to quick connect to SFP	SUP, Phase II	implemented	2020
1.9	Flood protection upgrade (additional protection of nuclear island and bunkered buildings)	SUP, Phase II	implemented	2015
1.10	Establishment of new technical support centre and upgrade of existing operations support centre (emergency operating facilities)	SUP, Phase II	implemented	2021

The SUP improvements have drastically decreased risk and improve the robustness of the Krško NPP. This is best seen from the PSA results, where core damage frequency has been reduced by around 75%. With SUP implementation unfiltered releases are reduced by about 70% mainly due to the filtering effect of the passive containment filtering vent system (PCFVS) and additional preventive DEC A systems, such as ASI, AAF and ARHR.

The second part of the Slovenian NAcP form the so called "soft" improvements. based on additional documents reviewed by the SNSA in the aftermath of Fukushima Daiichi accident.

The "soft" improvements included actions, such as:

- Revision of legislation (on Fukushima lessons learned, e.g., the 2014 WENRA SRLs).
- Emergency response improvements (e.g., supplementing the national radiological emergency response plan, preparing national strategy for nuclear and radiological accident, enhancing training of intervention personnel, trans-boundary arrangements and education of the public and media, enhancing cooperation with neighbouring countries (especially Croatia), including mutual exercises, enhancing emergency response exercises, and enhancing the national radiological monitoring system).
- Implementing special inspections at the Krško NPP on topics like external hazard protection equipment, mobile equipment (test and maintenance, procedures), power supply for communication systems in case of prolonged loss of AC, radiological protection in case of severe accidents (including equipment, procedures, mapping, staff training).
- Additional studies required regarding accident timing, including core melt, reactor pressure vessel failure, basemat melt-through, SFP fuel uncovery, etc., using different computer codes.

- Development of nuclear safety infrastructure (education, training, staffing, financing).
- Enhancing SNSA processes (e.g., improving SNSA's capability for evaluating defence-in-depth, enhancing staff training on severe accidents and SAMGs).
- Inviting IAEA peer review missions (EPREV, OSART, IRRS, RAMP)
- Upgrading the Emergency response data system (for transferring data about plant parameters in case of an emergency).
- Developing full scope PSA for Krško NPP (especially shutdown modes and spent fuel pool PSA).
- Improving and maintaining transparency (public discussion of safety issues), open and trustful relationship between regulators, operators and the public, enhancing safety culture at regulatory and operational organizations, develop methods to evaluate and detect degraded safety culture.
- Changing the national strategy on spent fuel to enable licensing of the spent fuel dry storage.

Most of the above actions were implemented, with a few of them still in progress (e.g., developing external hazard PSA for SFP). Anyhow, all of these actions are part of the continuous improvement process (for example, legislation is currently being revised again, to include some newest IAEA design requirements; in April 2022 the SNSA will again be reviewed by the IAEA IRRS mission, and then again in 10 years, etc.) and therefore are constantly being implemented, as there are always new ways to improve the processes that ensure and enhance nuclear and radiation safety.

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 Krško NPP defined more demanding criteria for the storage of spent fuel assemblies. 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. The new storage system will contain the storage building, constructed on the Krško NPP site 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 new building with the belonging systems and components shall fulfil design extension conditions (DEC). 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 principle in designing the SDFS 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 safety demonstration. The impacts of various natural hazards and their combinations on SFDS were evaluated. Possible sources of natural hazards are earthquakes, strong wind, rain, snow, ice, thunder/lighting, river (flood) and extreme temperatures. The Krško NPP is 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 Krško plant specific aging management program for SFDS was prepared. A preliminary decommissioning plan for the decommissioning of the storage was made, 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.

In 2017 the SNSA issued the design conditions for the new spent fuel dry storage facility which were prepared in accordance with new DEC requirements and international standards for spent fuel storage facilities. SNSA issued the positive opinion for the construction license in January 2019. 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.

Following the completion of the cross-border assessment procedure, in which Austria and Croatia participated, the Ministry of the Environment and Spatial Planning issued a construction license for the dry storage of spent fuel at the Krško NPP in December 2020. Based on the requirements of the ZVISJV-1, the approving a safety-relevant change to the Krško NPP, which entails a new spent fuel dry storage facility, was began in 2020.

The construction of the Krško NPP spent fuel dry storage was started in March 2021 and will be completed in 2022. 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 2023. 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 spent fuel elements will be stored in the dry storage building until the final decision is made on the selection of a national spent fuel disposal or reprocessing strategy.

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 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 and finished in 2021 when environmental consent was issued.

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. The decision was amended in 2019.

In July 2019, the ARAO submitted an application for a construction consent by submitting documentation for the first thematic sections. In 2020 and 2021, the documentation submitted for all thematic sections was intensively reviewed and supplemented. The SNSA also appointed an expert in the field of the use of concrete to carry out an additional expert examination and participated in the review of documentation for the construction consent related to the concrete structures and their characteristics and processes, which affect the long-term safety of the repository. The consent for construction as well as decision on the status of nuclear facility and on the facility of national importance were issued in January 2022. As far as the building permit is concerned, it is still in preparation and foreseen to be issued soon.

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 Arrangements for nuclear or radiological EPR between Slovenia and Croatia were tested and their 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 CNS review Meeting and also those being recalled within Organizational Meeting of the Joint Eighth and Ninth Review Meeting of Contracting Parties. These include also experience from the response to the Covid-19 pandemic and address especially Ageing Management and Safety Culture in Topical Sessions. The implementation of the Vienna Declaration on Nuclear Safety, adopted on 9th February 2015, is also described in this chapter.

i. 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 (recognizing 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. In recent years, the AMP was also checked within the scope of IAEA missions (OSART, pre-SALTO; see Section 14, Assessment and Verification of Safety) in order to verify the preparedness of the Krško NPP on its long-term operation. During 2021, the Krško NPP carried out some additional activities within preparations for the long-term operation. The most notable were the establishment of the Department of engineering support for long-term operation, new long-term operation programme, upgrades of existing corrective action programme for better ageing management involving operating experiences as well as new programmes for ageing management of active components and technological obsolescence.

By now the Krško NPP has not identified any unacceptable degradations that would affect safe operation of the plant in the course of the implementation of the ageing control activities. All perceived deviations are recorded in the framework of the implementation of the Krško NPP corrective action program. 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. 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. Apart from that, the Krško NPP intends to introduce further improvements, e. g. the implementation of the mechanical stress improvement method for dissimilar metal welds on the reactor vessel, which is planned for the next regular outage.

ii. 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."

Since 2012, the SNSA assess the safety culture in the Krško NPP. The SNSA collects the observations on safety culture at the Krško NPP. The key input data for the observations are inspections, communications with the licensee (e.g. meetings, oral hearings, …), licensing process (e.g. review of the documentation, review and assessment, …) and reviewing of the NPP's events analysis reports (comparing NPP analysis report to the SNSA independent analysis performed by the SNSA team). Positive or negative observations are divided into one of five safety culture characteristics according to the IAEA standards. After each fuel cycle (18 month) the report on safety culture is written. In the report the results are compared to the previous reports. The report is sent to the Krško NPP.

In 2020, the SNSA performed safety culture self-assessment. The SNSA conducted a survey which consisted of 42 statements. All the SNSA employees had an opportunity to participate in the survey. Around 62 % of the SNSA employees decided to participate in the survey. The survey results were presented in the report and the action plan was prepared. One of the suggestions in the action plan was to conduct interviews for the statements at which more than 20 % employees did not agree with them. Interviews will be completed in 2022 and the report on the safety culture self-assessment will be revised.

iii. 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 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.

The Krško NPP takes care 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. A generation change that has taken place a decade ago, when almost half of the staff had retired in a short time frame, went through without any particularities. This was because of the Systematic Approach to Training (SAT) usage and appropriate knowledge management, using different plant processes.

The knowledge management process at the Krško NPP is not an independent or isolated program. It 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. The knowledge management program will be upgraded in 2022 to retain critical knowledge in a common organizational database. So far this has been done on department level only, because the department leaders are responsible for retaining knowledge in their organization.

iv. 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."

The IRRS mission took place on the premises of SNSA from 4 to 14 April 2022 to review the Slovenian governmental, legal and regulatory framework for nuclear and radiation safety against the relevant IAEA safety standards including overview of the organization and functioning of both two relevant regulatory authorities in this area, the SNSA and the SRPA. The mission was organized back-to-back to an ARTEMIS mission scheduled on 22 to 30 May 2022.

Beside strong commitment and dedication of both SNSA and SRPA staff, the importance for the government to ensure that sufficient funding and human resources are provided to both authorities to enable them to fulfil their responsibilities was recognized by the IRRS mission. Some of the recommendations and suggestions were in light of a possible decision to build a new nuclear power plant Slovenia, i.e. on licensing processes, development of regulations, NPP design requirements: and commissioning. The IRRS mission included policy issues on the implications of the covid-19 pandemic and regulatory challenges in the context of possible new build. A good practice in SNSA's activities related to emergency exercises with cyber security scenarios was identified and several areas of good performance. The mission also commended the good working environment.

The final report of the IRRS mission is expected in three months after the conclusion of the mission. Both regulatory authorities are going to prepare an action plan and the IRRS follow-up mission is expected to be invited in three or four years to verify the progress

Before moving to the long-term operation of the Krško NPP, Slovenia also invited the IAEA pre-SALTO peer review mission to the Krško NPP to evaluate their aging management program beside other programs and procedures important for safe long-term operation. The SNSA suggested that the pre-SALTO mission could be carried out as part of the PSR3 to optimize the necessary resources. Before the mission, the Krško NPP carried out some additional activities as part of preparations for the long-term operation (i.e. establishment of an engineering support department for long-term operation, a new program for long-term operation, upgrading the program of corrective actions, a new program for managing aging of active components and technological obsolescence).

The pre-SALTO mission took place at the Krško NPP between 5 and 14 October 2021. The mission's findings were 9 good performance, 9 suggestions and 5 recommendations. The final report of the mission was prepared by the IAEA at the end of January 2022. The implementation of the SALTO mission, which is to follow the pre-SALTO mission at the Krško NPP, is expected after the implementation of the action plan for safety factor 4 within the PSR3.

More information on the pre-SALTO mission in the Krško NPP can be found in Article 6.5.

Some other peer review missions are planned. Slovenia invited the IAEA for an EPREV follow-up mission, which is planned in October 2022. In the upcoming years also IAEA Severe accident peer review mission is planned after the completion of the Krško NPP's Safety Upgrade Program.

v. Supply Chain

Referring to the 7th Review Meeting Summary Report:

"Availability of components to replace those which are ageing, due to non-availability of identical replacement parts from original manufacturers, detecting non-conforming, counterfeit, suspect or fraudulent items received from suppliers before they are installed, lack of suppliers of ageing components."

In general, the Krško NPP long term operation (LTO) program consists of various programs, procedures and activities which ensure that all intended functions of systems, structures and components (SSC) are in place, that all SSCs managed for LTO are recognized, properly reviewed and managed in such a way, that they will fulfil their intended function until the end of the Krško NPP entire operating lifetime.

The process for detecting non-conforming, counterfeit, suspect or fraudulent items received from suppliers before they are installed is established in the Krško NPP. The Quality Control Program defines indicators representing areas about which QC department reports to the Krško NPP Management Board once per year. The area of counterfeit spare parts is also defined in the program. The procedure for entrance control specifies, that the task of entrance control is to verify the quality of the goods delivered by paying attention to potentially counterfeit spare parts (SFSI). In the appendix of the mentioned procedure, the guidance for the identification of counterfeit spare parts is included. This guidance consists of characteristics that are common to counterfeits and on which types of spare parts counterfeits can be expected according to industry practice. To help controllers and all those involved in the process of supplying spare parts to the Krško NPP, they use informal guide to identify counterfeit spare parts (current revision 3) and EPRI database of counterfeit spare parts. The document is updated from time-to-time and contains descriptions and pictorial material.

Addressing the lack of suppliers of ageing components, the focus of the Krško NPP technological obsolescence program is on "part obsolescence" and "component obsolescence" which refers to parts, materials, and components likely to be replaced one or more times over the lifetime of a plant. This program is aligned with the requirements of IAEA SSG-48 and EPRI-1016692. Once a manufacturer and model number are identified for plant equipment, an analysis is made to determine if the original manufacturer still supports (provides) replacement equipment and spare parts by the eng. support for LTO engineer. If this is not the case, further effort is made to determine if a different supplier or vendor exists through POMS system or the Krško NPP procurement process.

vi. Stakeholder Consultation & Communication

Referring to the 7th Review Meeting Summary Report:

"This can include involvement of the public in development of policy and regulations regarding nuclear safety infrastructure. Outreach activities by operators in the local communities could also enhance public understanding of the nuclear industry. Contracting Parties further noted that communication of understandable, accurate and transparent information to the public and decision-makers during emergency situations"

With regard to the scope and manner of communication, the SNSA is independent within the framework set forth by the applicable legislation, and it does not receive any formal or informal instructions from any source.

One of the main principles in the 2017 Act is the principle of publicity. According to the paragraph 11 of the Article 4 information on radioactivity in the environment, on the exposure of members of the public and on procedures and activities of State authorities, providers of public

services and holders of authorization relating to radiation protection and nuclear safety shall be public.

Openness to the public and regular communication with the public is also one of the SNSA values set out in the Management Manual of the SNSA.

The document on »Internal Organization and Job Systematization« in the SNSA stipulates that the SNSA ensures the publicity of its work, taking into account the restrictions arising from the regulations governing the protection of personal and classified information and other regulations. All the forms of communication with the public and stakeholders is described in the »Public Communication Strategy«, which is a part of Management System documentation.

SNSA informs interested parties through the SNSA's website and through press releases. Regarding the decisions taken in the administrative procedures and inspection control the SNSA reports to the public in the annual report. There are two versions of the annual report – one includes all information as determined in the Ionizing Radiation Protection and Nuclear Safety Act and another is extended version, which gives more detailed information. Some inspection decisions are also published on the SNSA's website. In addition, SNSA also issues Radiation News and the News from Nuclear Slovenia.

Considering legislation, each draft of legal act must be sent prior the adoption to interested parties (stakeholders) and must be published on the pre-defined website (eDemokracija), which is known to the public, where general public can comment and express their opinion regarding the proposal of an Act, Decree or Rule. Besides the formal, by legislation required involvement of independent bodies, interested parties and the public, in practice there is also a very intense dialog established even in the phase of drafting, which means that the regulations are coordinated with interested parties before the formal mandatory coordination.

The general provisions regarding the involvement of the interested parties and the public in the legislation procedure is set out in the Resolution on Legislative Regulation and in the Rules of Procedure of the Government of the Republic of Slovenia. The public debate should last at least 30 days.

The Ionizing Radiation Protection and Nuclear Safety Act also stipulates that the Expert Council for radiation and nuclear safety must consider draft legislation and must give its opinion about it. Besides general provisions regarding the consultation with the interested parties and the public during the process of adoption or amendments of legislation, also Environmental Protection Act stipulates this obligation (Article 34a).

In SNSA's Management System documentation there is an internal procedure OP 4.1 Preparation and monitoring of the regulations, which determines the internal system for monitoring and improvement of the regulations. The internal procedure in its chapter 9 also defines the validation of the quality of regulations, which is carried out through cross - sectoral reviews and discussions, legal reviews, public hearings, coordination and opinions of all interested stakeholders. The SNSA issues so called Practical Guidance (i.e. Regulatory Guides), which are non-mandatory and are aimed at licensee to understand how to comply with requirements and obligations, as stipulated in legislation (obligatory legal or legally binding acts).

The Krško Nuclear Power Plant is open to the public and ensures the transparency of its operations and has established communication with local communities and other stakeholders in the vicinity of the Krško NPP. At least once a year, the plant presents its activities, plans, and

achievements to the council of the municipality in which the power plant operates. Local communities receive all the plant's press releases directly.

The Krško NPP informs the local public about its plans and achievements through the regional newspaper, which is received by all households in the region and local television.

Current data on the operation of the power plant are available on the Krško NPP website; monthly and annual reports are also obtainable as well as the annual reports on radioactivity control in the vicinity of the Krško NPP. The plant also constantly publishes up-to-date data on local television and local environmental data displays.

To support the understanding of nuclear energy, the Krško NPP has established various forms of cooperation with primary and secondary schools and faculties in the local environment. For example, we conducted a module Basic Knowledge of Nuclear Technology for students of electrical engineering; we participate in information days for primary and secondary school students. Together with a Slovenian partner, we organize a quiz for primary schools from our region and for secondary schools from all over the country, which is spreading knowledge about energy, with the emphasis on nuclear energy.

Within the open-door policy, the Krško NPP also presents various aspects of its operation to interested groups; especially visits of school groups, societies, associations and residents from the local environment are encouraged. The Krško NPP receives about 5,000 visitors a year. For the last two years, we have had to suspend this kind of cooperation with the public due to the new coronavirus pandemic.

vii. 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. The Rules on radiation and nuclear safety factors contains the 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 from 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, the third is underway, 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 on radiation and nuclear safety factors 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. By preparing new revisions of regulations, the SNSA is harmonizing the legislation with the key IAEA standards.

viii. Experience from the response to the Covid-19 pandemic

Even before first cases were discovered in Slovenia, the Krško NPP started intensive and proactive preparations of safety measures. The goal was to protect the health of all workers on the plant, preventing the spread of the virus and to sustain safe and reliable plant operation in all conditions. Introduction of measures was gradual, in dependency of situation in the country and on site.

Some of the introduced measures were: suspend visits to plant, establish Covid-19 task force to monitor conditions and adopt measures in the fight against the virus, hygiene measures, social distance, identify critical functions to continue around the clock operations, adjust shift schedules to reduce the risk of infection of the critical staff, self -isolation of employees, work from home, use of protective equipment (masks), cancel of training, on-line meetings, employees testing for coronavirus, etc. The Krško NPP got really good feedback from employees and the contractors and there were no issues in following the pandemic measure rules that were active at the certain time.

The scope of training in 2020 was consequently much lower than usual, only 56% of the usual training conducted. Training defined in the knowledge matrix for each individual job position and training required by law was carried out. Training programs were also implemented remotely by a variety of long-distance learning (real time collaborating) tools as Teams or Zoom. Those tools were also used in the power plant to conduct internal training. Due to restrictions for preventing the spread of the virus, the capacity of the classrooms was halved, making it much more difficult to get a free classroom, and therefore it took twice the time to perform the training for all predicted participants. All participants and the lecturers also had to wear masks during the training sessions and air disinfectors were placed in the classrooms. However, a large share of the training program within the Krško NPP still took place through the on-the-job training. The implementation of various specific trainings was also organized in cooperation with external training providers, both domestic and foreign, mostly also at a distance. In the year 2021 we adapted to the virus conditions and reached 80% of the of usual training. The difference up to 100% was mostly due to travelling restrictions.

Special challenge for the plant was the outage, which was planned in April 2021. Since it was not known at that time, what kind of conditions are going to be at the time of the outage, the Krško NPP prepared different scenarios. The plan was to perform full scope outage, but contingency measures were prepared as well. There was a very good collaboration between NEK and SNSA in preparing measures in case that regulatory requirement activities could not be performed.

Some of the outage preventive measures were mandatory use of FFP-2 masks at all site, introducing Covid point with 24/7 medical staff present (control of Covid measures following, advising, performing tests on Covid), additional restaurant capacities, additional RNO entry wardrobes, etc. Even though the outage was performed in the peak of the third pandemic wave in which there were numerous cases of infection, spreading of virus among workers was prevented, so it didn't have a negative impact of performing outage activities. All planned activities were successfully performed in the planned time frame.

At the beginning of 2022, fifth pandemic wave with Omicron variant occurred. Although there was no spreading of virus on site, there were a high absence rate due to infection of employees which they got at home and the self-isolation cases due to their family members infection. The absence was the highest from the beginning of the pandemic. Even in those conditions there were no negative impacts on plant operation.

To conclude, the Krško NPP was proactive in pandemic protective measures preparing and introducing from the very beginning and also throughout the whole pandemic period. Measures were adequate at all times, so the pandemic did not have the real impact on plant safe and reliable operation. The Krško NPP still has introduced measures active and will adjust them in accordance with the situation in the surrounding.