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

Slovenian Report on Nuclear Safety

Slovenian 7th National Report as Referred in Article 5 of the Convention on Nuclear Safety

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EXTENDED SUMMARY

The seventh Slovenian Report on Nuclear Safety covers the period since the previous review meeting of the contracting parties, i.e. from 2014 to 2016. The report focuses on safety of the only Slovenian nuclear power plant Krško, which was assessed by the Slovenian Nuclear Safety Administration as satisfactory. No major problems or deviations were encountered in its operation. As expected and announced in the previous national report, the main highlight of this reporting period is the implementation of the post-Fukushima National Action Plan, which was also identified as one of the three challenges, besides the knowledge management and the dry spent fuel storage. 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, planned measures to improve safety and special topics, which describe also implementation of Vienna Declaration and the IRRS Follow-Up Mission.

Post-Fukushima National Action Plan

The most important part of the post-Fukushima National Action Plan consists of the Krško NPP Safety Upgrade Programme (SUP), which is divided into three phases. It has to be mentioned that the initial plans timelines were very ambitious. Due to financial, design and public tender procedure constraints these modifications will take longer than planned three years ago. It is expected that the implementation of all modifications will be delayed for two outages, i.e. by 2021. The phase I has been completed in 2013. Currently, the phase II is under way with some of its modifications already completed. The modifications of Phase II, planned to be concluded in 2018, are:

- Flood protection of the nuclear island;
- Operation support center reconstruction;
- Installation of pressurizer power operated valve (PORV) bypass;
- Spent fuel pool (SFP) alternative cooling;
- Alternate cooling of reactor coolant system (RCS) and containment;
- Installation of emergency control room (ECR);
- Upgrade of bunkered building 1 (BB1) electrical power supply;
- Emergency Control Room / Technical support center ventilation and habitability system;
- Replacement and upgrade of critical instrumentation.

The third phase is in the design stage and it comprises erection of dry spent fuel storage facility, bunkered building with additional sources of borated and unborated water with injection systems for reactor cooling system / containment and steam generators capable of assuring reactor cooling for at least 30 days. The third phase will be completed by the end of 2021. However, completion of the spent fuel dry storage facility and movement of 592 fuel elements into the dry storage facility is scheduled for the year 2020. It has to be noted that the SUP is just one part, albeit the most important, of the post-Fukushima National Action Plan, which consists of additional 11 actions. Most of these latter actions have been or will be performed by the SNSA itself in the scope of legislation changes, issuing decisions or planned topical inspections. In this context are the also the actions, such as additional studies (accident timing, radiation protection, stress on the staff, etc.),

inviting peer review missions, reassessment of the Krško NPP severe accident management strategy, existing design measures and procedures. Actions concerning changing or enhancing nuclear safety infrastructure require involvement of other stakeholders, including the operator, utility, technical support organizations and others.

Challenges

Besides the post-Fukushima National Action Plan there are two challenges, knowledge management and the decision to construct dry spent fuel storage.

Knowledge and competence management is getting more and more important with the ageing of the existing regulatory and nuclear power plant staff. Unstable research funding for areas related to nuclear technology and the constant pressure for phasing out the nuclear by some countries, as well as relatively small number of new builds, makes the nuclear technology and safety less attractive for the new young graduates with technical background, who would decide to pursue their careers in the nuclear area. In Slovenia, we try to increase and improve training programme in the Slovenian Nuclear Safety Administration by the implementation of a systematic approach to training. Also the Resolution on Nuclear and Radiation Safety in the Republic of Slovenia for the Period 2013–2023 should contribute to improving the situation in the area of knowledge and competence management.

The Krško NPP will fill out the capacity of its spent fuel pool in 2019. At that time the Krško NPP will require additional storage capabilities for spent fuel. The decision was made to construct a spent fuel dry storage within the Krško NPP perimeter with capacity of 2,600 spent fuel assemblies. At the end of 2014, the Krško NPP prepared the conceptual design package for the spent fuel dry storage. The decision has not been made yet, but multipurpose canister system stored in vertical position or in horizontal position are two preferred options. In 2015 the Slovene-Croatian commission, responsible for the Krško NPP, gave consent for the construction of dry storage of spent nuclear fuel on the site. Construction of dry storage of spent nuclear should be finished by 2019. Transfer of spent nuclear fuel from the pool into dry storage is planned for 2020.

Measures to Improve Safety

Among the measures to improve safety identified during the previous review meeting are the implementation of recommendations from the second periodic safety review, implementation of the Krško NPP Safety Upgrade Programme, the reactor vessel up-flow conversion, coordination of emergency planning with Croatia and inviting the peer review missions.

In 2014 the SNSA reviewed and approved all the PSR2 topical reports, which were prepared by the Krško NPP from 2010 to 2013. The final PSR report concludes that the plant is safe and there were no such findings which would prevent continuous operation of the Krško NPP. The PSR2 identified areas for improvements, in particular these areas comprise procedures, control and qualification, aging of materials, emergency planning, design bases and improvements in the field of plant safety analyses (deterministic and probabilistic analyses and analyses of potential threats and hazards). The report contains 397 recommendations, 152 of them will be re-evaluated in the context of the third periodic safety review, the remaining recommendations have already been implemented or their implementation is under way. In the end of 2015, the Krško NPP reported on the progress of implementation. About 55% of planned actions have been completed. The goal is to implement all actions by May 2019.

During the 26th fuel cycle the Krško NPP experienced open defects in the fuel, which were discovered during the regular refuelling outage in October 2013. The major cause of open fuel defects was baffle jetting that produces strong vibrations in core locations close to the baffle. The

Krško NPP decided for corrective action against baffle jetting, which was successfully applied in other NPPs, the so called up-flow conversion, which changes the coolant flow path between the core barrel and the baffle plate from down-flow direction to up-flow. This modification was successfully implemented during the 2015 outage.

In the area of emergency planning and preparedness the expert group, which comprised also members from the Croatian nuclear safety regulator and the civil protection administration, was established to analyse current assumptions for emergency planning zones and guidance for protective actions. The revised protective actions measures, including the decision making, have been proposed to be introduced in the next version of the National Nuclear and Radiological Emergency Response Plan after the necessary planning is done by the Administration for Civil Protection and Disaster Relief. Croatian authorities took part in the March 2016 INEX-5 exercise to test the protective action coordination and information exchange. The lesson learned was that the harmonization of emergency measures with Croatia has to be continued.

Slovenia placed a request to the IAEA that we would like to host the OSART and the EPREV missions. The IAEA positively replied to both requests. The missions will take place in 2017.

Other Topics

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

A major prerequisite for the stable and safe operation of the Krško NPP is the long term financing commitments of its owners, i.e. the Slovenian state owned utility GEN Energija and the Croatian utility HEP. The plant owners ordered the financial feasibility study, which compared nuclear with other energy sources. This study showed that the continuation of operation of the Krško NPP is the best economical solution for electrical energy production in Slovenia and Croatia even with the implementation of the Safety Upgrade Program. This document provides for the justification for the decision to continue with the planned SUP and was also the basis for the decision to extend the operating life of the plant for additional 20 years.

The Act on Ionising Radiation Protection and Nuclear Safety was amended in 2015, including also provisions based on lessons learned following the Fukushima Daiichi NPP accident and the European Union stress tests, such as the extended design basis of a nuclear facility, provisions on safety culture management systems, and on preventing the incorporation of non-conforming, counterfeit, fraudulent and suspect items.

The Resolution on Nuclear and Radiation Safety in Slovenia for the period from 2013 to 2023 represents the highest strategy and policy in that area and is setting clear goals. The SNSA has to report to the Parliament on the implementation of the provisions of the Resolution once a year, which is done in the annual report. The new Resolution on the national program for radioactive waste and spent fuel management for the period 2016-2025 (ReNPROG), replacing the old one of 2006, was adopted by the Parliament in April 2016.

In 2015 conservatively estimated effective dose received by members of general public as a result of the Krško NPP emissions amounts to a value of less 0.3 μSv per year including atmospheric and liquid discharges. This value represents 0.6% of the authorised effective dose limit (50 μSv) which is the sum of the contributions from all exposure pathways to the member of the public at 500m distance from the reactor.

Throughout the reporting period the Krško NPP maintained the operability of emergency centers and equipment, regularly revised emergency documentation and performed systematic communication testing and checking of emergency personnel response. The Krško NPP Emergency Plan, revision No. 32, was issued in June 2015. Since 2013 four regular annual NPP exercises have been conducted in June 2013, November 2014 (national), December 2015 and March 2016. The last one being organized as a regional international exercise INEX 5.

The SNSA operates its own system for screening and analysing operating experience. The results of such screening and analyses are communicated internationally either through formal channels like the Incident Reporting System (IRS) or at different international meetings and conferences. In the period from 2013 to 2016 124 potentially interesting events were evaluated in detail for applicability in the Krško NPP. The Krško NPP performance monitoring program covers more than 100 indicators. Besides the Krško NPP set of indicators, the SNSA developed its own internal set of 36 safety and performance indicators, which help to recognise in a very early stage eventual precursors, which might adversely influence nuclear safety.

Severe accident management guidelines (SAMG) for the Krško NPP were upgraded in 2014 to adapt strategies after introduction of passive autocatalytic recombiners and filtered venting modifications. In 2014 also the new SAMG for shutdown modes and for spent fuel pool accident were introduced. The SAMG are continuously revised and developed according to results of plant specific PSA and deterministic analyses results as well as results from 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 www.ursjv.gov.si.

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

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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 2014 to 2016 is evaluated in this seventh 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 major projects, programs and modifications, and explaining the impact of the nuclear and radiation safety act, which was adopted in 2002 and subsequently revised five times, the last time in 2015, as well as the whole set of secondary legislation (so called rules). The report also addresses the areas which were identified during previous evaluation and during the Sixth Review Meeting as well as the areas, which need additional attention, including the findings from the last review meeting rapporteur's report. These areas are described in the Appendix II. Detailed information about the post-Fukushima related activities is given in Appendix II, A. Challenges (i) and B. Planned Measures to Improve Safety (ii).

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 (all users except the nuclear power plant), and one uranium mine in a decommissioning stage. 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 recent years a significant progress has been made. In November 2015 the company IBE won the contract for the design of new repository. The construction licence is planned to be issued in 2017 and the construction will take place from 2017 to 2019. Trial operation of the repository is foreseen in 2020.

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. Full power was reached in August 1982, and the first full year of commercial operation was 1983.

Krško NPP was constructed as a joint project of the electric utilities of Slovenia and of the neighbouring Croatia on an equal 50:50 share. 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 ratified also by Slovenian Parliament on 25 February 2003.

Based on the 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 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 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 changing international standards and regulatory practices.

Solid radioactive waste and spent nuclear fuel are stored on-site. After the Fukushima Dai-ichi accident a dry storage of spent fuel is becoming a viable option. 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. supercompaction, incineration, in-drum drying system).

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

The Žirovski Vrh Uranium Mine and Mill was in operation in 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 are closed. The uranium mill was decommissioned and the resulting wastes are 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 a total activity of 21.7 TBq. On the uranium mill tailings disposal site Boršt, 610,000 tons of hydrometallurgical waste, 111,000 tons of mine waste and 9,450 tons of the material collected during decontamination of the surroundings of Boršt site were disposed of. In March 2013 the SNSA approved the safety analysis report for the Jazbec repository. With this action the condition was met that the Jazbec repository ceased to be a radiation facility and it became a subject of long term radiation monitoring.

The Central Radioactive Waste Storage at the Jožef Stefan Institute in Brinje is used for storage of 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.

The Ministry of Infrastructure has Slovenian Energy Concept under preparation. This document which is aimed at consultation with experts in the area of energy, political opinion makers and civil society would set the goals of reliable energy supply for the period of 20 to 40 years. In this document the role of nuclear energy as a low carbon emission source has not been overlooked and the nuclear energy remains as a viable option also after the end of the Krško NPP lifetime.

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

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

COMPLIANCE WITH ARTICLES 4 AND 6 TO 19

ARTICLE 4. IMPLEMENTING MEASURES

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

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

ARTICLE 6. EXISTING NUCLEAR INSTALLATIONS

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

In the period 2013-2016, 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 annual Reports on Nuclear and Radiation Safety prepared by the SNSA.

Besides the continuous regulatory safety assessment, the Krško NPP has experienced a number of different reviews and assessments of its safety since 2013. The most important activities in the area of safety reviews and assessments are described in the following paragraphs.

6.1 Stress Tests and Post-Fukushima Actions (see also Appendix II, A. Challenges (i))

Post-Fukushima actions in Slovenia started immediately after the accident. After the adoption of the stress tests specifications in May 2011 by ENSREG and the European Commission, the SNSA issued a decision to the Krško NPP to perform an extraordinary safety review. In addition, the SNSA also issued the second decision in September 2011 requiring from the plant 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. The action plan was reviewed and approved by the SNSA. In January 2012 the SNSA issued the third decision regarding the Fukushima event, with which it requires from the Krško NPP to review the basis and assumptions for the Radiological Emergency Response Plan. In the beginning of 2014 the Krško NPP notified the SNSA that the implementation of the post-Fukushima Safety Upgrade Program (SUP), which was planned to be finished by the end of 2018 is going to be challenged due to financial constraints. The plant owners ordered the financial feasibility study. This study showed that the continuation of operation of the Krško NPP is the best economical solution for electrical energy production in Slovenia and Croatia even with the implementation of the Safety Upgrade Program. This document provides for the justification for the decision to keep going with the planned SUP. For the time being, the SUP is divided into three phases. Phase 1 was already implemented in 2013, phase 2 is underway and is to be implemented until end of 2018 and phase 3 is planned to be completed by the end of 2021.

More details about the post-Fukushima National Action Plan (NAcP) and the SUP are described in Appendix II in sub-chapters A. Challenges (i) and B. Planned Measures to Improve Safety (ii).

6.2 The Second Periodic Safety Review (PSR2)

At the beginning of 2014 SNSA reviewed all the reports on the PSR2 prepared by the Krško NPP in the period from 2010 to 2013. The final PSR2 report concludes that there are no major findings, the plant is safe, as it was planned, and it can continue safe operation. Identified are also areas in which improvements can be introduced, especially for procedures, control and qualification, aging of materials, planning in case of emergency, improving the design bases and in the field of plant safety analyzes (deterministic and probabilistic analyzes and analyzes of potential threats and

hazards). The implementation plan contains a plan of activities and deadlines for implementation of individual recommendations.

In May 2014, the SNSA approved the PSR2 and the associated implementation plan, which must be implemented by the NPP by the 30 May 2019.

More details about the PSR are in Appendix II, sub-chapter B. Planned Measures to Improve Safety (i).

6.3 Events in the Krško NPP

In the period 2013-2016, the following events occurred in the Krško NPP:

- Discovery of damaged fuel assemblies and one part of fuel rod in the fuel transfer channel,
- Reactor trip due to spurious actuation reactor protection signal Over Power Delta Temperature (discussed in detail in Article 19.6),
- Reactor coolant pump trip due to failure on 400 kV transmission line,
- Partial loss of operability of the Passive Containment Filter Venting system,
- Activation of alarms in seismic monitoring system due to earthquake in the vicinity of the Krško NPP,
- Reactor trip due to sudden main steam line valve closure in 2013 (discussed in detail in Article 19.6).

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

ARTICLE 7. LEGISLATIVE AND REGULATORY FRAMEWORK

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

2. The legislative and regulatory framework shall provide for:

(I) the establishment of applicable national safety requirements and regulations;

(II) a system of licensing with regard to nuclear installations and the prohibition of the operation of a nuclear installation without a license;

(III) a system of regulatory inspection and assessment of nuclear installations to ascertain compliance with applicable regulations and the terms of licenses;

(IV) the enforcement of applicable regulations and of the terms of licenses, including suspension, modification or revocation.

7.1 Description of the Legislative and Regulatory Framework

In Slovenia, the main act in the area of nuclear and radiation safety is the Act on Ionising Radiation Protection and Nuclear Safety (Off. Gaz. RS, 67/2002, hereinafter referred to as »2002 Act«). As defined in its first article, the main purpose of the Act is »to regulate ionising radiation protection, with the aim of reducing the detrimental effects on health and reducing to the lowest possible level radioactive contamination of the environment due to ionising radiation resulting from the use of radiation sources, while at the same time enabling the development, production and use of radiation sources and performing radiation practices«.

The 2002 Act was amended in 2003, 2004 and 2011 as explained in our previous national reports. Since the last reporting period the 2002 Act has been amended in 2015.

A relatively long process of amending the Act on Ionising Radiation Protection and Nuclear Safety (the Act) was concluded in September 2015. The process began in 2013, but was frozen in May 2014 due to the resignation of the Government. The amendment process resumed after the new Government took office that same year. At the beginning of November 2014, amendments to the Act were sent for inter-ministerial co-ordination to all Ministries, the Information Commissioner and the Government Office for Legislation. The government adopted the amendments to the Act in May 2015 while the Parliament enacted it in September 2015.

The Act simplifies certain administrative procedures by:

- merging into a single administrative procedure radiation protection assessment of exposed workers and the license to carry out a radiation practice,
- simplification of licensing procedure for radioactive sources,
- eliminating a need for certificate of entry in the register of radiation sources as a special administrative decision, only a registration under the simplified procedure has been introduced instead.

Several amendments have been introduced as a consequence of the lessons learned following the Fukushima Daiichi NPP accident and the European Union stress tests:

- a new article on the design basis of a nuclear facility and another article on the extended design basis of a nuclear facility,
- new provisions on safety culture management systems,

- new provisions to prevent the incorporation of non-conforming, counterfeit, fraudulent and suspect items into nuclear and radiation facilities.

Other amendments include:

- a new provision related to the construction of a new nuclear facility allowing an investor to submit progressively and in parts the required documentation that accompanies an application for consent to the construction,
- clear definition as regards the obligations of the Agency for Radioactive Waste Management related to the provisions governing the implementation of various public utility services (management of radioactive waste, radioactive waste disposal, long-term monitoring and maintenance of mining waste disposal and tailings),
- provisions concerning the vetting of persons working in nuclear facilities,
- more detailed determination of different types of operational monitoring (pre-operational, operational and post-operational).

The Act also includes minor, editorial corrections as well as the elimination of minor inconsistencies and deficiencies that have been identified during the application of the Act. These amendments to the Ionising Radiation Protection and Nuclear Safety Act, together with amendments to several implementing governmental decrees and ministerial rules, transpose the new nuclear safety directive[1], as well as 2014 updated Western European Nuclear Regulators Association reference levels. The new European Union basic safety standards[2] will be transposed by the end of 2017.

In spite of the amendments, the short name "the 2002 Act" remains unchanged, and applies to the latest version with the amendments included.

It is worth mentioning that in 2013 the Resolution on Nuclear and Radiation Safety in Slovenia was adopted - first by the Government in April 2013 and after that by the Parliament in June 2013; it was published in Official Gazette of the Republic of Slovenia No. 56/2013.

The Resolution on Nuclear and Radiation Safety in Slovenia (which covered the period from 2013 to 2023) was prepared in response to one of the recommendation of the IAEA Integrated Regulatory Review Service (IRRS) mission to Slovenia, which took place from 25 September to 4 October 2011.

The Resolution, as a high level national policy paper, covers the following topics:

(a) fundamental safety principles;

(b) a description of nuclear and radiological activities in Slovenia

(b) a description of the international cooperation in the field of nuclear and radiation safety;

(c) a description of the existing legislation (including binding international legal instruments, such as conventions and other relevant international instruments);

(d) a description of the institutional framework;

(e) a description of the competence of professional support (research, education, training);

[1] Council Directive 2014/87/Euratom of 8 July 2014 amending Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations, OJ L 219 (25 July 2014).

[2] Council Directive 2013/59/Euratom of 5 December 2013 laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom, OJ L 13 (17 January 2014).

(f) the objectives and measures to achieve them during the period up to 2023

The SNSA has to report to the Parliament on the implementation of the provisions of Resolution once a year; such a report is an integral part of the SNSA's annual report on Ionising Radiation Protection and Nuclear Safety, which is adopted each year by the Government and subsequently by the Parliament of the Republic of Slovenia. In the annual report the progress made towards achieving the objectives of the Resolution is highlighted.

Although not directly related to this report let us mention also that the SNSA has prepared, based on proposal of the Agency for Radioactive Waste Management, a draft of the new Resolution on the national program for radioactive waste and spent fuel management for the period 2016-2025 (ReNPROG). Such Resolution was first time adopted by the Parliament in 2006 for the period of ten years and since it expires in 2016 the new one is needed. The Parliament adopted the new Resolution in April 2016.

The comprehensive legislative and regulatory framework which governs the areas related to nuclear and radiation safety is attached to this report (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.

Based on the 2002 Act, 27 governmental decrees and ministerial rules have been issued in total. Within the reporting period a number of new secondary legislation (rules and decrees) have been adopted, in most cases as amendments to the existing ones (see details in Appendix I).

7.2 Summary of Legislation

The 2002 Act is the most important document with regard to 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 paragraph 22 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 2002 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, 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 Act itself, where in paragraph 24 of Article 3, a nuclear facility is defined as "a facility for the processing or enrichment of nuclear materials or the production of nuclear fuels; a nuclear reactor in critical or sub-critical assembly; a research reactor; a nuclear power plant and heating plant; a facility for storing, processing and depositing nuclear fuel or high radioactive waste; a facility for storing, processing or depositing low and medium radioactive waste. A nuclear facility shall also mean several of nuclear facilities when they are functionally linked in the same geographically confined territory and are managed by the same person." Furthermore, the Governmental Decree on Radiation Practices (UV 1) determines the criteria for the classification of radiation facilities and less important radiation facilities.

The responsibilities for radiation protection are divided among two authorities. The responsibility for the supervision of nuclear safety in nuclear facilities and radiation practices outside 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, Slovenian Radiation Protection Authority, (see more in the report under Article 8 – Regulatory Body).

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

- application for the license for the use of land - the competent body is the Ministry of the Environment and Spatial Planning (see more about restructuring of the Government under next chapter of the report) - with preliminary approval of radiation and nuclear safety - the competent body is the SNSA,
- application for the license to construct a facility – the competent body is the Ministry of the Environment and Spatial Planning, with an approval from the SNSA,
- application for the license for trial operation – the competent body is the Ministry of the Environment and Spatial Planning, with an approval from the SNSA,
- application for the operation and the decommissioning – the competent body is the SNSA.

7.3 Inspection and Enforcement

In accordance with Article 138 of the 2002 Act, the inspection and enforcement of nuclear and radiation safety rests with the SNSA. On the other hand, the SRPA is in charge of 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 powers rests with the Ministry of Interior. Since 2011 more emphasis is 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 Interior, cooperate and coordinate cross-cutting activities. Inspection includes control over the implementation of the provisions of the 2002 Act, the ordered measures and the regulations and decrees issued in accordance with the 2002 Act.

The elements of risk informed inspection are already partially incorporated into the current annual inspection program, such as the inspection assessment of the NPP activities analysed by 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. Appeal against such decision of an inspector does not prevent its execution.

In 2002 Act, there is only one article on inspection since there is a general Inspection Act (Official Gazette of the RS, 56/02 and subsequent amendments) which 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 to be followed also by nuclear and radiation safety inspectors.

For each inspection, a separate administrative procedure (case) has to 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 has to 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 114 and 115 of the 2002 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 of time in spite of the request from the inspector to remedy the deficiencies.

The SNSA can order the suspension of the operation of a nuclear facility ex officio if the licensee did not submit for approval the changes and amendments of the evaluation of the protection of exposed workers against radiation within the prescribed period of time, or if the licensee has started maintenance work, testing or introducing modifications, which are significant for the radiation or nuclear safety of a facility, without the prior approval of the SNSA.

There is no right of 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 No. 29/2011 – official consolidated text and subsequent amendments). Based on this act, minor offences are divided into two main categories. For the majority of 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, 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 the previous national report, it was mentioned that in February 2012 the Act on Government was amended which reduced the number of ministries from 15 to 11. This was achieved by merging some of, at that time independent (autonomous), ministries with other ministries establishing the new ministries. The SNSA became the organizational unit / body within the newly established Ministry of Agriculture and the Environment (MAE). After another reform of the ministries, which took place in 2014, the SNSA became again the organizational unit / body within the "re-established" Ministry of the Environment and Spatial Planning, as it was in the past.

The 2002 Act divided the 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 the area of 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 emergency preparedness and planning, while the Ministry of Interior (as of today, after the above-mentioned reorganization of the Government in 2014) is responsible for physical protection of nuclear facilities and nuclear materials.

8.1 Slovenian Nuclear Safety Administration (SNSA)

As a regulatory body in the area of nuclear and radiation safety, the SNSA is a functionally autonomous institution within the Ministry of the Environment and Spatial Planning (MESP). The SNSA responsibilities and competencies are defined in the Decree on Administrative Authorities within Ministries, and are defined 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 detailed competencies of the SNSA and other relevant administrations, entrusted with the implementation of the legislative framework in the area of radiation protection and nuclear safety, are prescribed in particular in the 2002 Act and other legislation 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 Co-operation,
- Office of General Affairs,
- Inspection.

Current organisational chart, which has been in force since February 2010, is shown in the Figure 1.

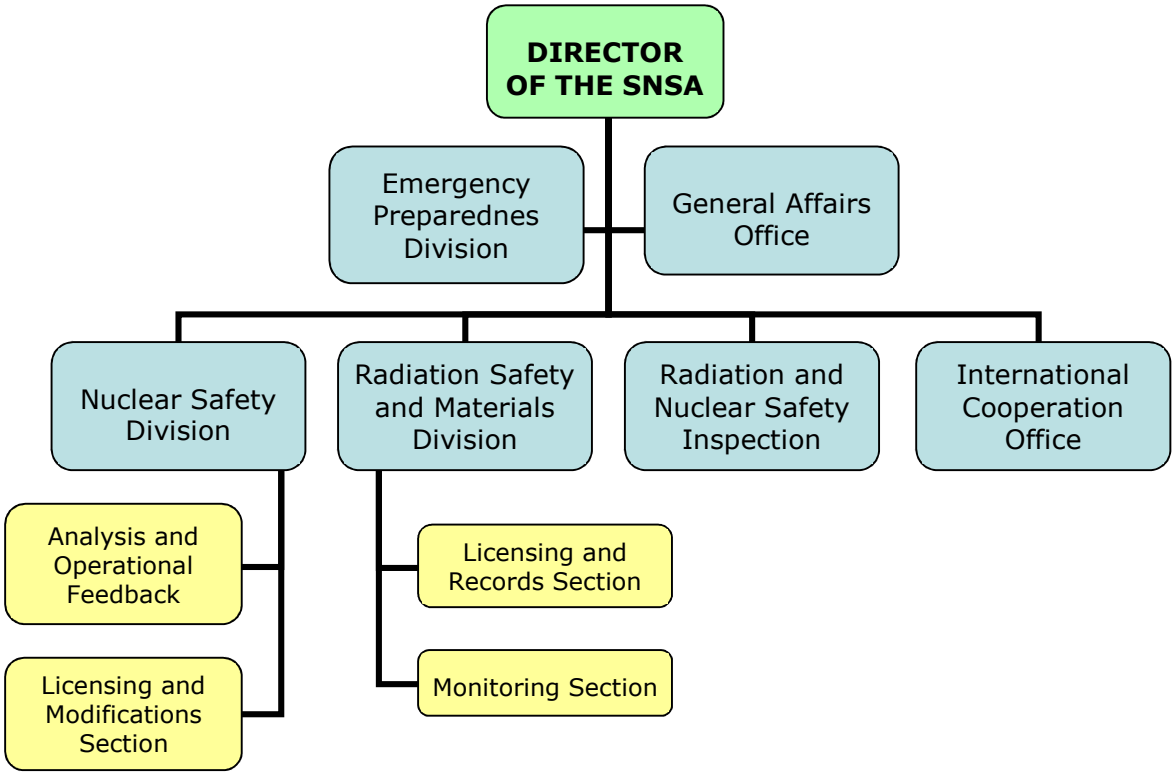

Figure 1: Organisational Chart of the SNSA

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

It has to be mentioned that due to very strict and restrictive governmental policy on employment for the last few years the SNSA has not employed any new staff member. In 2015 and 2016 such

restrictive governmental policy has slightly softened and the filling out vacant posts of workers, who have been retired or have been on maternity or sick leave, is allowed now.

At the same time the individual program for acquirement of necessary competences is in progress. The course on Fundamentals of Nuclear Technology and other courses at the Nuclear Training Centre in Ljubljana are frequently included in such program, as well as the events (courses, workshops) organised by the IAEA. Also, many of the SNSA staff attended courses on Westinghouse Technology organized in the US NRC Training Center in Chattanooga.

For 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 our young staff members, as yearly interviews, on the job training, and so on. Furthermore, so called »Systematic Approach to Training« has been finalized and it is used for training planning for the SNSA staff.

Due to the above mentioned governmental policy of not increasing the number of civil servants in administration the SNSA has substantially improved its management system and increased the effectiveness of its work. For the time being, the currently available technical staff at the SNSA and TSOs adequately covers the needs in various technical areas and has tools and ability to conduct independent safety analysis, both deterministic and probabilistic. Preliminary analysis shows that in case the second nuclear unit is going to be built the SNSA would need another 20 new staff. At the end of 2015 the SNSA employed 42 persons.

The budget of the SNSA is determined on the basis of 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, which is 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 costs by 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 biennial cycle. The composition of the SNSA budget for 2014, 2015 and 2016 is shown in the Table 1. This budget comprises all activities within the SNSA competences.

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

Table 1: The SNSA Budget for 2014, 2015 and 2016

STRUCTURE		**2014 (in EUR)**	**2015 (in EUR)**	**2016 (in EUR)**
Salaries/wages		**1.381.010**	**1.378.652**	**1.360.516**
Material expenditures		**502.523**	**539.624**	**540.000**
Investments and maintenance costs		**15.790**	**20.090**	**20.000**
International projects		**97.835**	**51.945**	**279.200**
Membership fees: (IAEA, OECD/NEA membership, USNRC programs)		**348.415**	**150.000**	**290.827**
Outsourcing	Nuclear safety	32.902	69.991	58.800
	Radiation safety	128.133	100.965	101.000
Total		**2.506.608**	**2.311.267**	**2.650.343**

8.2 Other Regulatory Bodies

The 2002 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.

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

- The Civil Protection and Disaster Relief Administration (within the Ministry of Defence), as the operator of the National Notification Centre, is responsible for notification procedures in the event of radiological emergency and for the off-site emergency planning.
- Ministry of 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 Civil Protection and Disaster Relief Administration and Ministry of Interior in the governmental structure is shown in the Figure 2.

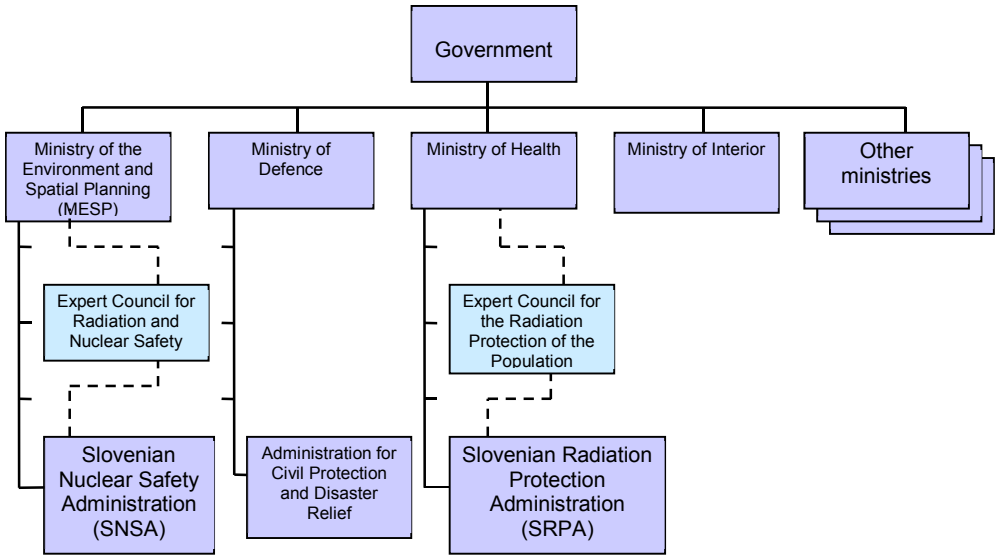

Figure 2: The SNSA and SRPA within the governmental structure

Based on the 2002 Act, the Expert Council for Radiation and Nuclear Safety was appointed in the mid 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, as an advisory body to the Ministry of Health and the SRPA.

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.

The Article 4 (the main principles), paragraph 6, of the 2002 Act states: »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«. This is the principle of prime responsibility.

Throughout the 2002 Act, there are several provisions designed for the execution of the above stated principle. For example, the 2002 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 (Art. 57),
- ensure that programs of recording and analysing operational experience at nuclear facilities are implemented; in the assessment, examination and improvement of radiation and nuclear safety, the operator must take into account the conclusions of such programs (Art.60),
- have sufficient financial resources guaranteed throughout the operating lifetime of a facility for implementing the prescribed measures of radiation and nuclear safety (Art.61),
- ensure, throughout the operating lifetime of a facility, a sufficient number of qualified workers with suitable education, additionally trained for the activities related to radiation and nuclear safety (Art. 62),
- set up and implement a quality assurance programme (Art.63).

Prime responsibility principle is embodied also in Article 70.a (design basis of a nuclear facility) and Article 82.a (extended design basis of a nuclear facility) and Article 80.a (operation of the facility).

In addition, the Rules on Radiation and Nuclear Safety Factors (JV 5) and Rules on Operational Safety of Radiation and Nuclear Facilities (JV 9) include provisions for the implementation of »prime responsibility« for nuclear safety of the operator in day-to-day activities.

For example, Rules JV 5 provide for the following:

- The investor/operator shall ensure that the plant is operated in a safe manner and in accordance with all applicable legal and regulatory requirements; the investor/operator shall ensure that decisions on safety matters are preceded by appropriate investigation and consultation so that all relevant safety aspects are considered. Safety issues shall be subjected to appropriate safety review by a suitably qualified independent review function [Art.49/(1), (2)];
- The investor/operator shall ensure that safety performance is continuously monitored through an appropriate review system in order to ensure that safety is maintained and improved as needed; the investor/operator shall ensure that relevant operating experience, international development of safety standards and new knowledge gained through R&D projects are analysed in a systematic way and continuously used to improve the plant and the investor/operator's activities; the investor/operator shall ensure that plant activities and processes are controlled through a documented management system covering all activities, including relevant activities of vendors and contractors, which may affect the safe operation of the plant [Art. 49/(4),(5),(6)].

- A written safety policy shall be issued by the investor/operator as a documented commitment to a high nuclear safety performance. Such safety policy shall:
  - include the commitment to ensure resources needed for reaching the planed goals,
  - be clear about giving safety an overriding priority in all plant activities
  - include a commitment to continuously develop safety,
  - require directives for implementing the policy and monitoring safety performance,
  - require safety objectives and targets, clearly formulated in such a way that they can be easily monitored and followed up by the plant management (Art.50(1), (2)).
- The investor/operator shall prepare the organisational structure for safe and reliable operation of the plant, and for ensuring an appropriate response in emergencies; such an organisational structure shall be justified and documented (Art. 51(1)).

Also, Rules JV 9 contain many provisions which clearly address the prime responsibility of a licence holder for nuclear safety. Some of them are indirect and calls for preparation of, for example, Operational Experience Feedback Programme (Art.7), Performance Safety Indicators Programme (Art. 11) or Ageing Management Programme (Art 15).

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 Act on Ionising Radiation Protection and Nuclear Safety. 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". The Act was amended in 2015 to include new requirements based on the EU directive on the nuclear safety of nuclear installations (2014) and the WENRA Safety Reference Level for Existing Reactors (2014). Article 63 of the Act defines requirements for integrated management system (IMS) that has to be continuously reassessed and improved. The IMS has to include provisions for safety culture. The IMS also needs to establish the control over suppliers and contractors.

Rules on radiation and nuclear safety factors (JV5) and Rules amending the rules on operational safety of radiation or nuclear facilities (JV9) further define the Act provisions and they were prepared in line with the WENRA reference levels of 2008. Both rules have been thoroughly revised and include the new WENRA reference levels of 2014. The revised versions are before the adoption and are reviewed by the Governmental legal service. The regulation JV5 gives a detailed definition of safety culture. Chapter V of the regulation JV5 includes requirements for the management of safety and quality in activities for the design, construction and operation of nuclear installations. These requirements define safety policies (Article 50 of the JV5), safety culture programs and development (Article 58), arrangements for safety management (Article 49), arrangements for safety monitoring and self-assessment (Article 53), independent safety assessments (Article 61), as well as a process oriented (quality) management system (Article 59). The Article 81 of the Act defines requirement to perform Periodic Safety Review (PSR) and the regulation JV9 defines in the Annex 9 the content of a PSR that includes, among other, the safety factors of safety culture (including priority to safety), management system and human factors.

In May 2011 the SNSA issued a decision requiring the Krško NPP to perform Extraordinary Safety Review according to the program of the ENSREG Stress Tests. The stress tests were completed by the Krško NPP with the final report in October 2011. In September 2011 SNSA issued the second decision requiring the NPP Krško to perform additional analysis as a basis for additional improvements for the plant safety against beyond design basis external events and for the mitigation of severe accidents. Based on additional analysis of potential safety improvements, the Krško NPP Safety Upgrade Program (SUP) has been prepared and is in implementation in the period from 2013 to 2021. The Safety Upgrade Program was revised in 2015 (approved by the SNSA in 2016) and consists of alternate safety injection, auxiliary feedwater, electrical supply, hydrogen recombiners, filtered venting system, reservoirs of water/borated water and spent fuel pit cooling. The third SNSA decision was issued in January 2012 and it required the NPP Krško to review the basis and assumptions for the Radiological Emergency Response Plan. This was completed in 2015 and results based on revised PSA level 2 analysis showed that it is important to perform population evacuation in case of a General Emergency in a 10 km zone. The protective action zones and proposed protective actions should be harmonized also for the neighbouring country of Croatia (10 km from the NPP).

10.2 Implementation of Regulatory Requirements for Priority to Safety

In the course of harmonization of WENRA reference levels and their transposition into the Slovenian regulation, the SNSA checked compliance of the Krško NPP arrangements with all the WENRA issues, including 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 was reported extensively in Slovenian national reports since the second review meeting.

The Krško NPP ensures management system which gives nuclear safety the overriding priority. Nuclear safety is 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 employees and the environment. Nuclear safety must be dealt with proactively foreseeing difficulties and respond early enough to prevent major deviations. Nuclear safety management is an inseparable part of management which clearly defines responsibilities and create organisational culture in support of nuclear safety. Managers promote and implement safety culture as outlined in The Code of Safety and Business Ethics as well as open communication which enable the employees to feel free to raise nuclear safety concerns without fear of retaliation. In order to improve safety culture and performance of personnel, Internal Commitments and Goals management manual has been recently supplemented with three priority areas: Excellence in Human Performance, Leadership Expectations and Coaching, and Excellence in Corrective Action Program.

In 2013 the Krško NPP conducted self-assessment of safety culture. In comparison to the previous self-assessment, positive changes were visible in the area of knowledge transfer and in horizontal communication between different organizational units. The results of self-assessment were presented to all organizational units at NEK and every organizational unit developed their own action plan to improve safety culture. Overall impression after the self-assessment in 2013 is that NEK has an excellent safety culture, thoroughly understands the nuclear safety concept, and is always prepared to improve and develop the competences and understanding of potential risks.

In 2014 the second Periodic Safety Review (PSR) was completed by the Krško NPP and it included also review of safety culture (including priority to safety). The PSR concluded that the Krško NPP has a decent safety culture with a deep understanding of nuclear safety concept of the plant as well as a willingness to continuously improve and develop competences and understanding of hazards. Some areas for improvement were identified such as change management process, leadership alignment, coaching and communication between departments or vertical communication. The findings of a 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 has not revealed any additional issues.

In the Krško NPP, the nuclear safety overview is achieved through the function 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 includes also a set of 30 indicators for 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 safety culture indicators are communicated all over the NPP organisation. Comparison of safety culture indicators status between 2013 and 2016 show improvement and currently, there are no indicators

with "red" status (Unacceptable Zone). There are only indicators in green (excellent), white (normal) and yellow (delayed/behind schedule)

The Krško NPP is required by the Act and the Rules JV9 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, including also those events that are connected with the safety culture and human errors. For the foreign operation experience the Krško NPP uses a program of industry experience for effective identification, reporting and screening of reported events.

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

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

The Krško NPP performs control over its suppliers and contractors. Selection of suppliers is based on evaluation of their capability to provide items or services in accordance with procurement requirements prior to the award of contract. Suppliers capable of meeting such requirements are included on Approved Supplier List. Audits of suppliers are performed to determine suppliers technical and quality capabilities by direct evaluation of their facilities, activities, personnel and implementation of their Quality Assurance Program. Local and mostly EU-based suppliers are being audited directly by the Krško NPP while suppliers from US are being audited in cooperation with Nuclear Procurement Issues Committee organization (NUPIC). Audit report with relevant findings is sent to the supplier who shall propose corrective actions and supplier shall submit evidence on corrective actions completion. 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.

Already implemented actions in response to Fukushima accident by the Krško NPP as well as planned activities can be seen as an example of good safety culture. The Krško NPP personnel have an understanding of nuclear safety concept of the plant with valuable knowledge and experience and are willing to continuously improve and develop competences. The safety thinking of employees is incorporated into 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.

10.3 Regulatory Oversight of Licensees on Prioritization of Safety

As mentioned above, the review of measures in place at the Krško NPP has been performed in the framework of the inspections, and audits, as well as through safety and performance indicators. The plant operation is carefully controlled by trained personnel who operate it in accordance with approved procedures. A 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 changes are evaluated for licensing applicability in accordance with the criteria defined in Rules JV9. For that purpose, an administrative procedure, called the Authorization of Changes, Tests and Experiments, was developed.

Independent reviews of outage activities and surveillance tests are performed by the Technical Support Organizations (TSO). The TSOs are engaged for the inspection, witnessing and safety evaluation of refuelling, surveillance and modifications activities.

The level of NPP safety is determined also by thorough review and analysis of plant operational events. There were six reportable events from 2010 to 2012, all of them with low safety significance. All of these events were rated as INES level 0 and there were no negative consequences or any radiological releases to the environment.

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

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 Management Manual, inspection plan, 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 the 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 communicates to the SNSA staff monthly the information on nuclear and radiation safety in Slovenia as well as presents the SNSA work and its international cooperation. As a method of 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 Act amendment in 2015 introduced new requirement in the Article 4a for self-assessment of the regulatory body every ten years. This self-assessment should review regulatory organization and legislation according to the international standards. After 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 results of the expert review have to be notified to other members of the EU and to the EC. The SNSA hosted the IRRS mission in 2011 and prepared an action plan according to the findings of the mission. The IRRS follow-up mission in 2014 checked the implementation of actions which were then mostly completed. At the end of the mission only one recommendation and one suggestion remained open out of the 9 recommendations and 29 suggestions. The mission also issued 2 new recommendations and 5 new suggestions. The recommendation, which remained open, was referring to the construction of a repository for low and intermediate level radioactive waste, which has not been progressing as planned. Since there has not been a visible progress since 2011, the mission again required that in the context of lack of space of the existing storage facility at the Krško NPP this issue should receive appropriate attention. The other open suggestion was aimed

at coordinating the nuclear emergency preparedness with the Republic of Croatia, which is a bilateral issue and needs to be accelerated.

The Act amendment in 2015 also introduced in Article 7 the provision that all the information on radiation practices, nuclear and radiation facilities are public (except for information relevant for the safeguards of nuclear materials and for physical security). Access of 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 in the SNSA web site to provide information to the general public. The Article 109 of the Act includes the requirement of international notification and provision of information in case of an emergency.

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 basis for SNSA processes improvement.

10.5 Voluntary Activities

At the SNSA's web site (http://www.ursjv.gov.si/), the Slovenian Reports on Nuclear Safety, the Slovenian Report for the Second Extraordinary Meeting of the Parties on Convention on Nuclear Safety, Slovenian National Report on Nuclear Stress Tests and Slovenian Post-Fukushima Action Plan, the national annual reports, the reports of international missions and other similar documents are regularly published. At the SNSA's web site there is also the Slovenian legislation in force, including the Act, the Governmental Decrees and the Rules, as well as the Practical Guidelines about conduct of periodic safety review, about contents of the safety analysis report, about management of design changes in NPP etc. The legislation is also translated into English and published in the web site. The SNSA publishes in its web site also additional information and reports on special issues, such as assessment of the Fukushima accident, reports on the seismic safety of the Krško NPP area, the reports on event with fuel damage in Krško NPP in 2013, etc. A newsletter News from Nuclear Slovenia is prepared biannually by the SNSA and also available at the SNSA web site. The SNSA prepares and delivers by mail to Slovenian licensees the Radiation News, a newsletter published three times per year.

The SNSA believes that open communication and provision of information to Slovenian and international public is a good practice and that this can improve the level of 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 2002 Act introduced as one of the main principles the »causer pays« principle (paragraph 7 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 2002 Act introduced a provision (Article 61) which relates strictly to the obligation of the operator of a radiation or nuclear facility to ensure sufficient financial resources guaranteed throughout the operating lifetime of a facility for implementing the prescribed measures of radiation and/or nuclear safety.

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

For the time being, the Krško NPP operator has allotted enough financial resources for maintaining the appropriate level of nuclear safety. The price of a kWh of electricity produced in the Krško NPP is set out by the NPP management and approved by the Supervisory Board, based on the annual business plan. Such price covers all gross operating expenses, i.e. electricity generation costs as well as necessary investments. Besides this, the Supervisory Board annually approves the Long-term Investment Plan (for five years). The amount foreseen for investments and improvements in recent years is stable and gives the management proper flexibility for the long-term maintenance of nuclear safety. 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.

As a consequence to the Fukushima accident substantial financial resources of the operator were allocated for many different actions, which are described in Appendix II.

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.

The financing of measures for the protection against ionising radiation and nuclear safety is prescribed in Chapter 12 of the 2002 Act, where division between the regular (and extra) costs of the user of a radiation source (Article 132) and the public expenses (Article 133, 134) 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 joint 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 radioactive waste and spent nuclear fuel management and 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.

In case of a nuclear accident, financial resources to compensate the claim are provided through the Slovenian third party liability legislation and through 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 ratified Protocols to both Paris Convention and to Brussels Supplementary Convention. The instrument of ratification will be deposited in accordance with the Council Decision 2004/294/EC.

11.2 Human Resources, Training and Qualification

11.2.1 Krško NPP

At the end of 2015 there were altogether 641 employees in the Krško NPP, who adequately covered all necessary functions for the technical operation, including QA, training and engineering. There are 6 operation shifts with a minimum shift composition of 5 licensed operators per shift, including an on-duty shift engineer.

Training and qualification activities at the Krško NPP are governed by:

- the 2002 Act with amendments,
- the Regulation on qualification requirements to be met by workers performing duties and tasks of safety significance in nuclear and radiation installations,
- 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, and so on. In addition, the Krško NPP personnel are trained and examined for using other relevant standard industry guides in areas like safety at work, hazardous chemicals, welding, non-destructive testing, specific equipment and machinery operation, and safety at work.

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

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

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

In 2002 the first group of operation personnel successfully finished the training program for reactor operator on the Krško NPP full scope simulator. The last generation (6 reactor operators) successfully completed training in 2014. There were 73 licensed reactor operators, senior reactor operators and shift engineers at the end of 2015. Average age of the operators is 40 years.

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

The training for maintenance personnel is conducted in a special training centre, using the Krško NPP own resources (instructors and subject matter experts), or 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 hands-on training.

11.2.2 Slovenian Nuclear Safety Administration and Technical Support Organisations

The SNSA makes sure that every employee goes through at least two months of initial training relating to nuclear technology at the Nuclear Training Centre in Ljubljana or at the US NRC

Training Centre in Chattanooga, USA. The SNSA employees also take part in international workshops and courses on topics related to their areas of work.

The training of the Technical Support Organisations personnel is organised according to the type of institution. They also attend international workshops, training courses at the Nuclear Training Centre in Ljubljana and similar events. Furthermore, the 2002 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 Article 62 of the amended Act on Ionising Radiation Protection and Nuclear Safety (2015), which defines workers' qualifications and physical as well as psychological requirements. The condition of workers must be regularly checked. The employer shall also ensure regular updating of the workers' professional knowledge. Rules on Providing Qualification for Workers in Radiation and Nuclear Facilities (JV4) further elaborate these requirements. The health surveillance of exposed workers is dealt with in the Article 39 and the re-evaluation of the assessment of fitness to work in its Article 42 are both in the amended Act on the Ionising Radiation Protection and Nuclear Safety (2015).

The Rules on Radiation and Nuclear Safety Factors (JV5) comprises basic human factors requirements in the nuclear installations design. The Rules Amending the Rules on Operational Safety of Radiation or Nuclear Facilities (JV9) comprises basic human factors requirements for operating nuclear installations.

12.2 Licensee Methods and Programs at the Krško NPP

The methods of dealing with human factor issues at the Krško NPP are covered in various plant documents like policy documents, plant programs, and high level administrative procedures. The methods which are used to prevent, detect and correct human errors are covered by the Operating Experience Assessment Program, which is 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. 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 in setting up the organisation and management of the plant. There are arrangements, such as Quality Assurance Plan, Plant Management Manual, Krško NPP Policies and Goals, Self-assessment Program, Safety Culture Principles, Human Performance Error Prevention Tools, Company General Employee Training Handbook, 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 analysis of human induced events at the Krško NPP and the feedback on the lessons learnt regarding plant operation procedures and training programmes.

The second Krško NPP periodic safety review was finished in 2013. This review was also augmented with impact assessment of the post-Fukushima developments, particularly with the results of actions that followed two SNSA decisions on the performance of NEK extraordinary safety review and on the development of the plant program for safety improvements for prevention of severe accidents and mitigation of its consequences, i.e. NEK Safety Upgrade Program. The second PSR process has revealed six new issues and identified one issue as not resolved from the first PSR. Issues identified are related to transfer of knowledge, capture of critical knowledge, training programme and post-Fukushima actions (see sub-chapters of Appendix II, A. Challenges (i) and B. Planned Measures to Improve Safety (ii)). All mentioned issues are of medium safety significance level and there were no high significance findings.

Staff workload is strictly regulated. Overtime is limited to 8 h/week, 20 h/month, and 170 h/year. Two plant administrative procedures deal with working time and salaries. Responsibility for controlling the workload of the personnel according to the procedures lies with the heads of departments. The overall monitoring of actual workload for the plant personnel is performed by the division of administration on a monthly basis. The staff turnover is rather low and is mostly due to retirement.

In 2013 Krško NPP staff have conducted a self-assessment of safety culture using methodology based on questionnaire. The self-assessment was organized in years 2006 and 2013 considering 70 arguments arranged into five criteria. The questionnaires were completed by all staff who were present at the NPP on the day the self-assessment took place, e.g. the NPP internal staff as well as external staff. As a result, an action plan was developed. In May 2015 a new internal procedure ADP-1.0.050 "Monitoring of Safety Culture and Human Factors" was issued. The SNSA have also performed a thematic inspection in 2016 covering safety culture. This inspection was a follow-up of the inspection conducted in 2014. For the preparation to the inspection the Krško NPP prepared answers to a set of questions, sent to the NPP in advance. The questions were based on the 2014 inspection findings.

Also, the SNSA performs a number of activities related to the human factors. Qualification of the licensed personnel is controlled by the SNSA operating staff and by the Ministry of Health (radiation protection staff). The training normally concludes with examination and the results are assessed by the examination committee, nominated by the regulatory body. As part of event analyses, the SNSA independently performs root cause analyses and determines the human factors that would lead to the events. Refueling outages are supervised by the SNSA and an analysis of the outage activities is done, which also includes the review of organizational deficiencies and human factors found by the SNSA inspectors. Based on the NEA system of safety performance indicators, the regulator established a safety-oriented system of performance indicators for plant supervision that includes several indicators to monitor human errors, organizational deficiencies and weaknesses in safety culture.

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

ARTICLE 13. QUALITY ASSURANCE

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

13.1 SNSA Quality Management System

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

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

The processes are documented at five levels of management documentation:

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

During the period between two reports several internal audits have been performed according to the internal annual audit plans. At the beginning of each year the management reviews fulfilment of annual action plan for the past calendar year. All findings of audits and management reviews are evaluated, recorded and, if necessary, remedied in a timely manner. Internal audits are performed only by trained and certified employees. The SNSA management reviews and evaluates the performance of the management system based on the management system records.

Even though the SNSA did not renew the certificate of compliance of the management system with ISO 9001:2008 at the end of 2013 due to austerity measures, the SNSA continues to carry out all activities in accordance with the requirements of this standard and the IAEA safety standard GS-R-3 and will ensure continuous improvement of the effectiveness and efficiency of its operations.

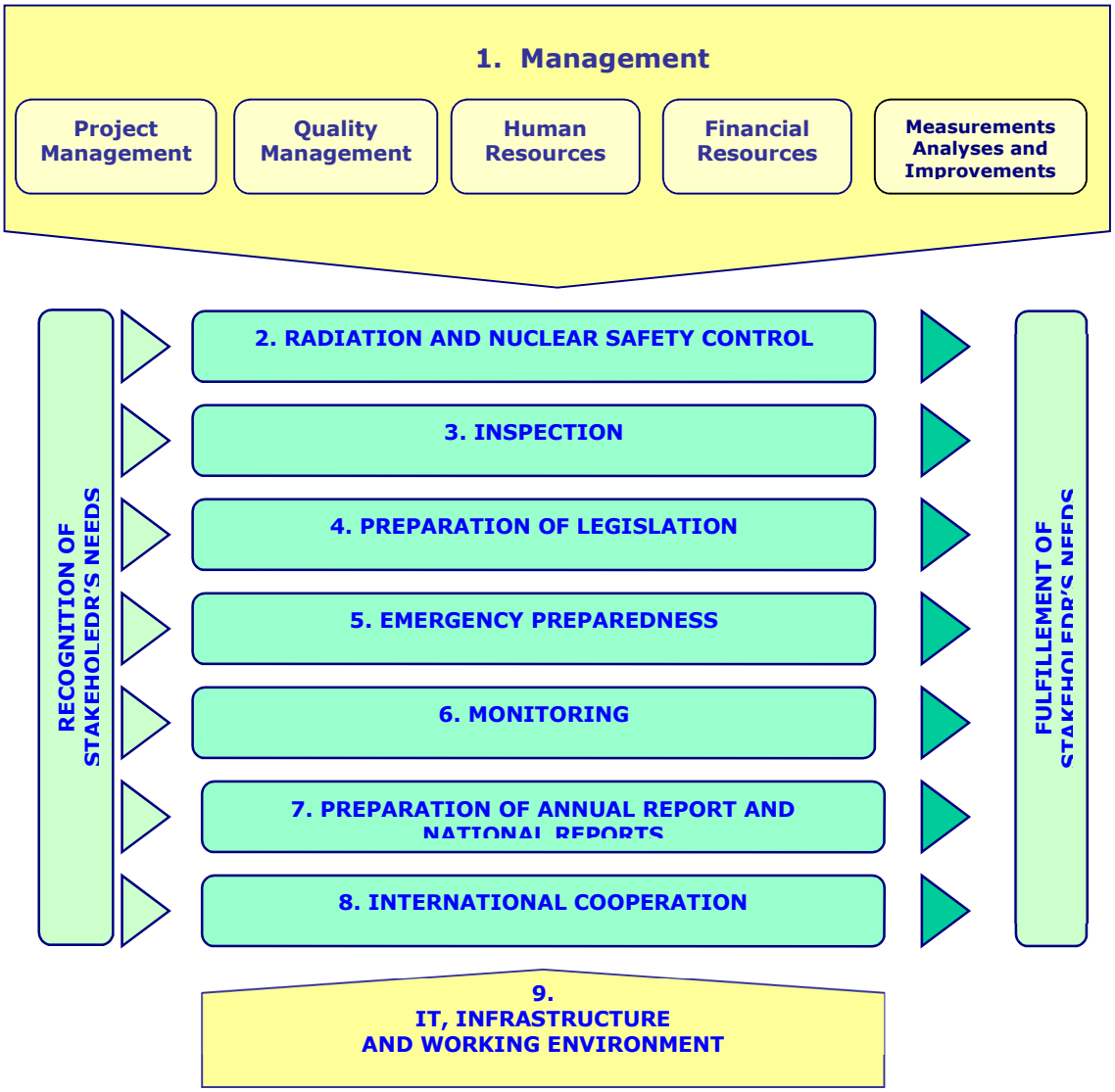

Figure 3: The SNSA Management System Processes

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

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

- The Ionising Radiation Protection and Nuclear Safety Act (Official Gazette RS 102/2004 and 60/2011), Article 63, and
- Rules on radiation and nuclear safety factors - JV5.

The Act on Protection against Ionizing Radiation and Nuclear Safety was amended in 2015. Amendments to the Act define also the new requirements relating to the management systems. Namely, the Article 63, among others, additionally defines that the operator of a radiation or nuclear facility shall as a part of its management system establish:

- Control over the contractors and suppliers and ensure that the work is carried out by companies that have established management system and employ experienced workers,
- Attitudes and behavior of employees in its organization, which has resulted in good safety culture. The operator must through self-assessment and regular reviews of the management system verify the adequacy and effectiveness of safety culture.

In addition, the amended Act requires in Article 4a, that the competent authorities must at least every ten years carry out a self-assessment, which includes harmonization of its own organization and legislation with internationally recognized standards in the field governed by this Act and regulations issued pursuant thereto, and other regulations in the field of peaceful uses of nuclear energy.

The most important regulation defining quality management systems is:

- Rules on Radiation and Nuclear Safety Factors (Official Gazette RS 92/2009 and 9/2010).

The fifth chapter (Articles 49 to 61) entitled "Safety and quality management" of the above mentioned Rules is dedicated to the requirements of the process oriented management system.

The management systems requirements in Slovenian legislation transferred most of the provisions from the IAEA GS-R-3 standard "The Management System for Facilities and Activities", 2006.

Rules on Radiation and Nuclear Safety Factors – JV5 have been revised and the document is before the adoption, currently under review by the Governmental legal service. Regarding the chapter on management system the new Rules transposed all requirements of IAEA standard GS-R-3 as well as all management system provisions from the latest WENRA Reference Levels setting more precise requirements on establishing and implementing integrated management systems for radiation and nuclear facilities.

13.3 The Krško NPP Quality Assurance System

The Krško NPP integrated management system brings together in a coherent manner all requirements for managing the organization. The main aim of the management system is achieving and improving of safety by 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 safety requirements. The policy is established by Management Board's Statement of Policy and Authority.

The Krško NPP Quality Assurance Program is established and systematically implemented in accordance with Slovenian regulations and US regulation 10CFR50 Appendix B. Quality Assurance Program defines the control activities which affect the quality and operational condition 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 implementing appropriate corrective actions. Quality related activities need to be performed under controlled conditions, which include 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. 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 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 Quality Assurance Plan which incorporates various changes and improvements resulting from regulatory requirements (2002 Act, JV5, JV9), international standards (IAEA GS-R-3, ISO 14001, ISO 17025, BS OHSAS 18001, ASME NQA-1, ANSI/ASME N45.2, …) and revised international guidelines (WANO, INPO, NRC…). Quality Assurance Plan defines the expectations for the implementation of the following: internal plant audits, supplier audits, oversight of plant modifications, procedures review and approval, procurement documents control, evaluation and approval of suppliers, observation of plant activities, review and approval of outage documents, oversight of equipment manufacturing and other activities.

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). Program is an intrinsic part of overall management system aiming at continuous progress in nuclear safety, thus ensuring that taken measures will not jeopardize nuclear safety.

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

The SNSA review and control activities regarding licensee quality assurance and management system programme 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 which is dedicated to the licensee management system and/or quality assurance system.

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

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

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

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

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

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

The review identified 3 unresolved or partially resolved issues from NEK PSR 1 and 4 new issues. These were mostly deficiencies in review and hierarchy of plant documents, internal audits scope and performance and responsibilities of committees. All of the issues identified are of low safety significance level. All issues from PSR 2 have been already 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

Nuclear and radiation safety are regulated by the 2002 Act. It ensures that licensee shall write safety analysis report for a nuclear facility under construction, commissioning or operation, following termination of operation or under decommissioning. The 2002 Act was revised in 2015. Several amendments have been introduced as a consequence of the lessons learned following the Fukushima Daiichi nuclear power plant accident and the European stress tests. Also, a new provision related to the construction of a new nuclear facility was added.

Details of radiation and nuclear safety, as well as operational safety of radiation and nuclear facilities are regulated by the secondary legislation. The 2009 Rules on Radiation and Nuclear Safety Factors (JV5), revised in 2016 and to be published in autumn, prescribes that the safety analysis report must provide information on the facility at a level of detail allowing independent assessment of the safety of the facility. It also gives an exhaustive list of topics which have to be included in the report, like safety basis and project concepts, an analysis of the location, object technical characteristics, programs for quality assurance, the evaluation of the protection of exposed workers against radiation, programs for pre-operating tests and programs for trial operation, training programs, the assessment of the exposure of the population and the environment, a safety analysis, the anticipated discharge of radioactive substances into the environment, and emergency planning.

The assessment of the nuclear facility safety throughout its life is ensured through the provisions of the 2009 Rules on Operational Safety of Radiation and Nuclear Facilities (JV9).

Regarding modifications, the 2002 Act requires that for each intended change 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 change which affects or could indirectly affect the content of the safety analysis report, the licensee must evaluate the change in relation to its significance for radiation or nuclear safety.

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

- 1st category modifications, for which it shall be necessary to notify the SNSA,
- 2nd category modifications, for which the intention of their implementation must be reported to the SNSA; the licensee may commence the implementation of the proposed changes after the SNSA confirms in writing that it is not necessary to obtain approval for the changes,

– 3rd category modifications of significance for radiation or nuclear safety, for the implementation of which a license from the SNSA must be obtained; the licensee must attach a proposal for the amendments to the safety analysis report and an expert assessment from an authorized expert for radiation and nuclear safety.

The 2002 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 competent ministry. Approved safety review report is a condition for further operation of a facility. Detailed information about performing PSR is presented in Rules JV9 and in the practical guidance issued by the SNSA. The SNSA can require an extraordinary safety review if new and important evidence on the radiation or nuclear safety of a facility has come to light.

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 plant modifications, guidance is provided for the NPP staff as well as for the contractors. The screening criteria for determining the need for safety evaluations, guidance for the performance of these safety evaluations and the requirements for documentation review and approval are specified in Rules JV9, which has been revised in 2016 and currently is reviewed by the Governmental legal service.

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

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

The licensee's obligations including documentation for granting an authorization for modifications are prescribed in the 2002 Act and more specifically in Rules JV9.

The SNSA reviews in detail the submitted documentation and assess it in accordance with a dedicated, written procedure. Such assessment shall take into account also all relevant operating experience and significant new safety information. In accordance with the procedure, a review assessment report shall be prepared as a basis for the final decision. At the SNSA, an information system is used for archiving modification data. It 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, about which we reported in the previous national report.

In 2010, the second Periodic Safety Review (PSR2) program was approved by the SNSA. At the beginning of 2014 SNSA reviewed all the safety factor's review reports prepared by the NPP, carried out from 2010 to 2013. The final report of the NPP on the periodical review concludes that there the plant is safe and there are no findings, which would prevent further operation. The PSR2 identifies also areas, in which improvements can be introduced, in particular this refers to procedures, control and qualification, aging of materials, emergency planning, improving the design bases and in the field of plant safety analyzes (deterministic and probabilistic analyzes and analyzes of potential threats and hazards). The implementation plan contains a plan of activities and deadlines for implementation of individual recommendations.

In May 2014 the SNSA approved the PSR2 and the resulting implementation plan, which must be implemented by the NPP by May 2019.

In response to the Fukushima accident, the SNSA issued a decision to the Krško NPP to perform an Extraordinary Safety Review. The programme of this review was completely in line with the ENSREG specifications for European Stress Tests. For the preparation of the stress test report the plant performed some additional analyses (e.g. evaluations of seismic and flooding margins, additional station blackout analyses to support the newest severe accident strategies, drain cycle of the 1E batteries, water heat-up and evaporation rate in the spent fuel pool, evaluation of spent fuel pool criticality). The contents of the Krško NPP's safety review report were used as a basis for the Slovenian stress test report.

The results of the stress tests showed that the plant was well designed and constructed and that all potential external events were taken into account during preparation of protective and mitigating measures. In months after the Fukushima accident short-term improvements were performed, what resulted in the procurement of additional portable equipment, e.g. AC diesel generators, pumps and compressors, implementation of quick connection points for this equipment, as well as amendments to the emergency operating procedures and severe management accident guidelines. This also meets B.5.b requirements (referenced in Appendix II, B. Planned Measures to Improve Safety).

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

However, the core of the NAcP and post-Fukushima improvements is the Krško NPP's Safety Upgrade Program (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 from the plant to upgrade its systems, structures and components to enable coping with severe accidents after the extension of plant lifetime. After the Fukushima accident the SNSA ordered the plant to implement these measures in advance. Currently, the SUP is divided into three phases. The first one was implemented in 2013 and included installation of passive containment filter filtered venting system and replacement of active hydrogen recombiners with passive ones which are also capable to manage hydrogen in severe accidents. The second phase is underway and has to be implemented by the end of 2018. It includes flood protection of the nuclear island, reconstruction of the operations support center, installation of pressurizer PORV bypass, alternative cooling of the spent fuel pool, alternative cooling of reactor coolant system (RCS) and containment, installation of emergency control room (ECR), upgrade of bunkered building 1 electrical power

supply, ECR ventilation and habitability system, replacement and upgrade of critical instrumentation. A bunkered building with additional sources of borated and unborated water with injection systems to RCS and steam generators will be built in the third phase which has to be finished by the end of 2021. Also the new dry spent fuel storage facility will be built in the third phase, but it will be finished by the end of 2019.

14.2 Verification of Safety

14.2.1 Actions of the Licensee

In 2012 the SNSA issued a decision which allows the Krško NPP to extend life span beyond 2023, if the given conditions are met. The US NRC requirements were used in the regulatory process. Amongst the conditions to extend its operational life span, the Krško NPP will have to finalize already planned safety upgrades, to regularly implement periodic safety reviews in 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). The objective of the AMP is to determine whether 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-Service Inspection (ISI) program is carried out by the plant's specialists and subcontractors. The program is in compliance with the regulatory policy 10 CFR50.55a and ASME Code XI, Components subject to examination are Class 1, 2 and 3 pressure retaining components and their integral attachments. ISI program employs examination techniques as described in ASME Section XI and ASME Section V such as Visual Examination Method, Surface Examination Method including Magnetic Particle, Liquid Penetrant and Eddy Current, and 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 verification of efficient connection of activities from different programmes is required with regard to components failure, the trends of components and systems performance, corrective actions prioritization and the verifying of the status of long-term investment plan and maintenance activities.

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

With the purpose of establishing and maintaining evidence that structures, systems and components will perform their function under normal and accidental environment conditions, the "Environmental Qualification Programme" (EQ) is being developed together with appropriate procedures. In accordance with requirements from 10 CFR 50.49 and standard IEEE 323-1974, the EQ program includes safety related electrical equipment located in harsh environmental conditions.

14.2.2 Regulatory Surveillance

The SNSA carries out its surveillance responsibilities with a combination of tasks, e.g. inspections, review of documents, approval of modifications and regular monitoring and evaluation of the NPP's performance. During the refuelling outage the technical support organizations are engaged to inspect and evaluate selected activities of plant maintenance and testing. The SNSA does not have resident inspectors on site. Inspectors, based at their headquarters in Ljubljana about 100 km from the plant, yearly have more than 50 inspection days on site during non-outage years. Furthermore, the inspectors are present every day at the NPP during the outages.

During plant outages, inspections over the plant staff and subcontractors work are performed more frequently. As a result of 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 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. At the end of 2007, the SNSA initiated the new regulatory approach in supervising the Krško NPP through its own set of 46 safety performance indicators. Some of the indicators are identical to the Krško NPP indicators, while others were selected specifically for the regulatory use. The input data for the indicators are submitted by the Krško NPP once per month. The SNSA set of performance indicators is intended to search for potential weaknesses that might lead to the degradation of nuclear safety.

The SNSA has developed its own system for tracking, screening and evaluating operational experience of the nuclear installations. The SNSA staff regularly tracks the operating experiences throughout the world and screens them for applicability in the Slovenian nuclear facilities. The operating experiences, which pass the screening, are thoroughly evaluated and also recent operational events in these facilities are taken into account. If the analysis shows that lessons learned are applicable also for Slovenian licensees, then more information is gathered to do the evaluation and appropriate corrective actions are considered. For instance, an analysis of the Korean experience with counterfeited items resulted in a change of the Slovenian legislation. The Krško NPP performed analysis of internal flooding hazard and implemented necessary modifications after the US experience with internal flooding hazard. The Swedish and US experience with imbalance of electric grid also resulted in modifications of the Krško NPP.

Slovenian licensees must submit a report to the SNSA if a situation important to safety occurs. Such a report must include a brief description of the event, the probabilistic safety analysis of the event, the analysis of contributing, direct and root causes, implemented measures and the classification of the event according to the international nuclear and radiation event scale. In parallel, SNSA has developed the internal system for event analyses. It serves for identification of shortcomings in NPP operation and identification of priority areas of SNSA control over the operation.

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, Radioactive Contamination and Intervention Levels (Official Gazette No. 49/04). Regulatory approved dose constraint of effective dose is set to 15 mSv per year for Krško Plant 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 own accredited methods of its dosimetric service, approved by the Slovenian Radiation Protection Administration (SRPA). The exposure data for plant workers include also neutron doses and internal exposures derived from the whole body counter measurements. Dose constraint for internal dose is set to 0.2 mSv per year. Table 2 shows personal dosimetry data for the last few years.

Table 2: Personal dosimetry data for 2012-2015 for Krško NPP workers and contractors (outside workers).

2012			
	No. of persons	Average dose (mSv)	Maximum dose (mSv)
NPP personnel	436	0.50	5.64
Outside workers	975	0.68	6.55
Total	**1411**	**0.63**	
2013			
	No. of persons	Average dose (mSv)	Maximum dose (mSv)
NPP personnel	450	0.50	6.41
Outside workers	1124	1.00	11.28
Total	**1574**	**0.86**	
2014			
	No. of persons	Average dose (mSv)	Maximum dose (mSv)
NPP personnel	423	0.13	3.89
Outside workers	365	0.14	3.12
Total	**788**	**0.13**	
2015			
	No. of persons	Average dose (mSv)	Maximum dose (mSv)
NPP personnel	434	0.50	5.63
Outside workers	1011	0.57	7.72
Total	**1445**	**0.55**	

Radiation protection in the Krško NPP is organized and implemented by the radiation protection unit (RPU). There are seventeen of 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. Head of the RPU is a qualified expert in radiation protection.

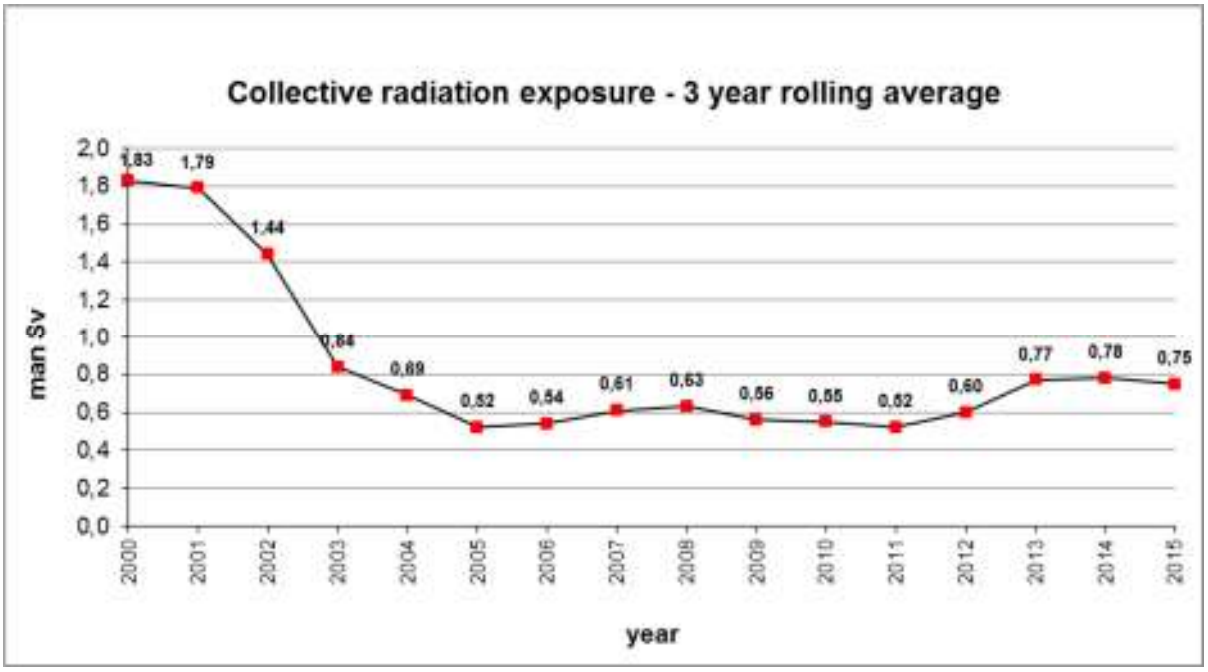

Figure 4: Collective radiation exposure in the Krško NPP

Figure 4 shows the collective doses of 3 year rolling average in the Krško NPP in the period of 2000-2015. After 2000, when both steam generators were replaced, collective doses reached new expected values for Krško plant. Then reactor vessel head replacement was performed in 2012 with new gamma and neutron shielding. The following year RTD by-pass piping was removed and these have also beneficial effect for future maintenance activities. During outages 2013 and 2015, RP staff has carefully controlled additional beta/gamma and alpha contamination due to some fuel failures caused by rod fretting. No cases were detected of effective dose exceeding 15 mSv or internal dose over 0.2 mSv per year. After work on reactor baffle up-flow conversion in outage 2015, the problem of fuel failures has been eliminated.

15.2 Radioactive Discharges and Environmental Monitoring

The authorised dose limit for the members of the reference group due to radioactive discharges from the Krško NPP during normal operation was set to 50 μSv per year. This figure takes into account all 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 (Table 2). The annual limits of discharged activities into the environment are stipulated by the operation licence of the Krško NPP. The limits of annual liquid releases are given for the fission and activation products and separately for ^{3}H. Besides annual limits, the quarterly limit for fission and activation products (without ^{3}H) is also set. Annual activity releases of noble gases to the air shall be within the total dose limit (< 50 μSv), and

there are also additional radioiodine (in ^{131}I equivalent) and aerosols activity limits for a calendar year.

The environmental radioactivity monitoring of the nuclear installation is defined in the Rules on the Monitoring of Radioactivity (OJ RS, 20/07 and 97/09) and prescribed in detail within the Plant Radioactive Effluent Technical Specifications.

Table 2: Released activities from the Krško NPP in the period 2012-2015 and the corresponding limits

LIQUID EFFLUENTS		2012	2013	2014	2015
Fission and activation products Limit: 100 GBq	Released activity	100 MBq	36,9 MBq	48,4 MBq	33,6 MBq
	% of the limiting value	**0,1 %**	**0,037 %**	**0,048 %**	**0,034 %**
Tritium (H-3) Limit: 45 TBq	Released activity	16,6 TBq	11,6 TBq	1,73 TBq	16,3 TBq
	% of the limiting value	**36,9 %**	**25,9%**	**3,85%**	**36,2%**

GASEOUS EFFLUENTS		2012	2013	2014	2015
Fission and activation gases Limit: dose< 50 µSv	Released activity	1,42 TBq	2,58 TBq	1,07 TBq	3,72 TBq
	% of the limiting value	**0,26 %**	**0,32 %**	**0,12%**	**0,31%**
Iodines (I-131 and others) Limit: 18,5 GBq (eq. ^{131}I)	Released activity	10,9 MBq	426 MBq	29,8 MBq	764 MBq
	% of the limiting value	**0,037 %**	**0,59 %**	**0,059 %**	**1,19 %**
Aerosols (cobalt, cesium …) Limit: 18,5 GBq	Released activity	183 kBq	124 kBq	228 kBq	1,33 MBq
	% of the limiting value	**0,001 %**	**6,7E-4 %**	**1,2E-3 %**	**7.2E-3%**
Tritium (H-3) No limit	Released activity	8,77 TBq	6,21 TBq	4,36 TBq	5,56 TBq
Carbon (C-14) No limit	Released activity	139 GBq	133 GBq	23,1 GBq	78,6 GBq

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

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

For the year 2015 off-site radiological monitoring reports show that conservatively estimated effective dose received by members of general public as a result of the Krško NPP emissions amounts to a value of less 0.3 μSv per year including atmospheric and liquid discharges. There is no observed change as regards the previous years. The value 0.3 μSv per year represents 0.6% of the authorised effective dose limit (50 μSv) which is the sum of the contributions from all exposure pathways to the member of the public at 500m 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.

15.3 Implementation of the optimisation principle (ALARA)

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

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

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

The Figure 4 shows collective doses in the Krško NPP, which were optimized by ALARA planning.

15.4 Regulatory Control Activities

According to the 2002 Act, the Krško NPP applied for additional licence, others than those covered by the operating licence. In 2004, the SNSA issued the licences for internal industrial radiography, for an X-ray device used in the internal control of received goods, and for radioactive sources for the calibration of radiation measurement equipment. These radiation sources are regularly inspected by the SNSA.

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

The SNSA inspectors ensure oversight of the Krško NPP radiation 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 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 2002 Act and the Protection against Natural and Other Disasters Act issued in 2006 (Official Gazette, 51/06). According to the Act on Organization and Field of Activities of the Ministries 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 population protection and for the organization of civil protection units in nuclear installations, and the SNSA, which is responsible for on-site procedures and measures related to the on-site emergency plan.

The 2002 Act requires from the operator to forward in the safety analysis report, which is the principal licensing document and a complete radiological emergency response plan, which is prepared in line with the civil protection regulations. The 2002 Act provisions mostly focus on the intervention measures in case of emergency. According to these provisions the operator needs to be capable to classify accidents, assess the consequences of the event and propose countermeasures. In the operator's emergency plan the intervention measures should be planned upon the emergency class declared. The operator must provide emergency planners all requested information which is available to the operator. The operator must maintain the emergency preparedness and provide response as stipulated by the on-site emergency plan. The prompt notification of the authorities of an event, without an undue delay, is stipulated and the public needs to be informed about important facts in the emergency plans. The ministry accountable for environment shall notify about the potential trans-national emergency in compliance with the international conventions.

The Decree on Preparation and Contents of the Emergency Plans (Official Gazette 24/2012 and 17/06, 76/08) stipulates that the on-site nuclear emergency plan should be coordinated with national and municipality level, and that nuclear emergency plans should be revised at least every three years. Emergency plans are public documents and should be presented to the public within 90 days after their adoption.

The last revision of the National Nuclear or Radiological Emergency Plan was adopted by the Government in 2010. The new revision is in preparation as of spring 2016.

16.2 Implementation of Emergency Preparedness Measures

The emergency planning zones, the classification of emergencies, the structure of emergency plans and the relations between them were described in the first and the second national report and have remained unchanged. The new national plan revision is going to improve preparedness and response within the zones.

The SNSA carried out a smaller scale revision of its emergency preparedness and its emergency team in 2015, taking into account the latest international developments and lessons learned from the exercises.

The SNSA maintains and develops MKSID, which is a dedicated web based communication system during radiation emergencies for information and document exchange. There are 29 national organizations connected by the system.

In 2009, the SNSA started a campaign to solve the iodine prophylaxis issue. After adopting new regulation in 2010, the potassium iodide tablets were pre-distributed in 10 km radius around the Krško NPP in 2013 and regional stock piles established around the country. The pre-distribution was financed by the Krško NPP. There is a process established for maintaining iodine thyroid blocking preparedness.

Throughout the reporting period the Krško NPP maintained the operability of emergency centers and equipment, updated emergency documentation and performed systematic monthly communication testing and checking of emergency personnel response. The Krško NPP Emergency Plan, revision no. 32, was issued in June 2015.

16.3 Informing the Public

In line with the Council Directive 89/618 EURATOM on informing the general public about the health protection measures, the Krško NPP prepared an information brochure entitled "How to Act in a Nuclear Emergency" for people living within the area of planned urgent protective actions. The brochure is regularly updated and distributed to all households in the municipalities around the Krško NPP. The last update was in 2014.

16.4 Training and Exercises

There are on average over 100 emergency trainings and exercises per year carried out at the SNSA. 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 personnel for emergency response. Besides regular training, they conduct annual exercises run by their full scope simulator, which are jointly organized with the SNSA.

National exercise is conducted every three years. Some of them are radiological, like the one in 2011, but most are related to the Krsko NPP and are tied to their annual exercise.

In this reporting period the following bigger exercises were conducted: regular annual NPP exercises June 2013, November 2014 (national), December 2015 and March 2016 as a regional international exercise INEX 5.

The SNSA actively and regularly cooperates with domestic and international organizations in conducting and participating in different exercises.

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16.5 International Agreements and International Projects

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

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

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

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 Act on Ionising Radiation Protection and Nuclear Safety (amended in 2015), the Environment Protection Act (consolidated text - Official Gazette RS, No. 39/06 with subsequent amendments), the Siting of Spatial Arrangements of National Importance Act (Official Gazette RS, No. 80/10 with subsequent amendments), the Construction Act (consolidated text - Official Gazette RS, No. 102/04 with amendments), the Rules on Radiation and Nuclear Safety Factors (JV5), the Decree on Categories of Projects for which an Environmental Impact Assessment is Mandatory (consolidated text - Official Gazette RS, No. 78/06 with subsequent amendments) and the Decree on the Content of Report on the Effects of Intended Activity to the Environment and Method of its Preparation (Official Gazette RS, No. 36/09).

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

According to the revised 2015 Act, the safety documentation needed to build a safety case to prove nuclear and radiation safety during the siting and construction of a nuclear facility shall consist of three main documents:

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

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

Article 64 (the siting of a nuclear facility) of the 2015 Act on Ionising Radiation Protection and Nuclear Safety determines that the selection of a site for the location of a nuclear facility shall be based on an Environmental Report (ER), of which a special part will be dedicated to the nuclear

and radiation safety. This part of the ER will be used to assess all the factors at the site of the future nuclear facility which may affect the nuclear safety of the facility during its active life and the effects of the facility operation on the population and the environment.

This special part of the ER shall include:

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

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

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

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

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

The Rules JV5, which stipulate the design bases of the nuclear facilities, were amended in 2016 taking into account the Fukushima Daiichi accident's lessons learned and the revised WENRA Reference Levels. The amended Rules JV5 are yet to be published and are currently reviewed by the Governmental legal service.

The Environmental Impact Assessment is provisioned in Article 51 of the Environment Protection Act in the course of issuing environmental protection consent for a nuclear facility. The SNSA proposes the content of the Environmental Impact Assessment in the part related to radiation and nuclear safety. The conditions, the scope and the content of the Environmental Impact Assessment is drawn up by the Environmental Agency of the Republic of Slovenia on the basis of the SNSA proposal.

The Safety Analysis Report is required for the approval of the construction of a facility. An investor, who intends to construct the nuclear facility, needs to submit a Safety Analysis Report together with the application for the approval and also with the project documentation along with the

opinion of an authorized expert for radiation and nuclear safety. The content of the Safety Analysis Report is determined by the Rules JV5.

According to the Siting of Spatial Arrangements of National Importance Act and the 2002 Act, the siting of the nuclear facilities and the conditions for their location in a spatially and functionally contained area is carried out through the process of 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 a preparation of the Environmental Report it is the subject to public hearing and the consultation with the neighbouring states (cross-boundary impacts) and becomes a public document. 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 neighbouring states. When positive opinions of all competent ministries, municipalities and other organizations are given, the National Spatial Plan is adopted with a governmental decree. Together with adoption of the National Spatial Plan, the design conditions are also issued.

The procedure is similar for the Environmental Impact Assessment (EIA), which is necessary for obtaining the Environmental Protection Consent from the Environmental Agency of Republic of Slovenia (EARS). The investor of the sited nuclear facility needs to submit an Environmental Impact Assessment, which includes description of the project, its impacts to the environment, comparison with other assessed alternatives and proposed mitigating activities. Similar to the Environmental Report in the National Spatial Plan stage, the EIA is a subject to public hearing and consultation with neighbouring states. Before issuing the environmental protection consent, the EARS shall obtain positive opinions from competent ministries and organizations and a preliminary consent on nuclear and radiation safety from the SNSA.

17.2 Impact of the Installation on Individuals, Society and Environment

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

The amended Rules JV5 stipulate (in line with the WENRA reference levels and requirements for new designs) that the accidents with core melt, which would lead into early or large releases, shall be practically eliminated, meaning that these 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 2015 Act on Ionising Radiation Protection and Nuclear Safety as well as the Rules JV5 and JV9 stipulate that the plant shall perform a Periodic Safety Review (PSR), which shall, besides re-evaluating design against newest standards and assessing the overall state of the power plant, also re-evaluate the natural hazards on site taking into account the latest site related data and the state-of-the-art methodologies.

The result of the first PSR for the Krško NPP (2003) was 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. Also some other hazards (severe winds, aircraft accidents) were reassessed and recommendation for improvements were given.

The review of natural hazards was again 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. For more information on PSR see Appendix II, B.Planned Measures to Improve Safety (i).

17.4 Re-Evaluation of Site Related Factors

Public involvement in the siting process is ensured through spatial conferences, public hearings, neighbouring states consultation and the public availability of the documentation. It starts with the presentation of the National Spatial Plan and the Environmental Report to the general public. Consultation with the neighbouring states takes into account the Espoo Convention in the National Spatial Plan stage of the siting. A similar procedure is followed in the process of obtaining environmental protection consent, for which the EIA is required. The documentation shall be available to public at least 30 days, while the duration of consultation with neighbouring states is agreed upon between the states. The competent ministries and organizations prepare their positions on the opinions and comments given by the public and neighbouring states. Both, the final National Spatial Plan and the environmental protection consent, are adopted and issued respectively after positive opinions of all competent ministries, organizations and local communities have been issued.

In the last stage, the investor needs to obtain the construction license by forwarding the Safety Analysis Report, which is also a public document. There are no special provisions for the public hearing of the Safety Analysis Report. However, in accordance with the General Administrative Procedure Act (consolidated text - Official Gazette RS, No. 24/06) any person, who demonstrates their legal interest, has the right to participate in the licensing procedure.

The list of international and bilateral arrangements is in Appendix I.

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

ARTICLE 18. DESIGN AND CONSTRUCTION

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

(I) the design and construction of a nuclear installation provides for several reliable levels and methods of protection (defense in depth) against the release of radioactive materials, with a view to preventing the occurrence of accidents and to mitigating their radiological consequences should they occur;

(II) the technologies incorporated in the design and construction of a nuclear installation are proven by experience or qualified by testing or analysis;

(III) the design of a nuclear installation allows for a reliable, stable and easily manageable operation, with specific consideration of human factors and the man-machine interface.

18.1 Implementation of Defence in Depth

The construction license for a nuclear facility is issued by the Ministry for Infrastructure and Spatial Planning on the basis of the Construction Act (Official Gazette RS, No. 102/04). The investor can submit an application for it, only after the SNSA gives its consent for construction (as stipulated in Article 68 of the 2015 Act on Ionising Radiation Protection and Nuclear Safety). The submitted application for the consent for construction needs to include project documentation (e.g. design for construction license), a Safety Analysis Report including relevant evaluations, the opinion of an appointed expert for radiation and nuclear safety, decommissioning programme, and other documents. The contents of the project documentation and other conditions are prescribed by the Rules JV5.

The 2015 Act on Ionising Radiation Protection and Nuclear Safety and the Rules JV5 provisions the defence in depth concept as the fundamental principle. According to the Rules, this concept shall be used as the basic design criteria for designing a nuclear facility and especially for designing safety systems, systems for mitigating radioactive releases and fire protection systems. Also the JV5 stipulates that external hazards must be considered in the design bases of the plant. As a minimum, the following external initiating events must be taken into account:

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

The Rules JV5 are in the process of amendment taking into account the Fukushima Daiichi accident lessons learned, the revised WENRA Reference Levels of September 2014, the WENRA's "Safety of new NPP designs" report, and some other minor changes. Major changes, in particular those coming from the revised WENRA Reference Levels, concern the design extension for existing reactors and the area of natural hazards, which require the reasonably achievable improvements to be implemented, which would ensure the plant could withstand less frequent initiating events (internal and external) and their combinations.

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

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

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

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

- Installation of containment filtered venting system and passive autocatalytic recombiners (PARs);
- Installation of additional pumps for injecting (un)borated water into steam generators and reactor, as well as indirectly also to the containment spray system;
- Installation of additional residual heat removal pump and dedicated heat exchangers;
- Installation of additional pressurizer relieve valves qualified for severe accidents conditions;
- 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;
- Establishment of new technical support facility with provisions for long term habitability even in case of severe accidents and enhancement of existing operational support centre.

For additional information on the Krško NPP's SUP and other post-Fukushima improvements see Appendix II, A. Challenges (i) and B. Planned Improvements for Nuclear Safety (ii) of this report.

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

In winter 2014 freezing rain hit almost the entire country, which caused large damage to the electrical network (around 250,000 people were left with no power). The Krško NPP survived the event without a problem (the freezing rain was less severe in eastern part of the country, where the NPP is located). The SNSA requested the plant to perform a detailed freezing rain survivability

analysis taking into account even more severe scenario of the event (loss of offsite power for one week, no connection to the dedicated gas power plant Brestanica, ventilation openings blocked due to glaze formation on walls (15-20 cm thick), load on roofs more than 150 kg/m2, etc.). The results showed the plant can endure even such scenario with just minor improvements of its procedures.

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

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

18.2 Incorporation of Proven Technology

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

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

18.3 Design for Reliable, Stable and Manageable Operation

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

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

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

The Krško NPP has in place plant-specific EOPs as well as SAMGs, which are regularly updated and verified with the use at training and simulated exercises on their plant-specific full-scope simulator. Within the implementation of training and exercises the plant also observes the impacts of the human factors, which are then incorporated into the changes of procedures and controls of the plant if necessary.

The main control room (MCR) of the Krško NPP has in place systems which ensure adequate working conditions for the operators, e.g. main control room air conditioning, MCR charcoal

cleanup system, and chilled water generating and distributing system. During accident conditions the MCR is automatically isolated. The MCR cleanup system is started to keep the area habitable. The MCR air conditioning and charcoal cleanup systems are redundant, safety related, seismically qualified system energized from independent safety power buses.

In addition, as already mentioned in Chapter 18.1, the Krško NPP plans to build the emergency control room, which will have its own independent power supply system, independent instrumentation and controls qualified for severe accidents conditions. It. will be located in a physically separated bunkered building, protected against design extension conditions (higher seismic loads, extended flood protection, large aircraft crashes and fires). For more details on the emergency control room and other post-Fukushima improvements see Appendix II, A. Challenges (i) and B. Planned Improvements for Nuclear Safety (ii) of this report.

Each modification of safety related equipment (including MCR) must be reviewed and approved by the SNSA. The SNSA is also regularly informed of all changes in the EOPs and SAMGs. The SNSA inspection and other technical staff regularly oversee the regular operation, changes implemented in the plant. The SNSA staff takes part in the exercises and performs licensing the reactor operators.

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

ARTICLE 19. OPERATION

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

(I) The initial authorisation to operate a nuclear installation is based upon an appropriate safety analysis and a commissioning program demonstrating that the installation, as constructed, is consistent with design and safety requirements;

(II) operational limits and conditions derived from the safety analysis, tests and operational experience are defined and revised as necessary for identifying safe boundaries for operation;

(III) operation, maintenance, inspection and testing of a nuclear installation are conducted in accordance with approved procedures;

(IV) procedures are established for responding to anticipated operational occurrences and to accidents;

(V) necessary engineering and technical support in all safety-related fields is available throughout the lifetime of a nuclear installation;

(VI) incidents significant to safety are reported in a timely manner by the holder of the relevant license to the regulatory body;

(VII) programs to collect and analyse operating experience are established, the results obtained and the conclusions drawn are acted upon and that existing mechanisms are used to share important experience with international bodies and with other operating organisations and regulatory bodies;

(VIII) the generation of radioactive waste resulting from the operation of a nuclear installation is kept to the minimum practicable for the process concerned, both in activity and in volume, and any necessary treatment and storage of spent fuel and waste directly related to the operation and on the same site as that of the nuclear installation take into consideration conditioning and disposal.

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

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

19.2 Operational Limits and Conditions

In accordance with the 2002 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 (Official Gazette No.92/09) and The Rules on operational safety of radiation and nuclear facilities (Official Gazette No.87/11) 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 11 changes of Technical Specifications during the last 3 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 25 of Rules on radiation and nuclear safety factors (Official Gazette No.92/09), the documentation submitted for an application for an operating license shall also contain a list of prepared operating procedures and rules together with the plant start-up report, the QA program report, the technical specifications, the Safety Analysis Report and maintenance and testing instructions.

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

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

In the field of maintenance, the Krško NPP has developed the following programs, such as:

Preventive Maintenance (separate programs for each specific set of equipment), Predictive Maintenance, Implementation, Monitoring and Evaluation of Preventive Maintenance, Corrective Action, Surface Protection Maintenance, and Technical Surveillance of Civil Structures and Other Structures.

In the field of monitoring, inspection and testing, there are the following programs and administrative procedures, such as:

Plant Performance Monitoring, Reliability of Operation and Ageing of the Equipment, System Health and Maintenance Rule, Steam Generator, Emergency Diesel Generator Reliability, Corrosion-Erosion, Fuel Integrity, Control of Civil Structures and Other Constructions, In-service Inspection – the 4th Inspection Interval; Containment Inspection Program; Snubber Program; Boric Acid Inspection Program; ASME Section XI Pump and Valve In-service Testing

Documents; Containment Leakage Rate Testing Program; Motor Operated Valves (MOV) Program; Pressure Vessel Inspection Program; and Fuel Integrity Program.

Activities of 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. Partially implemented programs were modified for full implementation. 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. Plant specific symptom based EOPs and SAMGs have been developed based on Westinghouse generic procedures.

19.5 Engineering and Technical Support

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

Other engineering and technical support is assured through outsourcing at research and engineering organisations in Slovenia or abroad. However, major projects require an open bidding process. The Ministry of Education, Science and Sport financially supports 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

Article 87 of the 2002 Act (reporting on the operation of facility) stipulates that operator must 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 108 of the 2002 Act the license holder is required to report to the SNSA and to other competent authorities about the accidental condition as soon as possible.

The Rules JV9 on operational safety of radiation and nuclear facilities (Official Gazette No.87/11) prescribes detailed requirements for reporting to and notifying the regulatory body by the operator of a nuclear facility. The regulation distinguishes between routine reporting and notification, and reporting in the case of an abnormal event. It specifies the time period for each report. Reporting criteria are also given and abnormal events are specified. In the period from 2013 to 2016, the Krško NPP reported 13 events and 2 of them caused an unplanned shutdown, which are described below. These automatic shutdowns were "reactor trip due to sudden main steam line valve closure" and "reactor trip due to a spurious actuation reactor protection signal over power delta temperature". None of these events jeopardized nuclear and radiation safety. All events were reviewed and analysed by the SNSA.

Reactor trip due to sudden main steam line valve closure (2013)

On 25 February 2013 an automatic shutdown of the Krško Nuclear Power Plant occurred. The sequence of events started with sudden closure of the main steam isolation valve (MSIV) on steam line No. 2. Due to the MSIV closure the steam flow increased in steam line No. 1, which resulted in a pressure drop actuating the safety injection system (SI), causing the reactor trip. During the event all safety systems functioned as intended.

The event was analysed and it was concluded that an MSIV stem break was the direct cause of the event. The root causes were deficiencies in the design of the MSIV (construction, material, etc.), unimplemented valve modification, and deficient surveillance and testing procedures (manufacturer instructions). There was also inadequate attention paid to operating experience, because a similar event occurred in 1997. Furthermore, vibrations due to turbulence in the main steam line and MSIV were a contributing cause.

The broken stem was replaced with a new one. In the 2013 outage a new modification of the MSIV was implemented. The modification should resolve the design problems in the main steam line and MSIV.

Reactor trip due to spurious actuation reactor protection signal over power delta temperature (OPΔT) (2013)

On 23 November 2013, just a few days after the end of the refuelling outage, an automatic shutdown of the Krško nuclear power plant occurred. A reactor trip occurred due to spurious actuation of the OPΔT (Over Power Delta Temperature) reactor protection signal. During the event all safety systems performed their functions as designed.

An analysis of the event identified electromagnetic (EM) interference as the trigger for the actuation of the OPΔT signal. The EM interference was caused by switching the auxiliary relays of the reactor makeup water system, which dilutes the primary system during plant start-up. This EM interference was reflected as a drop in the voltage measurement on some reactor coolant system (RCS) temperature measuring circuit boards (performing conversion of resistance from the resistance temperature detectors (RTDs) to voltage) resulting in spurious actuation of the OPΔT reactor protection signal and consequently in a reactor trip.

A detailed analysis of the event showed that a modification performed on the RCS temperature measuring circuit boards during the regular outage introduced a small difference in the processing of the hot and cold leg temperatures of the RCS, which caused the EM interference to be reflected in the output of the circuit boards. The analysis concluded that spurious actuation of the OPΔT reactor protection signal was the direct cause of the event. The root causes of the event were inadequate preparation and implementation of the "RTD Bypass Elimination" modification (i.e. possible electromagnetic interference was not considered).

The problem with the EM interference was temporarily solved by the installation of AC suppressors on auxiliary relays. The Krško power plant has also implemented additional long-term improvements ensuring a more robust RTD measuring system.

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. There is no formal committee established to evaluate the event rating. 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 60 of the 2002 Act (the use of experiences gained during operational events), the operator of a nuclear facility must ensure that the programs for recording and analyzing operational experience at the nuclear facility are implemented.

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

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. The plant is considering aggregating a large number of cause categories into smaller categories to obtain a more meaningful trending analysis, facilitate the preparation of management reports, and create a selection of appropriate action plans covering an adequate scope. 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 analyzed through internal SNSA investigation and the results are compared to the facility's corrective actions. If necessary, additional actions are required.

An 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.

Off-site event reports safety screening is part of the Krško NPP operating experience assessment program. Off-site event reports are provided by the SNSA, IAEA, INPO, NRC, WANO, NUMEX, Westinghouse and PWROG. The Krško NPP shares all on-site events for which investigation was performed within INPO/WANO Newsgroup and NUMEX. These events are significant occurrences which affect plant safety (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, management needs. and

personnel or general public), less significant SSC (systems, structures, components) or human deficiencies which affect plant safety or reliability (e.g. deficiencies in design, analysis, operation, maintenance, procedures or training, unplanned radiation exposure or major equipment damage) and minor conditions which affect the quality of process (failures on non-safety SSC, minor human issues, non-radiological environmental events, and isolated seismic deficiencies on components). The technical director confirms the suitability of reported information which is prepared according to the WANO operating experience programme guideline.

The SNSA has 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 analyzed for their applicability to nuclear safety in Slovenia. The results of such screening and analyses are communicated internationally either through formal channels like the Incident Reporting System (IRS) or at different international meetings and conferences. In the period from 2013 to 2016 124 potentially interesting events were evaluated in detail for applicability in the Krško NPP.

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 annual reports. The plant performance monitoring program comprises also the international performance indicators defined by the World Association of Nuclear Operators (WANO), which are regularly reported to WANO.

Besides the Krško NPP set of indicators, the SNSA developed an internal set of indicators. The SNSA monitors a set of 36 safety and performance indicators, which help to recognise in a very early stage eventual problems, which can influence nuclear safety. 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 yearly reporting, some SNSA indicators are evaluated through monthly or quarterly periods. In the last 3 years, the indicators did not show significant negative trends. Some warnings or alarms have been associated with corrective work orders, programs and procedures updating and mitigating systems performance indicator.

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 location.

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

Numerous program improvements, design changes and work practice improvements have been pursued at the plant with a purpose to decrease the generation rate of radioactive wastes of different types (e.g. super-compaction campaigns, introduction of In-Drum Drying System). With the introduction of 18-month fuel cycle the generation of radioactive waste is 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 2015 amounted to 2,264 m^3. The total gamma and alpha activity of the stored waste were 1.78E+13 Bq and 2.55E+10 Bq, respectively. In 2012 and 2015, around 50 tons of secondary waste in form of ingots was returned from Sweden after melting of metal radioactive waste and 600 drums of combustible waste were sent to Sweden for incineration.

As a consequence of the Fukushima accident, stress tests were performed and an action plan on how to improve the operational safety of the Krško NPP was prepared. In the light of new information, new knowledge regarding spent fuel management in general, and the SNSA decision issued in 2011 regarding the prevention of severe accidents and mitigation of their consequences, the Krško NPP assessed the options to reduce risk associated with spent fuel, taking into account the change in the long-term strategy for spent fuel. Wet spent fuel storage was assessed and compared to dry storage and a reprocessing (recycling) option was reviewed. Since the current wet storage capacity is not adequate, from both safety and operational capacity points of view for the plant's commercial operational lifetime until 2023. In the light of the possible lifetime extension until 2043, a dry storage option was proposed. To ensure uninterrupted operation and sufficient storage capacity in the spent fuel pool, a dry cask storage facility should be operational in 2018 (see also subchapter A. Challenges (iii) in Appendix II).

The Resolution on the 2006–2015 National Programme for Managing Radioactive Waste and Spent Nuclear Fuel was revised to take into account 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). The revised Resolution for the period 2016-2025 was adopted by the Slovenian Parliament in April 2016.

In 2014, the Krško NPP began to design a waste manipulation building. With the construction of the new facility, the plant will be 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 is informed 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 is 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.

A Decommissioning Programme was prepared and needs to be revised at least every five years. The purpose of the programme was to estimate the costs of decommissioning and to determine the corresponding amount of regular levy liable for payment for every kWh of electric power delivered from the NPP. The programme was confirmed in March 2005 by the Interstate (Slovenian-Croatian) Commission. The preparation of the next revision of the Programme started in 2008, which granted the mandate for the preparation of the document to: the Agency for Radioactive Waste Management (ARAO) from Slovenia and the Agency for Special Waste (APO) from Croatia. The first version of the document was elaborated by June 2010 and the second version by February 2011. Since, the interstate commission has not met since May 2010, the indicated documents have not been discussed nor endorsed by the interstate commission for monitoring the implementation of the Agreement. The interstate commission met in July 2015 and examined the status of the Programme and decided to stop all activities for the preparation of this version of the document. The interstate commission also addressed the need for creating a new version of the Programme by the organisations, responsible for radioactive waste management, in accordance with the Agreement. The preparation of terms of reference for new Programme is ongoing.

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

APPENDICES

APPENDIX I: LIST OF LEGAL DOCUMENTS IN FORCE IN SLOVENIA (AS OF 30 APRIL 2016)

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),
- Act on Protection against Ionizing Radiation and Nuclear Safety – ZVISJV (Off. Gaz. RS, 67/2002, 24/2003, 50/2003, 46/2004, 102/2004, 60/2011 and 74/2015),

A.2 Governmental decrees and ministerial regulations issued on the basis of 2002 Act (Act on Protection against Ionizing Radiation and Nuclear Safety – ZVISJV (Off. Gaz. RS, 67/2002, 24/2003, 50/2003, 46/2004, 102/2004, 60/2011 and 74/15)

- Decree on activities involving radiation - UV1 (Off. Gaz. RS,48/2004, 9/2006),
- Decree on dose limits, radioactive contamination and intervention levels - UV2 (Off.Gaz.RS,49/2004),
- 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, 36/2004, 103/2006 and 92/2014),
- Decree on safeguarding of nuclear materials - UV 6 (Off. Gaz. RS, 34/2008),
- 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, 92/2014, 46/2015),
- Decree on checking the radioactivity for shipments of metal scrap - UV11 (Off. Gaz. RS, 84/2007)
- Rules on the expert council on radiation and nuclear safety - JV1 (Off. Gaz. RS, 35/2003),
- Rules on the use of radiation sources and on activities involving radiation - JV/SV2 (Off. Gaz. RS, 27/2006),
- Rules on authorised experts on radiation and nuclear safety - JV3 (Off. Gaz. RS, 51/2006).
- Rules on providing qualification for workers in radiation and nuclear facilities – JV4 (Off. Gaz. RS, 32/2011)
- Rules on radiation and nuclear safety factors - JV5 (Off. Gaz. RS, 92/2009, 9/2010)
- Rules on radioactive waste and spent fuel management - JV7 (Off. Gaz. RS, 49/2006),
- Rules on operational safety of radiation and nuclear facilities - JV 9 (Off. Gaz. RS, 85/2009, 9/2010 and 87/2011)
- Rules on the monitoring of radioactivity - JV10 (Off. Gaz. RS, 20/2007, 97/2009),
- Rules on transboundary shipments of radioactive waste and spent fuel - JV11 (Off. Gaz. RS, 22/2009),
- Rules on the transboundary shipment of nuclear and radioactive substances - JV 12 (Off. Gaz. RS, 75/2008 and 41/2014)

- 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, 62/2003),
- Rules on the requirements of using ionising radiation sources in healthcare - SV3 (Off. Gaz. RS, 111/2003 and 75/2015),
- Rules on the method of keeping records of personal doses due to exposure to ionizing radiation - SV4 (Off. Gaz. RS,33/2004),
- Rules on the requirements and methodology of dose assessment for the radiation protection of the population and exposed workers- SV5 (Off. Gaz. RS, 115/2003),
- Rules on health surveillance of exposed workers- SV6 (Off. Gaz. RS, 2/2004),
- Rules on approving of experts performing professional tasks in the field of ionising radiation - SV7 (Off. Gaz. RS,18/2004),
- Rules on the obligations of the person carrying out a radiation practice and person possessing an ionizing radiation source - SV8 (Off. Gaz. RS, 13/2004),
- Rules on the Use of Potassium Iodide – SV 9 (Off. Gaz. RS, 59/2010)
- Rules on the Conditions to be met by Primary Health Care Centres for Breast – SV 10 (Off. Gaz. RS, 110/2004),
- Rules on Monitoring Radioactivity in Drinking Water (Off. Gaz. RS, 74/2015),
- Rules on physical protection of nuclear facilities, nuclear and radioactive materials and transport of nuclear materials (Off. Gaz. RS, 17/2013),
- Rules on establishing a basic training program and periodic in-service training of security personnel performing physical protection of nuclear facilities, nuclear or radioactive materials, and transport of nuclear materials (Off. Gaz. RS, 12/2013).

In addition to the above mentioned decrees/rules the 2002 Act was used as a basis for the adoption of the:

- Programme on Systematic Monitoring of Working and Residential Environment and Raising Awareness about Measures to Reduce Public Exposure Due to the Presence of Natural Radiation Sources (Off. Gaz. RS, 17/2006).

A.3 Other legislation

Third Party Nuclear Liability

- Act on Third Party Liability for Nuclear Damage (Off. Gaz. SFRY, 22/1978 and 34/1979);
- Act on Insurance of Liability for Nuclear Damage (Off. Gaz. SRS, 12/1980),
- Decree on Establishment of the Amount of Limited Operator's Liability for Nuclear Damage and on Establishment of the Amount of Insurance for Liability for Nuclear Damage (Off. Gaz. RS, 110/2001)
- 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).

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 Establishment of a Public Agency for Radwaste Management (Off. Gaz. RS, 45/96, 32/99, 38/2001),
- Decree on Mode and Conditions of Discharging the Public Service on Radioactive Waste Management (Off. Gaz. RS, 32/1999).

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 Contents and Writing of the Civil Protection and Disaster Relief Plans (Off. Gaz. RS, 3/2002 and subsequent amendments).

Administrative

- State Administration Act (Off. Gaz. RS, 113/2005 – Official Consolidated Text and subsequent modifications),
- Inspection Act (Off. Gaz. RS, 43/2007 - Official Consolidated Text and 40/2014),
- Act on General Administrative Procedure (Off. Gaz. RS, 24/2006 - Official Consolidated Text and subsequent modifications),
- Act on Administrative Fees (Off. Gaz. RS, 106/2010 - Official Consolidated Text and subsequent amendments),
- Decree on Administrative Authorities within Ministries (Off. Gaz. RS, 58/2003 and subsequent amendments).

Energy

- Energy Act (Off. Gaz. RS, 27/2007 - Official Consolidated Text and subsequent modifications);
- Decree on the Transformation of the NEK p.o. into the Public Company Krško NPP, d.o.o. (Off. Gaz. RS, 54/1998 and subsequent amendments)

Environment

- Act on Environmental Protection (Off. Gaz. RS, 41/2004 and subsequent amendments);
- Act on Spatial Planning (Off. Gaz. RS, 110/2002 and subsequent amendments);

- Construction Act (Off. Gaz. RS, 110/2002 and subsequent amendments);
- Decree on Categories of Activities for Which the Environmental Impact Assessment is Mandatory (Off. Gaz. RS, 78/2006 and subsequent amendments);
- Decree on the Content of Report on the Effects of Intended Activity into the Environment and its Method of Drawing up (Off. Gaz. RS, 36/2009).

General

- Penal Code (Off. Gaz. RS, 63/1994 and subsequent amendments);
- Criminal Procedure Act (Off. Gaz. RS, 63/1994 and subsequent amendments),
- Act on Minor Offences (Off. Gaz. RS, 7/2003 and subsequent amendments);
- Maritime Code (Off. Gaz. RS, 26/2001 and subsequent amendments);
- Act on Transport of Dangerous Goods (Off. Gaz. RS,79/1999 and subsequent amendments);
- Act on Export of Dual Use Goods (Off. Gaz. RS, 37/2004 and 8/2010);
- Decree on the Control of Export of Dual Use Goods (Off. Gaz. RS, 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 of 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).

APPENDIX II: CHALLENGES AND PLANNED MEASURES TO IMPROVE SAFETY

Under this chapter we tried to address the challenges and planned actions to improve safety which were listed in the rapporteur's report for Slovenia in the end of the last (5th) CNS review meeting.

A. Challenges

i. Post-Fukushima National Action Plan (NAcP)

Post-Fukushima actions in Slovenia started immediately after the accident. While the SNSA cooperated in the preparation and issuance of the ENSREG Stress Test specifications, the Krško NPP implemented an analysis to identify short-term improvements. The result was the procurement of additional portable equipment, e.g. AC diesel generators, pumps and compressors, implementation of quick connection points for this equipment, as well as amendments to the emergency operating procedures and severe management accident guidelines enabling the use of this new equipment to mitigate consequences in case of a severe accident. For more information on these improvements see Part IV, Chapter 1.a of the Slovenian National Action Plan, available at:

http://www.ursjv.gov.si/fileadmin/ujv.gov.si/pageuploads/si/Porocila/NacionalnaPorocila/Slovenian_National_Post_Fukushima_Action_Plan_01.pdf

The operator applied a request to license the above mentioned modifications at the end of May 2011, while modifications were mostly implemented by the end of June 2011 and were also considered in the Stress Test report submitted to the European Commission, available at:

http://www.ursjv.gov.si/fileadmin/ujv.gov.si/pageuploads/si/Novice/Slovenian_Stress_Test_Final_Report.pdf

In the meantime, the SNSA also issued a decision requiring from the plant to perform an extraordinary safety review in line with the ENSREG Stress Test specifications. In the process of Stress Tests additional short-term actions were identified and were completely implemented by the end of 2011. For more information regarding the implementation of Slovenian Stress Test action plan see Part IV, Chapter 1.b of the Slovenian National Action Plan.

The process of the Stress Tests was implemented and completed by the end of March 2012. At that time also the first recommendation came up to be followed by regulator in its future activities. Namely, the Slovenian ENSREG Peer Review Country Report identified a single recommendation, i.e. "It is recommended that the regulator should consider requesting to update the seismic design basis for future design modifications and consequently the associated PSA model."

The Slovenian ENSREG Peer Review Country Report is available at:

http://www.ursjv.gov.si/fileadmin/ujv.gov.si/pageuploads/si/Novice/CountryReportSIFinal.pdf

In September 2011, the SNSA issued the second decision requiring from the plant 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. This program of upgrades was already envisaged in the Slovenian legislation from 2009. The plant is required to upgrade its systems, structures and components to enable coping with severe accidents after the plant lifetime is extended, but due to the Fukushima accident the SNSA ordered the plant to implement these measures in advance.

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, in 2013 the Krško NPP applied for the extension of the deadline for the implementation of the SUP. The reasons were the magnitude of the project, complexity of design documentation, delivery times of some of the main components, as well as inclusion of the Krško NPP into the Public Procurement in Water Management, Energy, Transport and Postal Services Area Act, which further complicated and delayed the bidding process for the project. At the end the bidding failed and it had to be repeated. The SNSA approved the extension of the deadline to the end of 2018.

Moreover, in the beginning of 2014 the Krško NPP notified the SNSA that the implementation of the SUP by the end of 2018 is going to be challenged due to financial constraints. Namely, the owners of the Krško NPP became unwilling to finance the SUP (in particular the larger part of it, the so-called "BB2 project") due to doubts that the plant would, after the implementation of the project, still continue to provide electricity at a competitive price. The owners ordered the financial viability study, which has shown that the continuation of the Krško NPP operation is the best economical solution for electrical energy production in Slovenia and Croatia even with the implementation of the BB2 project. Thus the decision was taken to continue with SUP implementation.

However, due to the delay of the implementation of the BB2 project the Krško NPP again applied for the extension of the deadline for the third SUP phase (the BB2 project), and also for some conceptual changes of the SUP. The major change is the revision of alternative ultimate heat sink, which will be assured through the use of steam generators fed by additional dedicated sources of water capable of replenishing water from the underground wells. This way the cooling of the reactor will be assured for at least 30 days even with the loss of existing Ultimate Heat Sink. The SNSA reviewed the revision of the SUP, as well as supporting analyses, and approved the new SUP program including the extension of the third SUP phase by the end of 2021.

For the time being the SUP is divided into three phases.

Phase 1 was implemented in 2013:

- Replacement of active hydrogen recombiners with passive ones (PARs); also capable of managing hydrogen from severe accidents;
- Installation of passive containment filtered venting system.

Phase 2 is underway and is to be implemented by the end of 2018:

- Flood protection of the nuclear island;
- Operation support center reconstruction;
- Installation of pressurizer power operated valve (PORV) bypass;
- Spent fuel pool (SFP) alternative cooling;
- Alternate cooling of reactor coolant system (RCS) and containment;
- Installation of emergency control room (ECR);
- Upgrade of bunkered building 1 (BB1) electrical power supply;
- Emergency Control Room / Technical support center ventilation and habitability system;

- Replacement and upgrade of critical instrumentation.

Phase 3 is planned to be completed by the end of 2021:

- Erection of dry spent fuel storage facility and movement of 592 fuel elements to the dry storage in 2020..
- BB2 - bunkered building with additional sources of borated and unborated water with injection systems for reactor cooling system / containment and steam generators capable of assuring reactor cooling for at least 30 days.

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

For more details regarding the SUP see Part IV, Chapter 2 and 5.2.1 of the Update of the Slovenian National Action Plan, available at:

http://www.ursjv.gov.si/fileadmin/ujv.gov.si/pageuploads/Info_sredisce/Tecaji_konference_seminarji/tecaji_MAAE/SLO_NAcP-2015.pdf

For the preparation of the long-term action plan, the SNSA reviewed several reports with post-Fukushima recommendations and compared them with measures already implemented in the Krško NPP or planned within the SUP, as well as other measures incorporated in the Slovenian nuclear infrastructure. The reports reviewed include:

- ENSREG's Peer Review Report,
- US Nuclear Regulatory Commission's (US NRC) "Recommendations for Enhancing Reactor Safety in the 21st Century", The Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident,
- US NRC's "Recommended Actions to be Taken Without Delay from the Near-Term Task Force Report,
- US NRC's "Prioritization of Recommended Actions to be Taken in Response to Fukushima Lessons Learned,
- 2nd Extraordinary Meeting of the Contracting Parties to the Convention of Nuclear Safety, topic and summary reports (CNS EOM),
- ENSREG Compilation of recommendations and suggestions,
- IAEA's Action Plan on Nuclear Safety,
- Japanese "The Official Report of the Fukushima Nuclear Accident Independent Investigation Commission",
- "Das KKW Krško in Licht der Nuklear-Katastrophe von Fukushima" (Eng.: The Krško NPP in light of the nuclear disaster in Fukushima) prepared by the University of Natural Resources and Life Sciences in Vienna (Department of Water, Atmosphere and Environment; Institute of Safety and Risk Sciences), and

– ASME's report "Forging a New Nuclear Safety Construct".

These reviews identified 11 additional actions that could further enhance nuclear safety in Slovenia, either indirectly by changing the legislation, hosting additional peer reviews, performing additional studies, or directly by improving the NPP and regulatory body processes, enhancing of emergency preparedness and nuclear safety infrastructure or improving the safety culture of both the operator and the regulatory body.

These 11 actions were combined with planned actions from the Krško NPP's SUP and together they form the Slovenian National Action Plan, which was updated in December 2014, to present the status of implemented improvements.

The implementation of the Action Plan is completely followed by the SNSA. Most of the actions have been or will be performed by the SNSA itself in scope of legislation changes, issuing decisions or planned topical inspections. Actions concerning changing or enhancing nuclear safety infrastructure require involvement of other stakeholders, including the operator, utility, technical support organizations and others.

For additional information on all implemented and planned activities see The Slovenian National Action Plan, which was published in December 2012 and its update from 2014 in the SNSA's web page:

http://www.ursjv.gov.si/en/info/porocila/national_reports/

The National Action Plan and its update were peer reviewed within the EU countries (plus Switzerland and Ukraine) in April 2013 and April 2015 respectively.

ii. Knowledge and Competence Management

SNSA, even under critical financial conditions and with the budget, reduced due to austerity measures, continues to pay attention to education and training with the aim of monitoring and developing the careers of public servants and the creation of conditions for improvement of professional skills of all employees.

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 Center 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 type of trainings are particularly suitable in areas where the education or training program are tailored to the demands and needs of the client (of the SNSA). Most of the time it is carried out in the premises of the SNSA, which also allows the participation of a large number of participants. The SNSA carried out over 100 different training events from 2013, most of them in the area of emergency preparedness. It is estimated that for all forms of training and education approximately 4,000 teaching hours have been carried out since 2013.

SNSA continued with the introduction of a systematic approach to training and optimization of the SNSA's internal organization based on the recommendations of the International Atomic Energy Agency. A set of hundreds of detailed SNSA employees' competencies has been narrowed

down to 196 broad competencies that were included in the questionnaire, which was first applied in the implementation of the annual career planning interviews in 2014.

The economic crisis that hit Slovenia in recent years has had a strong influence on the implementation of research activities. Already limited resources have decreased and substantially reduced the funds for research and development in the field of nuclear safety.

In 2014, the SNSA organized an all-day working meeting on the challenges of nuclear safety. The meeting was attended by about 60 experts from all prominent Slovenian organizations dealing with nuclear safety. At the meeting colleagues from the Jožef Stefan Institute, the Institute for Metal Constructions, the Faculty of Electrical Engineering, the Institute of Occupational Health and the Institute of Civil Engineering presented their research projects relating to nuclear energy. The SNSA presented its strategy regarding the research and development needed to maintain sufficient capacity for the provision of nuclear and radiation safety in Slovenia. The focal point of the meeting was to open a debate on how to ensure stable financing of research and development in the nuclear sector, thereby preventing migration of nuclear safety experts to other areas and abroad. Participants agreed that it is necessary to ensure stable financing for the institutions working in the area of nuclear safety, which would enable maintaining critical mass of experts. It was clearly pointed out that research in nuclear safety cannot meet high standards of scientific excellence, which means in other words, that "citation index" is too low and nuclear safety projects can simply not compete in open bidding process with other areas. One needs to make sure that nuclear safety would get the share it deserves.

The SNSA has investigated the possibility to establish the special fund for financing appropriate research and development in the area of nuclear safety. During the collection of date to support such project it became evident that yearly the nuclear industry and the state budget are spending for about 70 man/year of work to the research, development and engineering organisations and companies in Slovenia. It was agreed that the clear national research and development (R&D) strategy for future activities of that kind would be very beneficial. The SNSA has therefore in spring 2016 oriented its efforts towards expansion of its own R&D strategy to the national one covering needs of all interested parties.

iii. Spent Fuel Management Strategy – Dry Storage

The Krško NPP Spent Fuel Pool (SFP) has 1709 positions in the racks for storing spent fuel assemblies (FA). Some positions are administratively prohibited or physically inaccessible for actual use. As of December 2015, the Krško NPP filled out 1154 positions in the SFP and during each outage, which takes place in 18-month intervals (fuel cycles), approximately 56 FAs are additionally added to the pool. Considering the Krško NPP extended plant life (until 2043) a total of 2282 spent FAs are expected to be stored inside the SFP. Due to operation and management restrictions applied during the past years the Krško NPP will fill out the available SFP positions in 2019. At that time Krško NPP will require additional storage capabilities to store spent FAs.

Based on SNSA decision and Fukushima lessons learned the Krško NPP decided to speed up the construction of spent fuel dry storage (instead in 2023 the plans for spent fuel dry storage were shifted to the period 2018-2019). In 2012 the decision was made to start a new modification to increase the spent fuel storage capabilities.

According to the SNSA requirements, the new solution for spent fuel storage shall be such that the nuclear safety is enhanced as regards the passive decay heat removal, fission source term reduction and criticality of the system. Through the design of new Spent Fuel Dry Storage (SFDS)

and due to the relocation of spent FAs from SFP to SFDS the requirements to enhance the nuclear safety will be achieved.

SFDS system is a technical solution which has been used at many plants or utilities for a number of years. Many plants/utilities made a decision to use dry storage system as this is much safer and reliable as a passive system compared to SFP.

SFDS will be constructed within NPP Krško yard with capacity of 2,600 spent FAs. Additional capacity (difference between 2600-2282 FA) is considered for potential fuel management or operating changes in the future and for potential interim storage of produced High Level Waste (HLW).

As the existing SFP will be in operation all the time during the plant operation and minimum 5 years after the plant shut down, the Krško NPP can temporarily store FAs from the reactor for at least 5 years in the pool before they are transferred to the SFDS and later on transfer into SFDS can take place in several campaigns. For that purpose, four campaigns with transportation of spent fuel elements from SFP to SFDS are planned in year 2020, 2028, 2038 and 2048:

At the end of 2014, the Krško NPP prepared the conceptual design package (CDP) for SFDS and the document "Technical Specification – Spent Fuel Dry Storage Construction" for the purpose of starting a bidding process. While several different technical options are discussed in this document, no single decision has been selected by the Krško NPP. However, multipurpose canister system stored in vertical position or in horizontal position are two preferred options. The Krško NPP invited four companies to place the bid. In 2015 the Slovene-Croatian commission, responsible for the Krško NPP, gave consent for the construction of dry storage of spent nuclear fuel on the site. The Resolution on the national program for radioactive waste and spent fuel management for the period 2016-2025, adopted in April 2016, envisages dry storage of spent fuel. Construction of dry storage of spent nuclear should be finished by 2019. Transfer of 592 spent nuclear fuel elements from the pool into dry storage is planned for 2020.

B. Planned Measures to Improve Safety

i. Finalization of PSR1 and Implementation of PSR2

The Krško NPP completed its first Periodic Safety Review (PSR1) action plan with finalizing the following actions: PSA at shutdown conditions, reactor operating modes and review of civil structure adequacy of containment buckling capacity. The reason for delay (the PSR1 was finalized in end of 2015) was lack of standardized analysis methodology for fulfillment of tasks.

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. The additional diesel generator greatly increases the Krško NPP safety in case of a seismic event and also other events with loss of offsite power. Around 35% reduction of total CDF was achieved. After raising the flood protection dikes upstream of the Krško NPP, the plant cannot become surrounded by water even during the probable maximum flood.

The Second Periodic Safety Review (PSR2) is an extensive systematic review of all operational and safety aspects of the NPP. By the Law on Ionising Radiation Protection and Nuclear Safety, the PSR is a condition for continuation of the NPP operation, which shall be conducted every ten years.

At the beginning of 2014 the SNSA reviewed all the PSR2 topical reports, carried out by the Krško NPP from 2010 to 2013. The final PSR report concludes that there are no major irregularities, that

the plant is safe, as it was planned, and would operate safely. Identified are also areas in which improvements can be introduced, in particular the procedures, control and qualification, aging of materials, planning for the case of emergency, improving the design bases and in the field of plant safety analyzes (deterministic and probabilistic analyzes and analyzes of potential threats and hazards). The report contains 397 recommendations for improving the situation in the power plant, of which 20 have already been made, 225 of them goes into implementation, 152 of them will be re-evaluated in the context of the third periodic safety review, which is to be finished by 2023. The implementation plan contains a plan of activities and deadlines for implementation of individual recommendations.

At the end of 2015, the NPP reported on the progress of implementation of the implementation plan changes and improvements. About 55% of planned actions have been completed. The goal is to implement all actions by May 2019.

ii. Implementation of Safety Upgrade Programme and the National Action Plan (NAcP)

As described in in this chapter under A. Challenges (i) – implementation of the Safety Upgrade Programme is closely related to post-Fukushima safety related activities, and also to the Updated Slovenian post-Fukushima Action Plan. The post-Fukushima improvements have been and are still being implemented in several layers:

- Accelerated B.5.b requirements' actions (post 9/11 requirements endorsed by the US NRC) **were completed in June 2011**. These improvements include acquirement of tens of pieces of mobile equipment (diesel generators, pumps, air compressors, transformers) and installation of quick connection points.
- Implementation of the Slovenian Stress Test action plan **was completed in 2011**. In the process of EU Stress Tests additional short-term actions were identified, mainly acquirement of some additional larger pieces of mobile equipment (2 MW diesel generator, high pressure mobile pumps, etc.).
- The Krško NPP Safety Upgrade Program (SUP) is under way and shall be fully **completed by 2021**. The SUP comprises of a set of large plant modifications that will enable it to withstand more severe events than it was designed for (design extension conditions).
- Other improvements from the Slovenian post-Fukushima Action Plan (NAcP) are under way and shall be **completed by 2021**. The NAcP comprises, besides the SUP (see previous bullet), of additional 11 areas of improvements, such as legislation changes, enhancing emergency preparedness, performing special inspections, additional studies, etc.

The SUP is the core of the Slovenian NAcP. It comprises 10 areas of hardware improvements. It is divided into three phases, of which the phase I has been completed in 2013, and currently the phase II is under way with some of its modifications already been completed, while the rest will be completed by the end of 2018. The third phase is in the design stage. It will be completed by the end of 2021.

Besides the SUP, the NAcP comprises additional 11 actions (and these actions have additional sub-actions). The implementation of these actions started in 2012. Some of them have been completed, others are still under way. All of the actions of the NAcP, together with the SUP, and their status are described in the Table II.1 below.

Table II.1: The status of the Slovenian NAcP (the green colour means "implemented")

No.	Future action / activity	Area	Status	Deadline	Level
1	SUP SUP comprises of a set of modifications/ improvements (see numbers 1.1 to 1.10) that will be implemented in steps until the end of 2021.	SUP	in progress	2021	site
1.1	Safety upgrade of AC power supply	SUP, Phase II	in progress	2018	site
1.2	New pump for supplying SGs; in a bunkered building, with a dedicated water supply	SUP, Phase III	in progress	2021	site
1.3	Installation of alternative ultimate heat sink – revised into alternate long-term heat sink through using SGs and underground well water	SUP, Phase III	in progress	2021	site
1.4	Additional pump for injecting into the reactor primary system, in a bunkered building, with a dedicated (borated) water supply	SUP, Phase III	in progress	2021	site
1.5	Containment integrity safety upgrades including containment filtered vent systems and PARs	SUP, Phase I	completed	2013	site
1.6	Establishment of emergency control room	SUP, Phase II	in progress	2018	site
1.7	Installation of fixed spray system around the SFP with provisions for quick connection from different sources of water.	SUP, Phase II	in progress	2016	site
1.8	Mobile heat exchanger with provisions to quick connect to SFP	SUP, Phase II	in progress	2016	site
1.9	Flood protection upgrade (additional protection of nuclear island and bunkered buildings)	SUP, Phase II	completed	2015	site
1.10	Establishment of new technical support center (TSC) and upgrade of existing operational support center (OSC); these are both emergency operating facilities	SUP, Phase II	in progress	2018 (for TSC) 2016 (for OSC)	site
2.1	SNSA shall amend its legislation to include: • requirements regarding the use of advanced deteriorating weather warning systems • requirements regarding the use of seismic monitoring systems • PSA Level 3 requirements (at least for new NPPs) • requirements for Beyond Design Basis Accidents I&C for Spent Fuel Pool • emergency planning requirements for prolonged SBO in the areas of communications capability (onsite, e.g., radios for response teams and between facilities, and offsite, e.g., cellular telephones, satellite telephones), ERDS capability, training and exercises, and equipment and facilities	legislation	in progress	2016	national
2.2	The SNSA shall consider amending its regulation for the design basis by more stringent safety objectives for:	legislation	in progress	2016	national

No.	Future action / activity	Area	Status	Deadline	Level
	• Prevention and mitigation of core-melt accident in reactor and in spent fuel storage to avoid off-site long term contamination • Large or early release to be practically eliminated (for new NPPs) • Increase robustness of NPPs to be able to face natural hazards more severe than the ones considered in the design basis (DEC); this should also include requirements for test and maintenance of equipment, training,.. This will be done mainly by following WENRA/ENSREG new initiatives, updated reference levels,… The SNSA shall also examine whether more detailed requirements are needed regarding LOOP, SBO and loss of UHS				
3	In January 2012 SNSA issued the third decision regarding the Fukushima event requiring from the Krško NPP to review the basis and assumptions for the Radiological Emergency Response Plan. This is to be finished by March 2013. The results of the review, possible proposals for improvements of the Radiological Emergency Response Plan, shall be implemented as appropriate. In addition, the SNSA (together with other appropriate stakeholders) shall give further consideration to: • supplementing the national radiological emergency response plan with provisions for off-site support regarding to the long-term fuel supply and also some additional pieces of mobile equipment in case of widespread disruption of plant's infrastructure • within the supplementing of national radiological emergency response plan further consideration shall be given to: - Reference levels for importing food, - Trans-boundary processing of goods and services such as container transport - Approach / philosophy and associated limits and criterion to govern the 'remediation' phase of the event - Return to evacuated area criteria and criteria for return to normal from the emergency state - Establishing contamination monitoring protocols and locations during the recovery phase • preparing national strategy (also amending legislation if needed) regarding solutions for post-accident contamination and the treatment of potentially large volumes of contaminated water • enhancement of intervention personnel training, trans-boundary arrangements and education of the public and media • enhancing cooperation with neighboring countries (especially Croatia), including mutual exercises	emerg. response	in progress (65% complete)	2017	national

No.	Future action / activity	Area	Status	Deadline	Level
	• enhancing exercises by including all interface points (National, Regional, Municipal…), performing longer term exercises for better reflection of the extreme events challenges, and incorporating failure of communication systems and radiation data availability into drill programs • enhancement of national radiological monitoring system				
4	SNSA shall assign dedicated inspections to: • verify the external hazard protection equipment. • systematically review and inspect SAME equipment, SAMGs, test and maintenance procedures, as well as full scale training events at the Krško NPP with the emphasis on how the limited number of staff are able to cope with equipment deployment and transfer of additional fuel to the users, what are the available and needed times, are there enough resources (human and equipment) available. • check what are plant's capabilities to power communications equipment needed to communicate onsite (e.g., radios for response teams and between facilities) and offsite (e.g., cellular telephones, satellite telephones) during a prolonged SBO. • additional inspections on radiological protection equipment, procedures for radiological mapping in case of an accident, staff training (added from action #5, additional studies)	Inspection	in progress (63% complete)	2017	site
5	The SNSA shall consider requiring the plant to perform additional studies regarding: • accident timing, including core melt, reactor pressure vessel (RPV) failure, basemat melt-through, SFP fuel uncovery, etc., using different computer codes • radiological protection equipment for SA response • analysis and identification of situations that would prevent performance of work for radiological reasons. • the question of stress on staff behavior including emotional, psychological and cultural aspects associated with emergency response and associated training and support	additional studies	one analysis was completed in 2015 (bullet 1). The other three have been considered, and based on the results no additional analyses were required. Instead additional special inspections are planned for 2016 (see action #4, 4th bullet)	2017	site
6	Nuclear safety infrastructure in Slovenia needs more political support. Only in such	nuclear safety	complete	2016	national

No.	Future action / activity	Area	Status	Deadline	Level
	environment the human resource capacity and competence across all organizations in the field of nuclear safety can be further developed. SNSA shall organize a meeting, where this topic shall be brainstormed by all involved parties (the utility, the regulatory body, TSOs…). Special action plan shall be prepared and executed to enhance political support to nuclear safety infrastructure.	infrastruc-ture			
7	To enhance its processes SNSA shall: • reconsider, which of the international meetings/groups are of outmost importance, since the decreasing number of staff and increasing number of international activities the quality of regular work may start to suffer • review its capability for evaluating defense-in-depth to see whether and how it could be further enhanced • enhance its staff training on severe accidents and SAMGs	SNSA processes	partly complete (bullets 1 & 3), bullet 2 in progress	2016	national
8	The SNSA shall consider inviting the following peer review missions • additional RAMP mission (best after completion of SUP) to again properly and independently validate the SAMGs. Likewise, consideration shall be given to inviting peer review missions to reassess the external hazards. • a follow-up IRRS mission in 2014, and next IRRS mission in the next 5-6 years • OSART mission to review plant design safety features and related modifications (in next 3 years) • EPREV (Emergency Preparedness Review) mission	peer reviews	in progress partly complete: - IRRS mission implement ed - OSART and EPREV missions invited for 2017	2021	site
9	SA plant parameters are being transferred to regulator premises. Still, this system needs a revision to include all needed SA parameters, increase reliability of the system,…	ERDS	complete	2015	site
10	A full scope PSA (including Level 2) for low power and shutdown modes shall be implemented for the Krško NPP by the end of 2015. SNSA shall consider requiring a PSA for the Krško's Spent Fuel Pool.	PSA	in progress (Level 1 for low power and shutdown complete)	2016	site
11	SNSA shall (together with the operator) analyze how the following topics are taken into account, maintained and improved: • Transparency; public discussion of safety issues • An open and trustful relationship between regulators, operators and the public with keeping in mind their respective roles and functions •Define appropriate actions to ensure that the desired safety culture characteristics are achieved in the regulatory and operational organizations	safety culture	complete	2014	national

No.	Future action / activity	Area	Status	Deadline	Level
	• Methods to evaluate and detect degraded safety culture				
12	Within the reassessment of its severe accident management strategy, existing design measures and procedures, the operator has also reassessed its possibilities for alternative spent fuel strategy. The results showed that best strategy would be storing the spent fuel in dry cask storage with a possibility to combine it with later reprocessing. In accordance with the latest study further actions shall be implemented on the national level to change the national strategy and to enable licensing of the modification.	reviews and NPP improvements	in progress	2018	national

For more details about the NacP and the SUP see Chapter A. Challenges (i) and the Update of the Slovenian Post-Fukushima Action Plan – the URL is in the afore mentioned Chapter.

iii. Reactor Vessel Up-Flow Conversion

During the 26th fuel cycle, which ended in October 2013, fuel rods with open defects were identified in three fuel assemblies in the Krško NPP. The major cause of open fuel defects was baffle jetting that produces strong vibrations in core locations close to the baffle. Another three fuel assemblies with leaking fuel rods were found and the causes of these defects were attributed to debris or grid-to-rod fretting. The causes of the fuel damage were in the meantime evaluated by a Root Cause Analysis (RCA) by fuel designer. The corrective action against baffle jetting, which was successfully applied in other NPPs, is carrying out an up-flow conversion. The up-flow conversion changes the coolant flow path between the core barrel and the baffle plate from down-flow direction to up-flow. This modification decreases pressure difference across the baffle plates and is expected to practically eliminate vibrations due to baffle jetting. The hardware changes consisted of plugging the existing flow holes in the core barrel between the top and the second former level and machining new flow holes in the top former plate. The change of the reactor pressure vessel baffle-barrel region flow configuration has an impact on the licensing documentation as well as the supporting analyses as follows: thermal-hydraulic analysis, thermal analyses, calculated pressure drops across the baffle plates, calculated core bypass flow, fuel rod stability, dynamic response during loss-of-coolant accident (LOCA) conditions and structural analyses. The analyses presented in the documents reviewed by SNSA have shown that safety limits of the plant with the up-flow modifications are not exceeded. The modification was successfully implemented during the 2015 outage.

iv. Improvements of Off-Site Emergency Planning together with Croatia

The national Inter-ministerial Committee on Emergency Preparedness (EPR) established two working groups in December 2013. One on reassessing basis for the Krško NPP hazard assessment, taking into account lessons from the Fukushima accident, which comprised also members from the Croatian nuclear safety regulator and the civil protection administration. The

working group has finished its work in 2015 and made some proposal for changes in emergency planning. Besides the conduct of implementation of evacuation, the new guidance for protective actions within the existing radii of emergency planning zones, as recommended by the IAEA documents, have been proposed to be introduced in the next revision of the national nuclear and radiological emergency response plan. The necessary planning still needs to be implemented by the Administration for Civil Protection and Disaster Relief before amending the national nuclear and radiological emergency response plan. The working group on reassessing basis for the Krško NPP hazard assessment could not reach the common conclusion about the emergency planning zones, therefore the Croatian participants within the working group produced its own opinion.

Croatia took part in the March 2016 INEX-5 exercise to test the protective action coordination and information exchange. Croatia has been given access to communication system MKSID, described in Chapter 16, in order to speed up and facilitate direct exchange of information on protective actions. The lesson learned was that the harmonization of emergency measures with Croatia has to be continued.

v. Inviting Peer Review Missions

It has to be pointed out that Slovenia continues its approach to inviting international peer review missions, which has also been written down in the post-Fukushima National Action Plan. In November 2015 TRIGA Mark II research reactor hosted the IAEA INSARR (Integrated Safety Assessment of Research Reactors) Follow-Up Mission.

Slovenia placed a request to the IAEA that we would like to host the OSART (Operational Safety Review Team) and the EPREV (Emergency Preparedness REView) missions. The IAEA positively replied to both requests. The missions will take place in 2017 and the exact dates are not known yet. The OSART mission will be the fourth mission in a row to the Krško NPP. The OSART missions to the Krško NPP were implemented in each decade since the eighties. The Preparatory meeting for the Krško NPP 2017 OSART mission took place 12-14 April 2016. It was agreed that the scope of the mission will cover also the long-term operation and for the period, in which the mission will take place, is the second quarter of 2017.

All reports from the peer review missions in Slovenia are published in the SNSA web page:

http://www.ursjv.gov.si/en/info/porocila/reports_of_eu_and_expert_missions/

C. Special Topics

The topics in this chapter are taken from the Summary Report of the 6th Review Meeting of the Contracting Parties to the Convention on Nuclear Safety finished in April 2014. The implementation of the Vienna Declaration on Nuclear Safety, adopted on 9th February 2015 is also described in this chapter.

i. Counterfeit, Substandard and Fraudulent Items (CSFI)

From 6th Review Meeting Summary Report:

24. Quality and Availability Issues of in the Supply of Materials and Services: A number of Contracting Parties discussed the measures they have in place to protect nuclear power plants from problems in quality and problems in the supply of relevant materials and external services, including counterfeit, fraudulent and suspect items.

The area of counterfeit, substandard and fraudulent items (CSFI) was introduced into the Quality Assurance (QA) plan of the Krško NPP. There are no special records in the area CSFI. The records are kept within the Corrective Action Program (CAP). Suppliers for the Krško NPP are classified into three groups: "Approved", "Approved Conditional" and "Disapproved." The training of the employees in the Krško NPP in the field of CSFI is regularly carried out within the training program. In addition, two workers have undergone the training in relation to the issue of CSFI in the United States. Within a three-year period, the recertification is performed in the field of visual inspection of the parts for the employees at the Control of Purchased Material, Equipment, and Services. Information about CSFI is accessible to the employees and for this purpose a guideline has been produced to deal with parts of suspicious origin or provenance (July 2014), which is used together with information obtained information from the NRC, NUPIC, EPRI, SNSA, suppliers and others.

The Krško NPP conducts also regular audits by the suppliers. All documentation in the purchasing process is also verified and validated by the QA group. In case of any discrepancies at the Control of Purchased Material, Equipment, and Services, they are recorded in the Corrective Action Program. All findings are reported annually to the plant management in the Annual Report. In addition to the regular audits of suppliers by the plant, there are also regular periodic reviews for CSFI, which are listed in the database of the Nuclear Procurement Issues Committee (NUPIC). In case of non-conformances of the supplied parts, the further manipulation with these parts is stopped until the causes are revealed (eg. documentation). Also foreign experiences are being reviewed by the Krško NPP on a regular basis.

ii. Reduction of Radioactive Releases

From 6th Review Meeting Summary Report:

27. The importance of the integrity of the containment as a fundamental barrier to protect the people and the environment against the effect of a nuclear accident is well established. Contracting parties should ensure timely implementation of effective measures to preserve containment integrity, functionality and/or reduce radioactive releases.

The Krško NPP containment design is a large dry containment with concrete reactor building and steel containment vessel with design pressure of 3.15 bar. Containment systems include reactor containment fan coolers and containment spray system that provide cooling of containment atmosphere and containment pressure control. Electrical recombiners were installed as part of post-TMI improvement measures and were able to control the hydrogen produced during a design basis accident. Instrumentation to monitor conditions inside containment was also provided and include also hydrogen monitoring system.

In the year 2000 Krško NPP installed a wet cavity modification. This modification provides flooding of reactor cavity below the reactor pressure vessel to provide cooling of corium in case of reactor vessel failure and to mitigate the molten core concrete interaction.

As part of the Krško NPP Safety Upgrade Program the following modifications were installed in 2013:

- Passive Containment Filtered Venting System (PCFVS),
- Passive Autocatalytic Recombiners (PAR) in the containment.

PCFVS and PAR are designed to withstand DEC seismic event with PGA=0.6g (the design basis earthquake PGA=0.3g). The criteria for operability of PCFVS and PAR were included in DEC operation limits and conditions (DEC TS) and both systems are checked according to DEC TS surveillance requirements.

The containment filtered venting system is capable of depressurizing containment and filtering over 99.9% of volatile fission products and particulates (not including noble gasses). The system is composed of aerosol filters, penetration from containment to the auxiliary building, diaphragm that ruptures at 5.1 bar overpressure, isolation valves, iodine filter and venting line (stack) for release to the environment. Five aerosol filters are located inside containment and they would retain most of the activity from containment atmosphere. The diaphragm, isolation valves and iodine filter are located in the auxiliary building. The stack is a separate ventilation line that leads the release to the top of the reactor building. The set-point for passive actuation of PCFVS was determined from containment fragility curve from Krško NPP PSA level 2 analysis. The PCFVS is designed for passive actuation and depressurization of the containment in severe accident conditions. Krško NPP plans to install a radiation monitor on PCFVS stack and to provide electric supply to the motor operated isolation valves for active operation of the filtered venting system. These modifications shall be completed by the year 2018.

The Krško NPP installed two PAR to replace the electrical recombiners that were installed to cope with hydrogen produced during design basis accidents. Additionally, twenty PAR were installed for control of combustible gases produced in severe accidents (hydrogen and carbon oxide). The capability, number and locations of PAR installed were determined based on the results of a plant specific severe accident analysis. This analysis of extended SBO includes severe damage to the core, reactor vessel failure and molten core concrete interaction.

We can conclude that the Krško NPP containment design and improvements following the TMI and Fukushima accidents provide effective measures to preserve containment integrity and its functionality. Large or early releases are practically eliminated. In case of a severe accident due to extended SBO which would lead to containment over-pressurization the PCFVS will significantly reduce radioactive releases to environment (aerosols and iodine).

iii. Severe Accident Management/Emergency Preparedness

From 6th Review Meeting Summary Report:

28. A number of Contracting Parties presented their severe accident management measures described in their severe accident management guidelines and procedures. The Contracting Parties noted that such measures need to be based on an appropriate analyses and the application of at least level 2 PSA. These analyses could be enhanced by research and development, for example in the area of core retention where it was recommended that a state of the art report should be developed at the international level, e.g. by the OECD/NEA of the IAEA. The Contracting Parties noted the advantage of harmonizing the approach to severe accident analysis and the resulting emergency preparedness and response measures through exchange of information and experience. Further some Contracting Parties acknowledged the importance of harmonizing protective measures and trade measures to be taken during an emergency.

Severe Accident Management Guidelines (SAMG) were introduced at the Krško NPP in 2000. The development of Krško SAMG was based on the WOG generic guidelines. The basis for these guidelines is the identification of generic strategies, defined as actions or a set of actions to be taken to mitigate a given challenge using well identified equipment. Several additional steps were needed to develop specific plant guidelines including, among others, the development of plant specific background documentation, plant specific SAMG setpoints and computational aids, the review of Krško NPP's emergency operating procedures (EOPs) in order to incorporate the transition to SAMG. The plant specific basis for the SAMG were the Krško NPP PSA level 2 analyses developed in 1996.

The Krško NPP SAMG were reviewed by the IAEA RAMP mission in 2001 and in the process of Periodic Safety Reviews (first in 2003, second in 2013) which provided findings for further improvement of SAMG. In 2015 the PSA level 2 analyses were upgraded to take into account new

equipment and measures that were introduced after the Fukushima accident. Additional deterministic severe accident analyses by MAAP were also prepared as bases for designing modifications in the Krško NPP Safety Upgrade Program. SAMG were upgraded in 2011 to enable use of Severe Accident Mobile Equipment (SAME) and in 2014 to adapt strategies after introduction of passive autocatalytic recombiners and filtered venting modifications. In 2014 the SAMG for shutdown modes and for spent fuel pool accident were introduced.

According to the SAMG the strategy of mitigation of severe accident is not the in-vessel core retention but instead the SAMG provide the wet cavity cooling for molten core after reactor vessel rupture occurs. Severe accident analyses by MAAP were performed in 2015 to assess the possible modifications and strategies to provide cooling of the containment (in case of extended SBO) and to suppress molten core concrete interaction. Modifications will include independent cooling systems for the core and the containment (including supply of water to the reactor cavity to cool the corium). The SNSA and the Krško NPP also follow the international publications on severe accident research and development such us an IRSN paper on in-vessel core retention strategy (July 2015) and an OECD/NEA state-of-the-art report on MCCI (2016).

For the area of emergency preparedness, the SNSA issued in January 2012 a decision requiring from the Krško NPP to review the basis and assumptions for the Radiological Emergency Response Plan (RERP). This was completed in 2015 with a revision of the PSA level 2 analyses that included the calculation of source terms for different release categories and modelling of radioactive release dispersion in the environment for local weather conditions. The conclusions were that it is important to expand the protective action zones around the NPP and to perform population evacuation in case of a General emergency in 10 km zone. For the neighbouring country of Croatia, which is 10 km from the NPP, the aim was to harmonize the protective action zones and proposed protective actions between the two countries. The implementation of improvements shall be done through changes in National Nuclear or Radiological Emergency Plan and followed by amending the Krško NPP RERP.

We can conclude that the Krško NPP SAMG are in line with the expectations from the 6th CNS Review Meeting Summary Report and that they are continuously revised and developed according to results of plant specific PSA and deterministic analyses results as well as results from international research and development. The development of emergency preparedness is performed by taking into account the new severe accident analyses results and has the aim of harmonizing emergency response of Croatia with the one in Slovenia.

iv. Implementation of Vienna Declaration

The Vienna Declaration on Nuclear Safety calls upon Contracting Parties to reflect in their national reports for the 7th CNS Review Meeting the implementation of the Declaration provisions. This implementation is described in many chapters of this national report as it has already been foreseen by the Declaration, therefore this section is written as a guidance, where to find appropriate text describing meeting the intent and principles of the Declaration.

It has to be pointed out that the requirements stipulated in the EU Directive on Nuclear Safety of Nuclear Installations, which was adopted in 2009 and amended in 2014, significantly influenced meeting the principles of the Declaration. The first principle, that new nuclear power plants are to be designed, sited and constructed, consistent with the objective of preventing accidents, is very similar to the Article 8a of the amended Directive. This first principle has been fully taken into account and transposed in relevant provisions of the Rules JV5, which is described in relevant Articles of this national reports, i.e. 10.1, 14.1, 17, 18, as well as this principle will be contained in

the provisions of the new Act on Ionising Radiation Protection and Nuclear Safety, which will be published in 2017.

Comprehensive and systematic safety assessments are performed within a mandatory periodic safety review, which is described in B. Planned Measures to Improve Safety (i), as well as it is mentioned in other chapters, e.g. on Articles 6.2, 10.1, 12, 14, 17.3.

The third provision of the Declaration on national requirements and regulations, which shall take into account the IAEA Safety Standards, as well as identified good practices, is regularly applied in preparing the revisions of national requirements and regulations. This is clearly required by the SNSA management system and their relevant procedures. E.g. the SNSA procedure on preparation of draft legislation contains a specific chapter describing the international inputs (for a particular area or subject), which should be considered in preparation of the legislation. There are, inter alia, the IAEA Standards, EU Acquis, OECD/NEA documents, WENRA, HERCA, ENSREG, ICRP, US NRC, US DoE, etc.

It is necessary to mention the long list of the Krško NPP post-Fukushima improvements, of which some have already been implemented and the others are under implementation or in planning stage. A comprehensive description of these actions is in this Appendix under A. Challenges (i) and B. Planned Measures to Improve Safety (ii).

v. IRRS Follow-Up Mission

Between 9 and 16 September 2014, the IRRS Follow-Up Mission (Integrated Regulatory Review Service) visited Slovenia to review the implementation of recommendations and suggestions given by the IRRS mission in 2011. At the same time the IRRS Follow-up Mission also assessed whether any further recommendations need to be given on the basis of new findings.

At the end of the mission only one recommendation and one suggestion remained open out of the 9 recommendations) and 29 suggestions received during the IRRS in 2011. The mission also issued 2 new recommendations and 5 new suggestions. The recommendation, which remained open, was referring to the construction of a repository for low and intermediate level radioactive waste, which has not been progressing as planned. The open suggestion was aimed at coordinating the nuclear emergency preparedness with the Republic of Croatia, which is a bilateral issue and needs to be accelerated.

The mission found that the adoption of the Resolution on Nuclear and Radiation Safety in Slovenia for the period 2013-2023 was an example of good practice. The new recommendation points out that the Government should ensure adequate financial resources and a sufficient number of competent staff to work for the SNSA, as well as strengthening research and development for the purpose of administrative authority and technical support organizations is needed. In another new recommendation the mission found out that in the context of lack of space of the existing low and intermediate radioactive waste storage facility at the Krško NPP this issue should be revisited.

The mission suggested performing an analysis of adequacy and completeness of a set of the SNSA internal technical procedures, as well as improving the rules on subcontracting of technical support organizations' activities. Another suggestion was aimed at up-dating the Annexes of the National Nuclear and Radiological Emergency Response Plan. There was also a suggestion and a recommendation dealing with strengthening the administrative control over the storage of radioactive waste in the Krško NPP, particularly in terms of accessibility and integrity of the containers.