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

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

June 2010
Keywords:
Convention on Nuclear Safety, emergency preparedness, exercises, human factors, initial authorisation, Krško NPP, operating experience, operational limits, priority to safety, radiation protection, quality assurance, regulatory framework, regulatory surveillance, siting, training, verification of safety,
EXECUTIVE SUMMARY

In the period 2007-2010, the safety of the only Slovenian nuclear power plant Krško was assessed by the Slovenian Nuclear Safety Administration as satisfactory, no major problems were encountered. The Slovenian Nuclear Safety Administration (SNSA) is an administrative body in the structure of the Ministry of the Environment and Spatial Planning, established to perform tasks of the nuclear regulator.

Crucial factor, that is 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 HEP. The amount foreseen for investments and improvements is stable and gives the management proper flexibility for long term maintenance of nuclear safety.

With the adoption of Rules on operational safety of radiation and nuclear facilities (JV9) and Rules on radiation and nuclear safety factors (JV5), the WENRA reference levels were transposed into the Slovenian legislation in 2009. The priority to nuclear safety is promoted by the law, but the JV5 and JV9 provide more details, e.g. the definition of safety culture, requirements for management of safety and quality in design, construction and operation of nuclear installations. There are also requirements for safety policies, safety culture programmes and development, arrangements for safety management, arrangements for safety monitoring and self-assessment, independent safety assessments, as well as a process oriented management system.

In December 2007, the SNSA successfully acquired the ISO 9001:2000 certification for the management system. In December 2008, the SNSA has successfully undergone the first external control audit and in December 2009 the external organisation performed the second control audit of the management system, which forms the transition to the new version of the ISO standard, namely ISO 9001:2008.

The Krško NPP introduced an integrated management system which links together different quality systems as an upgrade of nuclear safety and quality requirements in its MD-1 Program “Commitments and Goals of Krško NPP”. Also many other improvements and upgrades were adopted through the integrated management system, e.g. safety culture, activity monitoring and verification, self-assessment, plant performance indicators, Corrective Action Program, environment protection, industrial safety, long-term planning. These improvements do not only cover the GS-R-3 Safety Guide requirements but also go beyond them.

Some of the more important licensing modifications in the Krško NPP in the period since the 4th Review Meeting were:

- the replacement of the old digital electro hydraulic turbine control system with the new programmable digital electro hydraulic system,
- the decreasing of heat load of the essential service water system by the removal of old water cooled chillers,
- the replacement of thermal insulation inside containment and installation of new recirculation sump strainers,
- the reconstitution of fuel assemblies.

The SNSA also carries out its surveillance responsibilities through safety performance indicators and operational experience. The SNSA staff regularly follows the operating experiences throughout the world and examines them for their applicability for the Slovenian nuclear facilities. At the end of 2007, the SNSA initiated the new regulatory approach in supervising the Krško NPP through its own

The Fifth Slovenian Report on Nuclear Safety 3
set of 46 safety and performance indicators. Some of them are identical to the Krško NPP indicators, while others were selected specifically for the regulatory use. The input data for the indicators are submitted from the Krško NPP once per month.

The monitoring results and the modelling of radioactive discharges of the Krško NPP showed that the annual effective dose for a member of the reference group due to the plant operation was estimated to be around 1 μSv. Most of this figure is due to the intake of the radionuclide carbon-14 discharged into the atmosphere and only a small part of annual public exposure belongs to the liquid discharges to the river Sava. Other exposure pathways are radiologically less important.

At the end of 2007, the SNSA began a comprehensive revision of its emergency plan for preparedness and response. The SNSA emergency organization was simplified; all operational procedures were revised and improved. The SNSA's Intranet was included in the emergency preparedness system as a main information hub. In the framework of these activities, the SNSA developed a simple web application for prompt, direct and safe information exchange among all SNSA emergency team members at the same time. Since this application was found to be effective, it is now used also for the external communication among all main Slovenian emergency organizations. The national nuclear emergency exercise in 2008 demonstrated a need to revise the national emergency plan, which would include radiological emergency as well. The new revision of national emergency plan is to be approved and adopted in 2010.

In the period from 2007 to 2009, the Krško NPP reported 20 events as requested by Technical Specification, none of which caused an unplanned shutdown or degradation of nuclear or radiological safety. On 4th June 2008, the Krško NPP was forced to perform a normal shutdown due to an excessive primary system leakage. Although the event meant a threat to nuclear and radiological safety, there were no negative consequences or radiological releases to the environment. In several hours, the plant was in hot shutdown condition and the leaking valve was repaired in two days. However, at the beginning of the event the lowest level of emergency state was declared, the so-called unusual event, and the emergency response teams were activated both in the plant and at SNSA. The SNSA has sent information about the developments to the neighbouring countries, IAEA and also as a so-called alert through the ECURIE system, managed by the European Commission. The European Commission decided to publish an immediate press release, which has caused an unprecedented media attention throughout Europe. The programmes of major European electronic media were interrupted, and in the morning, there were tens of journalists crews from all over Europe in front of the Krško NPP. The media pressure lasted several days.

At the meeting of the ECURIE member states and European Commission in November 2008 to discuss the event, it was determined that Slovenia did not need to send an alert message, but on the other hand, Slovenia was following the procedures to communicate transparently and to report minor events as well. It was also agreed that the press release was too alarming. Later, the European Commission prepared improved criteria for reporting to the ECURIE system.

Several studies have been prepared to assess the flooding hazard of the Sava river and of the series of hydro power plants construction on the Krško NPP. The results of the Probable Maximum Flood study show that the nuclear safety of the Krško NPP could be threatened since the design bases for the external flood protection of the Krško NPP site have been exceeded. This requires an upgrade of Krško NPP flood protection.

The Krško NPP plans to install an additional safety classified full scope emergency diesel generator. The additional diesel generator will greatly increase the Krško NPP safety in case of a seismic event and also other events with loss of offsite power. The Krško NPP will install a Class 1E 3.5MW diesel generator by 30 June 2012.
As part of the first Periodic Safety Review at the Krško NPP, an Aging Management Program was initiated with the objective to determine whether aging is being managed in such manner that the required safety margins are being effectively maintained. It is based on the USA practice and is in accordance with NRC requirements from 10 CFR 54 License Renewal Rule as well as the nuclear industry guidelines. Project phases of this program are as follows: Coping and Screening of Structures, Systems and Components; Ageing Management Review and Review of Time Limited Ageing Analyses. Within the scope of the program, there are totally 6531 mechanical, 1498 electrical and 694 civil components.

More details about nuclear safety in Slovenia can be found in annual Report on Nuclear and Radiation Safety, available from the SNSA home page www.ursjv.gov.si.

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

**EXECUTIVE SUMMARY** ........................................................................................................... 3

**CONTENTS** .................................................................................................................................. 6

**INTRODUCTION** .......................................................................................................................... 9

**COMPLIANCE WITH ARTICLES 4 AND 6 TO 19** ................................................................. 12

**ARTICLE 4. Implementing Measures** ...................................................................................... 12

**ARTICLE 6. Existing Nuclear Installations** ............................................................................... 13

**ARTICLE 7. Legislative and Regulatory Framework** ............................................................... 17

**ARTICLE 8. Regulatory Body** ................................................................................................... 21

**ARTICLE 9. Responsibility of the Licence Holder** .................................................................... 26

**ARTICLE 10. Priority to Safety** ............................................................................................... 28

**ARTICLE 11. Financial and Human Resources** ....................................................................... 31

**ARTICLE 12. Human Factors** .................................................................................................. 35

**ARTICLE 13. Quality Assurance** ............................................................................................. 37

**ARTICLE 14. Assessment and Verification of Safety** .............................................................. 41

**ARTICLE 15. Radiation Protection** ........................................................................................ 46

**ARTICLE 16. Emergency Preparedness** ................................................................................ 50

**ARTICLE 17. Siting** .................................................................................................................. 55

**ARTICLE 18. Design and Construction** .................................................................................. 58

---

**Introduction**

**CONTENTS**

EXECUTIVE SUMMARY ................................................................. 3
CONTENTS ........................................................................................................... 6
INTRODUCTION ........................................................................................................... 9
COMPLIANCE WITH ARTICLES 4 AND 6 TO 19 ................................................................. 12
ARTICLE 4. Implementing Measures ...................................................................................... 12
ARTICLE 6. Existing Nuclear Installations ............................................................................... 13
ARTICLE 7. Legislative and Regulatory Framework ............................................................... 17
ARTICLE 8. Regulatory Body ................................................................................................... 21
ARTICLE 9. Responsibility of the Licence Holder .................................................................... 26
ARTICLE 10. Priority to Safety ............................................................................................... 28
ARTICLE 11. Financial and Human Resources ....................................................................... 31
ARTICLE 12. Human Factors .................................................................................................. 35
ARTICLE 13. Quality Assurance ............................................................................................. 37
ARTICLE 14. Assessment and Verification of Safety .............................................................. 41
ARTICLE 15. Radiation Protection .......................................................................................... 46
ARTICLE 16. Emergency Preparedness ................................................................................... 50
ARTICLE 17. Siting .................................................................................................................. 55
ARTICLE 18. Design and Construction ................................................................................... 58

---

**The Fifth Slovenian Report on Nuclear Safety**
ARTICLE 19. Operation ................................................................. 60
19.1 Initial Authorization for Operation ........................................... 60
19.2 Operational Limits and Conditions ........................................... 60
19.3 Operation, Maintenance, Monitoring, Inspection and Testing ......... 61
19.4 Anticipated Operational Occurrences and Accidents .................. 62
19.5 Engineering and Technical Support .......................................... 62
19.6 Incidents, Significant to Safety ............................................... 62
19.7 Programs to Collect and Analyze Relevant Operating Experience .... 63
19.8 Radioactive Waste Resulting from Operation ............................. 64

APPENDICES .................................................................................. 66

Appendix I: Comprehensive List of Legal Documents in Force in Slovenia (as of 30 April 2010) .......................................................... 66
A. National legal frame ...................................................................... 66
B. International instruments to which Slovenia is a party ...................... 68

Appendix II: Challenges and Planned Measures to Improve Safety ...... 71
A. Challenges .................................................................................. 71
B. Planned Measures to Improve Safety ............................................. 78
C. Special Topics ............................................................................. 81
INTRODUCTION

On 20 September 1994, Slovenia signed the Convention on Nuclear Safety (hereinafter the Convention) and ratified it in the Parliament in October 1996. For Slovenia, the Convention entered into force in February 1997. The fulfilment of the obligations in the period from 2007 to 2010 is evaluated in this fifth 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, as well as the whole set of secondary legislation (rules). The latest rules with regard to pre-design phase and operation were issued in 2009. The report also addresses the areas which were identified as the areas, needing additional attention, during previous evaluation and during the Fourth Review Meeting. They are described in the Appendix II.

Slovenia has one operating nuclear power plant, one research reactor, one central radioactive waste storage for low and intermediate level solid radioactive waste from non-power users of nuclear energy, and one uranium mine and mill in a decommissioning stage. In July 2009, the local municipality gave consent to the final location of the low and intermediate level radioactive waste repository at Vrbina site near the Krško NPP. The Slovenian Government adopted the Decree on the national spatial plan for this repository at the end of 2009.

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 originally installed capacity of 632 MWe net electrical output power. The plant has constantly been modernised. The modernisation resulted not only in improved safety but also in the increased output power. After the replacement of steam generators, the power was uprated to 707/676 MWe (gross electrical power/net electrical power). During the outage in 2006, the low pressure turbines were replaced and the nominal output power reached 727/696 MWe. The basic safety features of the plant are typical for a two-loop Westinghouse plant. The construction started in 1974. On the basis of a special permit, the first fuel was loaded in May 1981, and the plant was synchronised to the grid in October of the same year. After an authorised trial operation, full power was reached in August 1982. The first full year of commercial operation was 1983.

As stated in the previous Slovenian National Reports, the Krško NPP was constructed as a joint project of the electric utilities of Slovenia and of the neighbouring Croatia on an equal, 50:50 basis.

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, and research with experimental development in the area of nuclear technology. Since the Krško NPP is located in Slovenia, it is subject of Slovenian law and Slovenian nuclear safety regulations.

The Krško NPP operates as a non-profit organisation, but the potential company’s profit can be put in the reserve assets.
The Fifth Slovenian Report on Nuclear Safety

The safety features of the Krško NPP design are based on the 1973 requirements of the US Atomic Energy Commission. As the main contractor, Westinghouse was responsible for the implementation of these requirements during the design, construction and testing phases. The Krško NPP has been the subject of IAEA scrutiny since the very beginning of the project. 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 fulfill western safety standards. Several software and hardware modifications and improvements have been implemented in the plant. They were based on the experience from the Three Mile Island accident, the recommendations of different international missions, the United States Nuclear Regulatory Commission requirements, the experience of the nuclear industry, the Institute of Nuclear Power Operations (INPO), the World Association of Nuclear Operators (WANO), the Westinghouse Owners Group, the experience gained from the Phare – Regulatory Assistance Management Group program of the EC and from bilateral co-operation of the regulators.

Solid radioactive waste and spent nuclear fuel are stored within the plant area. The major project in 2003 was expanding the capacity of the spent fuel pit, which now has enough capacity to store spent fuel until 2023, with the possibility for its further expansion. Solid radioactive waste is treated and then packed into steel drums, which are stored in the solid waste storage. In recent years, great effort was put into minimizing the amount of low and intermediate level radioactive waste (LILW) in the Krško NPP (i.e. supercompaction, incineration, in-drum drying system). In 2006, the Krško NPP started the continuous compression of radioactive waste with the super-compactor installed in the storage facility. In July 2009, the of council the Krško municipality approved the amendment to the National Spatial Plan for the repository location at Vrbina site, near the Krško NPP. After long debates, the local community agreed to have repository in their municipality. In December 2009, the Government adopted the Decree about National Spatial Plan for this repository, which brought the long-lasting process to conclusion. The construction of the repository is to begin in about two and a half years.

The Research Reactor TRIGA Mark II of the Jožef Stefan Institute is situated in the vicinity of Ljubljana and has a 250 kWth General Atomic pool reactor. TRIGA was initially licensed in 1966 as an IAEA project and after refurbishment and reconstruction in 1992, it was re-licensed for steady state and pulse operation. A decision was made that the reactor will operate at least until 2016. Then, the research reactor has to be shut down to start with the fuel cooling and preparations for shipment. The deadline to send spent fuel to the United States is in 2019.

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 (U₃O₈ equivalent) of yellow cake. Both the mine and the mill are undergoing decommissioning and the re-mediation of surface disposal of 1,548,000 tons of mine waste and red mud, and 593,000 tons of mill tailings respectively. In 2005, the activities in the mine were finished, the ventilation station was dismantled and the access to the mine is no longer possible. The main activities were related to remediation of the Boršt repository for hydrometallurgical tailings and the Jazbec repository for mine tailings. The work on the Jazbec repository was completed in 2008.

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. In recent years, the storage was
refurbished and, in 2006 and 2008, the waste characterisation campaigns were performed. After the two campaigns, the complete inventory was characterized.

The governmental energy policy is outlined in the National Energy Program, which also addresses nuclear power. The main principles of this program are sustainability, ecological acceptability and the reliability of supply.

In the following section, the fulfilment of each of the articles 4 - 19 of the Convention is evaluated separately. In Appendix I, there is a complete list of the nuclear related legislation in force in Slovenia. Since Slovenia attaches the utmost importance to the review process, it was decided that all the issues raised in the rapporteur’s report and in the review meeting summary report are discussed in one section, i.e. Appendix II. Besides “Challenges” and “Planned Measures to Improve Safety”, Appendix II also contains information concerning the Periodic Safety Review, Safety Management and Safety Culture, Ageing Management and Life Extension, as well as Application of Probabilistic Safety Analyses.

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 provides for 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 2008-2010, the SNSA assessed the safety of the only Slovenian nuclear power plant Krško as satisfactory in relation to the 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 reviews and assessments of its safety since 2008. The most important activities in the area of safety reviews and assessments are described in the following paragraphs.

Updated Fire Hazard Analysis

Due to significant number of improvements and changes, a complete set of the Krško NPP Fire Hazard Analysis (FHA) documents was revised in 2008. The third revision of FHA takes into account last physical modification and fire protection program enhancements, new implemented procedures, combustible material changes in individual fire areas, new defined fire areas in original buildings and in buildings recently built up. For FHA revision purposes, field walk-downs were accomplished in all fire areas with the intention of checking and establishing the combustible loading of fire area and finding out the adequateness of fire area construction, fire protection systems, safe shutdown train separation and other. The previous FHA (Rev. 2) was divided in four volumes. The latest FHA (Rev. 3) has five volumes. The additional FHA volume, titled as the FHA Supplement Documents, includes the description as well as the results of recalculation of combustible loading and fire severity for fire areas, the exact calculation of cable insulation volume for the most loaded fire area, the description of fire protection program field findings and the description of revision of the following FHA databases: Safe-shutdown Cable Schedule, Safe-shutdown Component Index and Fire Area Summary Table. A list of plant modifications considered at FHA revision was enclosed as a supplement. On the basis of the FHA in the beginning of 2010, the Krško NPP prepared the Fire Protection Action Plan (FPAP).

National Response to Forsmark Event

After the Forsmark-1 event, the SNSA performed an in-depth analysis of the Forsmark event and tried to identify lessons to be learned from it. The following areas were reviewed in detail:

− Maintenance and surveillance procedures for the plant electrical systems, i.e. switchyard, inverters, generator, protection devices, alternating current and the direct current power distribution system,
− Final test reports and the check lists of the plant electrical systems,
A comparison of the Krško NPP and Forsmark-1 design features showed major differences in the configuration of the plant electrical system, safety bus voltage levels and uninterruptible power supply design.

On a request from the SNSA, the Krško NPP analyzed the Forsmark-1 event, looking into its potential impact on the design of the plant electrical systems. The following was concluded:

- The plant's uninterruptible power supply configuration is different; the batteries are separated from the inverters (even if the inverters are inoperable, the DC power distribution system still remains operable).
- The Krško NPP was the owner of the 110 kV/400 kV switchyard until November 2007. All administrative, maintenance and surveillance procedures of the Krško NPP switchyard were developed by the plant personnel at that time. Since November 2007, the owner of the switchyard is the grid operator Elektro – Slovenija (ELES). In line with the Agreement between the Krško NPP and ELES, the plant management will maintain surveillance of the modifications which will be carried out in the 110kV/400kV switchyards. In the future, all modifications in 110 kV/400kV switchyards will be made by ELES. Electrical circuit breakers, disconnect switches, bus protection devices and several other parts of the 110 kV and 400 kV switchyards will be replaced until 2015.
- The suppliers of the inverters and battery chargers assured to the Krško NPP operator that similar over-voltage transient as it happened in the Forsmark NPP would not affect functioning of inverters. Further analysis of the direct current (DC) supply and inverters will be contracted to an engineering company.
- Electrical circuit breakers of specific types (EB, EHB) and direct current distribution panel will soon be coming to the end of their design life and will be replaced in the 2010 outage.
- Since electrical protection devices for some breakers (DS type) in a direct current distribution system will not work properly in the event of a station blackout, the DS breakers must be changed. Also, the issue of the power supply to the DS breaker protection needed to be resolved. This deficiency was resolved in the outage 2009 in the scope of modifications.

The SNSA has concluded that the Forsmark-1 event is not directly applicable to the Krško NPP and that the plant personnel are maintaining the plant's electrical systems properly.

*Periodic Safety Review (PSR)*

The second PSR program for the Krško NPP (PSR2) has been approved by the SNSA in the beginning of 2010. The program is in line with the requirements of the 2002 Act on Ionising Radiation Protection and Nuclear Safety (hereafter the 2002 Act) and the Rules on Operational Safety of Radiation and Nuclear Facilities (JV 9), as well as the Regulatory Guide provided by the SNSA. The review itself, prioritization and action plan will be completed by the end of 2013. The actions from action plan will be completed in the next 5 years.

The PSR2 project for the Krško NPP will cover all changes either from current national and/or international safety standards/practices or plant design and operational arrangements and history from the first PSR. The status of safety issues identified at the 1st PSR with special emphasis on aging management and equipment qualification programs will also be reviewed.

Within a period of ten years, the following developments are expected:
− Possible changes/advancements in safety standards, technology and underlying scientific knowledge and analytical techniques;
− A need for the evaluation of the cumulative effects of plant modifications and aging;
− A possibility of significant changes in the staffing,
− Changes in management structures and procedures of both the plant operating organization and the regulatory body;
− The influence of changes in the environment due to construction of hydroelectric power plants and other object near the Krško NPP.

Facilities in the Vicinity of the Krško NPP

In the vicinity of the Krško NPP, there are several facilities which are currently in the process of siting. These new facilities could have an effect on the nuclear safety of the Krško NPP. A major influence will be a construction of a chain of hydro power plants on the Sava river above the Krško NPP.

The Ministry of Defence expanded the Cerklje airport. The SNSA demanded that the new activities on the airport shall not influence the safety of the Krško NPP. An analysis has been prepared showing less than a minimal influence of the increased air traffic to the Krško NPP safety.

In July 2007, the preparation process for the national spatial plan for the Brežice hydro power plant began. The SNSA and the Krško NPP requested the assurance of flood protection for the Krško NPP, the preservation of the ultimate heat sink for cooling of the Krško NPP safety systems, the assurance of the Krško NPP external power supply, the restriction of interventions in the area of limited use of space around the Krško NPP, the assurance of cooling of the Krško NPP condensers with the Sava river, and the prevention of the Sava river quality deterioration due to operation of hydro power plants.

Several studies have been prepared to assess the flooding hazard of the Sava river and the influence of the hydro power plant chain construction on the Krško NPP. The results of the Probable Maximum Flood study show that nuclear safety of the Krško NPP could be threatened since the design bases for the external flood protection of the Krško NPP site have been exceeded. The Krško NPP flood protection is assured by flood protection dikes along the Sava river that are designed to protect the site against a ten-thousand-year flow of 4272 m³/s. If the flow exceeded the ten-thousand-year flow, then it would flood the right bank of the Sava river up to the probable maximum flood, which has been established in the current safety analysis report as 6500 m³/s. The new studies of probable maximum flood have shown that this value will be exceeded. This requires an upgrade of the Krško NPP flood protection, whether by raising the dikes or by other means.

The High-flow waves study assessed the transfer of waves through the hydro power plant chain. The results reflect the velocity of wave travelling through the hydro power plant chain and its highest flow. The study established that accumulation basin bank spillovers of the Brežice hydro power plant to the right bank of Sava river are not sufficient for draining the high-flow waves of 3860 m³/s onto the flooding area. Therefore, the project of the Brežice hydro power plant needs to take this into consideration and to be corrected accordingly.

The results of the study of flooding waves caused by dam failures show that these waves can reach a higher flow, if dam gates are opened by mistake than in the case of damage to dam gates due to natural causes (e.g. seismic). The flood wave
caused by the failures of upstream hydro power plant dam would not exceed the design bases of the Krško NPP flood protecting dikes.

In response to findings showing an increased external flood of the Krško NPP, the plant has committed to prepare a new concept of Krško NPP flood protection and to implement appropriate actions by the end of 2010. When preparing an upgrade of the Krško NPP flooding protection, a plan for a new road construction from Krško to Brežice and a new bridge over the river Sava upstream of the Krško NPP needs to be taken into consideration. The new road will be built on top of Krško NPP flood protection dikes along the Sava river.

*Events in the Krško NPP*

In the period 2008-2010, the following events occurred in the Krško NPP:

- Plant shutdown due to increased primary system leakage – INES 0 (discussed in detail in Article 19)
- Degradation of a steam generator auxiliary feedwater nozzle (discussed in detail in Article 19)
- Loss of offsite power during the generator protection 86G testing (discussed in detail in Article 19)

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 entered into force on 1 October 2002. On that day, two previous Acts ceased to apply, namely:

- Act on Radiation Protection and the Safe Use of Nuclear Energy (1984 Act),

The 2002 Act was amended in 2003 and 2004, as explained in our previous national reports. In spite of the amendments, the short name “the 2002 Act” remains unchanged, and applies to the latest version with the amendments included. The 2002 Act allows for the regulations issued on the basis of the 1984 and 1980 Acts to apply until new regulations, which are to be adopted pursuant to provisions of the 2002 Act, are issued. Based on the 1984 Act, only a part of one regulation is still in force.

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 decrees and regulations have been issued in total.

With the adoption of Rules on operational safety of radiation and nuclear facilities (JV9) and Rules on radiation and nuclear safety factors (JV5), most of the WENRA reference levels\(^1\) were transposed into the Slovenian legislation. These reference levels prescribe safety criteria for nuclear power plants and were developed by the

\(^{1}\) WENRA Reactor Safety Reference Levels, January 2008, see www.wenra.org
working group established under West European Nuclear Regulators Association. The preparation of rules JV5 and JV9 started in 2006 and was finished in the end of 2009. In this activity, the representatives of state, research and industry worked together to harmonize the national legislation with the best EU practices and requirements, which are contained in the WENRA reference levels.

In years to come, other decrees and regulations are expected to be adopted and issued.

### 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 20 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 22 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 - 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 Environment and Spatial Planning, with an approval from the SNSA,
- application for the license for trial operation – the competent body is the Ministry of Environment and Spatial Planning, with an approval from the SNSA,
- application for the operation and the decommissioning – the competent body is the SNSA.

For the EU Member States, the Council Directive on establishing a Community framework for the safety of nuclear installations was adopted in June 2009. Slovenia made a verification of the compliance with the requirements of the Directive, the so-called transposition, and it was found that most of the requirements have already been met. Some outstanding issues need to be clarified with other EU Member States and the European Commission, and resolved in due time.

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. 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 analyzed 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 Act on Inspection (Official Gazette of the RS, 56/02) 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 115 and 116 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 orders 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 ensured their fulfilment within a reasonable period of time in spite of the request from the inspector to remedy the deficiencies.

The SNSA orders 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.3/2007 – 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.

The 2002 Act divided the competencies in nuclear and radiation safety among two regulatory bodies, namely the Slovenian Nuclear Safety Administration (SNSA) and the 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 is responsible for physical protection.

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 (hereinafter Ministry). The SNSA's responsibilities and competencies are defined in the Decree on Administrative Authorities within Ministries, and are defined as follows: »The SNSA performs specialised technical and developmental administrative tasks and tasks of inspection in the area of radiation and nuclear safety, radiation practices and use of radiation sources (except in health and veterinary care), protection of the environment against the ionising radiation, physical protection of nuclear materials and nuclear facilities, non-proliferation of nuclear weapons and safeguards of nuclear goods; the SNSA furthermore monitors the radioactivity in the environment and third party liability. «

The precise competencies of the SNSA and other relevant administrations, entrusted with the implementation of the legislative framework, 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,
– Service of International Co-operation,
– Service of General Affairs,
– Inspection.

Current organisational chart, which has been in force since February 2010, is shown in the figure.
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 cover mostly general topics.

At the same time, the individual program for acquisition 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.

In recent years, the Government of Slovenia has strictly followed the policy of not increasing the number of civil servants in administration. Therefore, it was also not possible to increase the number of the SNSA staff. In parallel, 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. On the other hand, in case of Krško NPP lifetime extension or a new NPP, the technical staff of both, the SNSA and its TSOs should be increased. The concrete
analyses of needs has not yet been done because no final decision has been made with regard to lifetime extension and/or new built.

The budget of the SNSA is determined on the basis of the realisation from the previous year, taking into account new needs which have to be well justified. The budget is the only source for financing the SNSA's 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 Ministry, 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 biennium cycle. The composition of the SNSA’s budget for 2009 and 2010 is shown in the table. This budget comprises all activities within the SNSA competences.

<table>
<thead>
<tr>
<th>STRUCTURE</th>
<th>2009 (in EUR)</th>
<th>2010 (in EUR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salaries/wages</td>
<td>1,575,427</td>
<td>1,781,091</td>
</tr>
<tr>
<td>Material expenditures</td>
<td>320,000</td>
<td>316,207</td>
</tr>
<tr>
<td>Investments and maintenance costs</td>
<td>40,000</td>
<td>26,879</td>
</tr>
<tr>
<td>Goal-oriented research programme: assuring support to nuclear safety</td>
<td>114,323</td>
<td>112,567</td>
</tr>
<tr>
<td>Membership fees (IAEA, OECD/NEA membership, USNRC programs)</td>
<td>306,000</td>
<td>290,700</td>
</tr>
<tr>
<td>Outsourcing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nuclear safety</td>
<td>128,351</td>
<td>122,000</td>
</tr>
<tr>
<td>Radiation safety</td>
<td>120,965</td>
<td>122,820</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2,605,066</strong></td>
<td><strong>2,772,282</strong></td>
</tr>
</tbody>
</table>

As a preparation for an IRRS mission to be carried out for 2011 or 2012, the SNSA performed a self-assessment using the IAEA questionnaires. The self-assessment was finalised in April 2010 and an action plan for correcting the identified non-conformances was drawn up. About 30 actions were listed in the action plan and most of them were to be implemented by the end of 2010.

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.
Regulatory Body  Article 8

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.

Based on the 2002 Act, the Expert Council for Radiation and Nuclear Safety was appointed in mid 2003 as an advisory body to the Ministry of Environment and the SNSA, and the Expert Council for the Protection of the People 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 must:

− 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).

Above all, the newly adopted 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 provides 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)].

26
Article 9  Responsibility of the Licence Holder

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 planned 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 a organisational structure shall be justified and documented (Art. 51/(1)).

Also, JV 9 includes 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 2002 Act. The Act defines nuclear safety as "technical and organisational 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 ionising radiation". In 2009, new regulations JV5 and JV9 were issued that further define the 2002 Act provisions. Both regulations were prepared in line with the WENRA reference levels, including the issue A Safety Policy and the issue C Management System. 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 programmes 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).

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 performed the review of the Krško NPP arrangements in all the WENRA issues, including those defining approach to Priority to safety. Together, the SNSA and the Krško NPP drafted the new regulations JV5 and JV9 and in the process also checked the implementation of such (draft) regulatory requirements at the Krško NPP. 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 report since the second review meeting.

At the end of 2007, the SNSA initiated the new regulatory approach in supervising the Krško NPP through safety and performance indicators. The SNSA set of 46 indicators was prepared with the purpose to look for potential weaknesses that might lead to the degradation of nuclear safety.

In the case of 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). Members of ISEG are experts from different areas; the majorities have operational background and are trained in human performance areas, analysis techniques, and so on. The ISEG’s independence is achieved and assured through its reporting channel to the plant senior management and the plant management supervisory board. The ISEG maintains a Performance Indicators Program which is based on the document Operational Safety Performance Indicators for Nuclear Power Plants, IAEA TECDOC-1141 and WANO performance indicators. Establishing such program of monitoring and assessing operational plant safety performance indicators represents by itself an effective safety culture of the plant personnel. The
results of these performance indicators reviews identify weak points and define corrective actions for the adverse trend indicators.

Independent reviews of outage activities and surveillance tests are performed by the Technical Support Organisations (TSO). The TSOs are engaged for the inspection, witnessing and safety evaluation of refuelling, surveillance and modifications activities. Some of the important issues considered during the 2009 outage were problems with the replacement of under-voltage relay on 125 and 220 voltage DC bus, the replacement of the Digital Electro Hydraulic Turbine Control System, the upgrading of emergency airlock, the replacement of secondary pipelines, the replacement of the DC breakers and the seismic upgrading of polar crane.

Reporting events is also a way of implementing regulation. There were just a few reportable events since the last review meeting. Although the event presents a threat to nuclear and radiological safety, there were no negative consequences or any radiological releases to the environment.

**10.3 Regulatory Oversight of Licencees 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 the 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 the United States 10 CFR 50.59. For that purpose, an administrative procedure, called the Authorisation of Changes, Tests and Experiments, was developed.

**10.4 Priority to Safety Provisions of the Regulatory Body**

The SNSA designed an internal quality management (QM) system. The main reasons are, firstly, to fulfil its mission as a regulatory body for nuclear and radiation safety (the SNSA needs an adequate quality management system), and secondly, the Slovenian Government stimulated the initiation of a quality system in public authorities (for details see chapter 13). Therefore, many documents were prepared for carrying out meetings and procedures. In this context, the SNSA also prepared Quality Management (QM) Manual, inspection plan, organizational procedures and guidance which in general cover management, control of radiological and nuclear safety, inspection, preparation of regulation, and the preparation for an emergency.

At the request of the SNSA, a review of Krško NPP safety culture was performed in 2006 and guidelines for regulatory evaluation of Safety Culture at the plant have been prepared by the University Medical Center Ljubljana and the Institute for Occupational Health, Ljubljana. The scope of the review was limited to the PSR reports, the OSART mission report, the Safety Analysis Report (USAR), and NPP procedures. It was concluded that the nature and extent of programmes and organisational/management arrangements that contribute to the safety culture at Krško NPP are satisfactory and reflect the international good practice. On the basis
of the review and IAEA documents such as TECDOC-1321, the guidelines for safety culture regulatory evaluation were prepared for the SNSA.

10.5 Voluntary Activities

At the SNSA’s web site (http://www.ursjv.gov.si/), the Slovenian Reports on Nuclear Safety, the national annual reports, the reports of international missions, and other similar documents are regularly published.

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 must be guaranteed 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 by the two owners, a Slovenian and a Croatian state owned electrical utility. 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 yearly 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 does not change 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 recent years, there have been no problems with any delayed payments.

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

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 of a radiation source must 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 as well as one half of the radioactive waste and spent fuel which result from the operation of the Krško NPP and which will result from its decommissioning. On the basis of the treaty, Slovenia and Croatia have also assumed equal obligations relating to the radioactive waste and spent fuel management. The treaty envisages that both contracting parties shall prepare a joint Programme of disposal of radioactive waste and spent nuclear fuel as well as a joint Decommissioning programme. Both programmes were prepared and adopted by the authorities in Slovenia and in Croatia, as provided by the treaty. 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. It needs to be mentioned that the draft of new Third Party Liability Act was approved by the Government and sent to the parliamentary procedure. It is expected to be adopted in Parliament by the end of 2010.

11.2 Human Resources, Training and Qualification

11.2.1 Krško NPP

At the end of 2009, there were altogether 624 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,
- the Regulation on qualification requirements to be met by workers performing duties and tasks of safety significance in nuclear and radiation installations, which was adopted in August 2005 and entered into force on 1 January 2006,
- the plant’s Updated Safety Analysis Report, applicable plant procedures/programmes,
- the annual training program for licensed operators and shift engineers, approved by 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 (typically 4 per year) which comprise a two-year cycle of requalification 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, two from technical support organisations (3), two from the Krško NPP and two are retired senior experts. The examination consists of:

- written examination: 38 to 40 questions (mainly multiple choice),
- simulator examination – 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 second generation has completed initial training in 2004, the third generation in 2008 and the last generation (4 reactor operators) in 2009. There were 65 licensed reactor operators, senior reactor operators and shift engineers at the end of 2009.

Other types of training courses are conducted for specific areas, for example refuelling operations, maintenance, engineering, radiation protection, chemistry, security, emergency preparedness, 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 mainly recruits experienced staff with several years of experience in other institutions. In addition, 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. Between 2003 and 2009, special training was also carried out for the SNSA personnel involved with the Krško NPP. Specifically, it was a classroom and a simulator training with an emphasis on plant design transients and accidents. 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

Slovenian legislation covers the human factor issue in Article 62 of the 2002 Act, which defines workers’ qualifications and physical as well as psychological requirements. The condition of workers must be regularly checked. The employer must also ensure regular updating of the workers’ professional knowledge. Regulation JV4 further elaborates these requirements. For the work in a radiation or nuclear facility, a licence is issued to the workers for a maximum of 5 years according to regulation SV8. The health surveillance of exposed workers is dealt with in Article 39 of the 2002 Act and the review of the assessment of fitness to work in its Article 42.

The new Rules JV5 comprises basic human factors requirements in the nuclear installations design.

12.2 Licensee Methods and Programs at the Krško NPP

The methods of dealing with human factor issues at the Krško NPP were extensively described at the Second Review Meeting. 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 evaluation 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, 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.

Staff workload is strictly regulated. Overtime is limited to 8 h/week, 20 h/month, and 180 h/year. Two plant 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.

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 weak 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

In 2001, the SNSA decided to introduce an internal quality management (QM) system mainly because of two reasons. Firstly, in order to fulfil its mission as a regulatory body for nuclear and radiation safety, the SNSA should have an adequate quality management system, and secondly, the Slovenian Government stimulated the initiation of a quality system in public authorities. With the implementation of QM system, the SNSA strives for improving efficiency and effectiveness of the performed tasks in accordance with the contemporary lines of international institutions, such as the IAEA.

In 2005, the SNSA management decided to redefine the management system according to the IAEA Draft Safety Standard 338, later issued as IAEA Safety Standards Series No. GS-R-3 “The Management System for Facilities and Activities”, 2006.

The SNSA management system is based on the process approach. The processes are divided into seven core processes and two supporting processes.

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), in which the management of processes is described.
- Level 3: Organizational instructions (ON), in which the detailed performance of individual activities is defined.
- Level 4: Records that are made by the performance of the management system.

In 2007, four internal audits of management system as well as the management review were performed. In September, the external pre-certification audit took place, and in December 2007, the SNSA successfully acquired the ISO 9001:2000 certification for the management system.
In 2008 and 2009, some SNSA employees have been trained in the field of management system, and several internal audits have been performed according to the internal annual audit plans. In December 2008, the SNSA has successfully undergone the first external control audit. In December 2009, the external organisation performed the second control audit of the management system, which forms the transition to the new version of the ISO standard, namely ISO 9001:2008. During the control audit, no non-conformances were identified, thus the external auditor concluded that the SNSA management system complied with the standard ISO 9001:2008.
13.2 The Krško NPP Quality Assurance System

The 2002 Act explicitly requires that the operator of a radiation or nuclear facility must, with a view to quality assurance, set up and implement a quality assurance programme.

The Krško NPP as the license holder is responsible for the overall quality of the design, construction, operation, maintenance and modification of the NPP. The quality assurance programme was implemented already for the design and construction of the plant, and was in full compliance with the Appendix B to 10 CFR 50 Quality Assurance Criteria for NPP and Fuel Reprocessing Plant, and the QA guidance provided in WASH 12833 Guidance on QA Requirements During Design and Procurement Phase of Nuclear Power Plants and in WASH-1309 Guidance on QA Requirements During the Construction Phase of Nuclear Power Plants. Both documents were issued in 1974.

The Krško NPP Quality Assurance Programme is implemented and maintained to comply with the following codes and standards:
- 10CFR50, Appendix B,
- ANSI N 18.7-1976,
- ASME B&PV Code, Section III, NCA-4000;
- ANSI/ASME NQA-1,
- Regulation E-1 (Off. J. SFRJ No. 52/88)
- IAEA 50-C/SG-Q

It consists of the Statement of Policy and Authority, the QA Plan, and associated procedures. The Statement of Policy and Authority, issued by the Krško NPP Management Board, declares the overall policy for the Krško NPP, i.e. “to operate the Krško NPP in a manner which ensures the safety and health of the public, and the personnel on site”. This policy includes also a commitment that the Krško NPP shall comply with all the relevant codes, standards and guides applicable to the operation of the Krško NPP.

The Krško NPP developed the following Quality Systems Manuals/Directives:
- Krško NPP Quality Assurance Plan (QD-1),
- Quality Control Plan (QD-2),
- Training Programme of the Krško NPP Personnel in the Area of Quality Assurance (QD-3),
- Programme of Inspection of the Secondary Systems - Erosion/Corrosion (QD-4),
- Programme of Inspection of the Fire Protection System (QD-5)
- Quality Assurance Manual – Laboratory for dosimetry (QD-6)
- Inspection Programme for Pressure Vessels (QD-7).

The Quality Assurance Programme includes all planned and systematic actions taken by the Krško NPP, including the suppliers, contractors and consultants. This provides adequate confidence that the structures, systems and components shall perform the intended safety function in a satisfactorily manner. The programme consists of the Quality Assurance Plan and applicable procedures, and is mandatory for all activities affecting safety-related functions of the nuclear power plant structures, systems and equipment. This can also be applied to non-safety-related items as deemed appropriate by the plant management.

The QA Plan is a top-level quality document for operational phase activities. The requirements, identified in the QA Plan, are implemented according to management
directives, programs, plans, procedures or instructions, grouped in plant level manuals, division level manuals and department level manuals and programs. The QA Plan contains eighteen sections, relating to the eighteen criteria of 10CFR50, Appendix B and the intent of the fourteen criteria of 50-C/SG-Q. As cross-referenced in the Quality Assurance Plan, the subject of each section of the plan relates to the criterion on that subject found in 10CFR50, Appendix B and 50-C/SG-Q.

The quality management system, which includes quality assurance activities, is outlined in the established Plant Corrective Action Program (CAP). The CAP, besides the requested corrective actions and analysis, is spread on the non-conformances, audits and observation findings with different codes used for trending issues. Internal audits cover the functional and the cross-functional area in accordance with WANO Guidelines. The Krško NPP implementing procedures are in compliance with the purpose of new IAEA safety standards, such as GS-R-3 and GS-G-3.1.

Due to the Krško NPP’s policy to monitor and constantly upgrade its nuclear safety and QA requirements, the Krško NPP has constantly been following the efforts of nuclear industry (WANO, IMPO, EPRI, ASME, and other) and upgrading its management system to improve nuclear safety and to excel in operation.

The Krško NPP introduced an integrated management system which links together different quality systems and works as an upgrade of nuclear safety and quality requirements in its MD-1 Program “Commitments and Goals of the Krško NPP”. The Krško NPP has adopted various improvements such as safety culture, nuclear safety, activity monitoring and verification, self-assessment, plant performance indicators, corrective action program, environment protection, industrial safety, and long-term planning – cost adjustments through the integrated management system. These improvements do not only cover the GS-R-3 Safety Guide requirements but also exceeds them.

In conclusion, the Slovenian regulations and practices are in compliance with the obligations of Article 13.
ARTICLE 14. ASSESSMENT AND VERIFICATION OF SAFETY

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

(I) comprehensive and systematic safety assessments are carried out before the construction and commissioning of a nuclear installation and throughout its life. Such assessments shall be well documented, subsequently updated in the light of operating experience and significant new safety information, and reviewed under the authority of the regulatory body;

(II) verification by analysis, surveillance, testing and inspection is carried out to ensure that the physical state and the operation of a nuclear installation continue to be in accordance with its design, applicable national safety requirements, and operational limits and conditions.

14.1 Comprehensive and Systematic Safety Assessment

14.1.1 Regulatory requirements

The assessment of safety before the construction of a nuclear facility is assured through the provisions of the 2002 Act. It is ensured through the provision that an application for license shall contain project documentation, Safety Analysis Report and the opinion of an appointed expert for radiation and nuclear safety.

The safety analysis report must include at least the following: 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.

Since the last two Review Meetings, a new secondary legislation was adopted (see Article 7). Its purpose is to regulate radiation and nuclear safety, as well as operational safety of radiation and nuclear facilities.

The Rules on Radiation and Nuclear Safety Factors (JV5) provide more detailed requirements for the assessment of safety before the construction and commissioning of a nuclear facility.

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

The content of the safety analysis report is prescribed in Regulation JV5. The Safety Analysis Report must be amended when the changes of the situation arise during the construction or decommissioning of the facility or during the period of trial operation, and throughout its lifetime.

The 2002 Act and the Regulation JV9 require that for each intended change relating to the facility or to the management method used or to the operation, including maintenance work, inspection, testing or the introduction of a technical, organizational or some 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.
The 2002 Act requires that the licensee of a nuclear facility ensures regular, complete and systematic assessment and examination of radiation or nuclear safety of the facility by the periodic safety review (PSR) which has to be performed in the period of ten years. Detailed information about performing PSR is presented in Rules JV9 and in the practical guidance issued by the SNSA.

The operator must draw up a report on the periodic safety review and hand it over to the SNSA for approval. If its findings require the changes of the conditions of operation or the limitations from the safety analysis report in order to improve radiation or nuclear safety, the licensee must draw up a proposal for the required changes. The approved report on the periodic safety review is a condition for the operating license renewal.

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, 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.

### 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 accordance with United States 10 CFR 50.59.

A set of about 20 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 (i.e. Art. 83 for the authorization of modifications in nuclear and radiation facilities) and more specifically in Rules JV9 (Chapter IV, Appendices 7 and 8). The SNSA reviews in detail the submitted documentation and assess it. In case of the modifications of 3rd category the review and assessment are also done by TSOs who write a technical opinion and submit it to the regulatory body. The methodology to be used for the assessment and classification of changes is set in Rules JV9.

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, radiation sources base, contracts, open problems, the SNSA to-do system, the register of persons and organizations and the Krško NPP PSA model is accessible through the information system.

The adequacy of the Krško NPP design modification process has been proven in practice through several major modifications.

Since the 4th Review Meeting, the SNSA has approved 31 modifications of 3rd category on the facility and agreed to 83 other modifications, (2nd category).

14.2 Verification of Safety

The Krško NPP follows the requirements of the United States Nuclear Regulatory Commission regulations and other international practices. An overall "Programme on Inspection of Performance and Equipment Ageing" has been developed with the purpose to determine activities for ensuring long-term reliable plant operation and the supervision over ageing of structures, systems and components. The programme connects different plant programmes, such as In-Service Inspection (ISI) Programme, Containment Inspection Programme, MOV Programme, Snubber Programme, Erosion Corrosion Monitoring Programme, Steam Generators Programme, AOV Programme, Ageing Management Programme, Environmental Qualification Programme and Pressure Vessel Programme, to determine qualitative guidelines for maintaining high availability and reliability of components. Therefore it helps to improve the existing preventive maintenance programmes; the inspection programmes; the timely, appropriate and effective maintenance activities; the timely and effective equipment replacement on the basis of ageing evaluation; the long-term planning of major replacements and special replacements, maintenance and inspection activities.

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.

In-Service Inspection, Corrosion and Erosion Monitoring programmes are created by plant specialists for the primary and secondary side and are carried out by the plant’s specialists and subcontractors. All programs are in compliance with the regulatory policy 10 CFR50.55 and ASME Code XI, Amendment 8. The results of the In-Service Inspection are reviewed and evaluated after each outage. The procedure for the correction of deviations has been established.

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.

A common, integrated **Ageing Management Programme (AMP)** was developed in accordance with the NRC requirements from 10 CFR 50.54 (License Renewal Program). The objective of the AMP is to determine whether ageing processes are being managed effectively and required safety margins are maintained. The ageing management programme was completed by the end of 2008. Information about AMP is also presented in the report (see Chapter C.iii in the Appendix II).

With the purpose of establishing and to maintain 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. The EQ program is in the phase of implementation and will be finished until the end of 2010. Since the 4th review meeting, more modifications have been carried out with the purpose to meet EQ requirements (e.g. replacement of the equipment).

### 14.3 Regulatory Surveillance

The Slovenian Nuclear Safety Administration carries out its surveillance responsibilities with a combination of inspections, review of documents, approval of modifications and regular monitoring and evaluation of the NPP's performance. During the refuelling, Technical Support Organizations are engaged to cover (inspect and evaluate) parts of plant maintenance and testing. The Slovenian Nuclear Safety Administration does not have resident inspectors on site. Inspectors, based at their headquarters in Ljubljana about 100 km from the plant, visit the facility about twice a week. Yearly, there are about 100 inspection days on site during non-outage years. Furthermore, the inspectors are present every day at the NPP during the outages.

During plant outages, more frequent inspections over the plant staff and subcontractors work are performed. 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 safety performance indicators and operational experience (OE):

- **At the end of 2007, the SNSA initiated the new regulatory approach in supervising the Krško NPP through its own set of 46 safety and 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 presentation of current indicators status is available on the SNSA intranet through arrows and colour demonstration that enables a quick identification of potential problems.**

- The SNSA has developed its own system for tracking, screening and evaluating the OE of the nuclear installations. The SNSA staff regularly tracks the operating experiences throughout the world and screens them on the bases of applicability.
for 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 evaluate the conditions of the Slovenian facilities and appropriate corrective actions are considered.

**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) that follows the IAEA Standard Series No. 115. The occupational limit for effective dose is set to 20 mSv per year. For specially authorised exposures in exceptional circumstances, a higher limit can be allowed but not higher than 50 mSv per year and 100 mSv in five consecutive years. Special limits are set also for other groups such as apprentices and students, pregnant women (for an unborn child), and for intervention workers. Besides those, an annual limit for equivalent dose for eye lenses is set to 150 mSv, and for both, skin and extremities, to 500 mSv.

Individual exposures are measured with thermoluminiscence dosimeters by approved service providers. The Krško Nuclear power plant has its own 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.

Collective dose in the Krško NPP – dose distribution between regular operational works and outage. The low values in 2005 and 2008 were due the absence of refuelling outage.

Figure above shows the collective doses in the Krško NPP in the last decade (2000-2009). After 2000, when both steam generators were replaced, collective doses
reached the values usually reported for pressurised water reactors. No cases with effective dose exceeding the limit of 20 mSv were detected.

Each year, between 800 and 900 workers are under dosimetric control in the Krško NPP, including plant personnel and outside workers. About 80% of the collective dose belongs to the outside workers (contractors).

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 shall be the sum of partial exposures, taking 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.

The exposure of population is regulated also by the limitations of gaseous and liquid discharges. The environmental radioactivity monitoring of the nuclear installation was defined in the Rules on the Monitoring of Radioactivity (OJ RS, 20/07).

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 (without 3H) and for 3H separately. Besides annual limits, the quarterly limits were also set. The annual limits for gaseous releases are given for noble gases (in 133Xe equivalent), radionuclide (in 131I equivalent) and aerosols. Atmospheric releases of 3H and 14C are not limited.

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.

![Graph of annual discharged activity of 3H in liquid effluents. Higher authorized limit of 45 TBq per year was approved in 2007.](image-url)
The gaseous release activities for fission and activation products, iodine and aerosols in the period 2007-2009 were less than 1% of the limiting values. In 2005 and 2006, when the NPP started to operate in a longer, 18-month fuel cycle, a particular problem was tritium production and its liquid releases. In the first quarter of 2006, the authorised release limit of 8 TBq was even exceeded. The NPP applied for the new limits, i.e. 45 TBq annually (the previous value was 20 TBq) with no quarterly limit. The SNSA approved the new values but at the same time lowered the limit for fission products in liquid discharges to a half of the previous value. In the period 2008-2009, the levels of $^3$H decreased even below the long-term values of the period 1999-2007. The discharged activity in liquid effluents (other than $^3$H) amounted to less than 1% of the annual limit.

The monitoring programme includes measurements of radioactive discharges and radioactivity measurements in the environment. The measurements of radioactive discharges are performed by the nuclear power plant itself. Also, these measurements are partly a subject of regular intercomparison measurements, performed by technical support organisations. The EU verification commission (according to the Article 35 EURATOM Treaty) visited Slovenia in 2006 and reviewed the monitoring of radioactive discharges at the Krško NPP together with the environmental radioactivity monitoring in the surroundings of the plant. The final report of the verification mission, elaborated at the end of 2007, comprised two main requirements: (1) establishing an independent monitoring programme and (2) the accreditation of laboratories involved in radioactivity monitoring. Both requirements were completely fulfilled in 2008.

The monitoring programme of environmental radioactivity is performed exclusively by the technical support organisations and comprises the radioactivity measurements of surface and ground water, sediments and water biota, precipitation, air particulate and iodine, soil, crops and vegetation, and external radiation. Laboratories involved have to be accredited and approved to carry out these measurements. Until now, the monitoring programme has been directly contracted between the NPP and TSOs performing the measurements. According to the new regulations, issued in March 2007, the independent monitoring programme was also provided, which is financed by the competent authority (the SNSA).

The automatic radiation monitoring system was developed in Slovenia in the early nineties and initially started with dose-rate measurements in the environment of the Krško NPP. Currently, 13 stations are surrounding the plant and besides those, two aerosol measuring stations were installed, one on the site and the other 2 km away from the NPP. All incoming data from the NPP and from the national wide network altogether 75 stations for external radiation and 3 stations for airborne radioactivity are collected at the SNSA.

The monitoring results and the modelling of radioactive discharges of the Krško NPP showed that the annual effective dose for a member of the reference group due to the plant operation was estimated to be around 1 μSv. Most of this figure is due to the intake of the radionuclide C-14 discharged into the atmosphere and only a small part of annual public exposure comes from liquid discharges to the river Sava. Other exposure pathways are radiologically far less important.

15.3 Implementation of the optimisation principle (ALARA)

Every radiation practice may cause exposure only to the level which is as low as achievable with reasonable measures, taking into account economic and social factors (the principle of radiation protection optimisation). Radiation protection in
the NPP is effectuated by the special radiation protection unit, functioning separately from other organisational units. There are about twenty of well educated and trained engineers and technicians in the unit, which perform tasks based on the internal, written procedures.

The independent qualified expert in a nuclear power plant prepares an overall assessment of radiation protection at the NPP site and gives twice a year his/her opinion regarding the activities of the NPP radiation protection unit. In the cases (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 consider and 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. In the Krško NPP, the following ALARA measures were implemented for reducing the collective dose: careful ALARA planning, daily follow up of doses/planning, dose-rate reduction, the temporary use of shields, organisational changes; the reduction of time spend by member of the personnel in controlled areas, the additional training to shorten the time for particular works, the decontamination of equipment, the use of electronic dosimeters with a preset alarm.

15.4 Regulatory Control Activities

According to the 2002 Act, the Krško NPP applied for additional licences, 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.

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. 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 inspections conducted by the SNSA inspectors were mainly focused on upgrading the radiation protection measures at a site due to the fact that the legislation was in the process of very intensive changes in the last three years.

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 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 latest consolidated version of the Protection against Natural and Other Disasters Act (Official Gazette, 51/06), issued in 2006. 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, namely the Administration of the Republic of Slovenia 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 that the operator includes in the safety analysis report, which is the principal licensing document, a complete radiological emergency response plan, prepared in line with the civil protection regulations. The 2002 Act provisions mostly focus on the intervention measures to be taken in the case of an emergency. According to these provisions, the operator must 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 with all requested information available to the operator. The operator must stipulate about important facts in the emergency plans, about which the public needs to be informed. The ministry accountable for environment shall give notice to other states about the potential trans-national emergency in compliance with the international conventions.

The Decree on Preparation and Contents of the Emergency Plans (Official Gazette 3/2002 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 five years. Emergency plans are public documents and should be presented to the public within 90 days after their adoption.
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.

At the end of 2007, the SNSA began a comprehensive revision of its emergency plan for preparedness and response. The SNSA emergency organization was simplified, all operational procedures were revised and many new procedures were issued. The SNSA's Intranet was included in the SNSA emergency preparedness system as a main information hub.

One of major improvements during the revision, which was finished in 2009, was a new tool for internal communication during an emergency, called KSID - Communication System during an Emergency. The KSID, developed by the SNSA, is a simple web application for prompt, direct and safe exchange of information among all SNSA emergency team members at the same time. Since the KSID turned out to be effective, the SNSA developed a similar application, called MKSID for external communication among all main Slovenian emergency organizations. During 2008, the MKSID was adopted by the ACPDR, the Slovenian National Warning Point (CORS) and the Krško NPP (The Technical Support Centre and the Off-site Support Centre). The MKSID was successfully validated during the 2008 national NPP.

The national exercise of 2008 showed the need to revise the national emergency plan. The SNSA has several issues with the exercise conclusions as well as the national plan. Therefore, the Administration strongly supported a major revision of the national plan, so that radiological emergency was also incorporated. The revision was carried out in 2009 by a national working group established for this purpose, which included members from all levels of emergency planning in Slovenia.

The revised National Nuclear and Radiological Emergency Plan is to be adopted in 2010. It includes a number of improvements and new solutions, e.g. MKSID. Also, the coordination of the Mobile Unit was agreed, so that, according to the revised plan, the unit would be directed by the SNSA and coordinated by the Unit for a rapid rescue intervention during an emergency. The plan has numerous attachments and appendices, from which many of them still have to be developed. Thus the work on national emergency planning continues.

In the Training Centre for Civil Protection and Disaster Relief, between 250 and 300 emergency team members, capable of also taking part in nuclear or radiological emergencies, are trained every year.

In 2009, the SNSA started a campaign to solve the issue of iodine prophylaxis. The regulation that was in force was not operational enough to assure effective iodine prophylaxis as a protective measure during an emergency. A multidisciplinary working group was established, which drafted a new regulation based upon best international practices. The regulation is to be adopted by the Government in 2010. The principal novelty is that the iodide tablets are going to be pre-distributed in 10 km radius around the Krško NPP.

Throughout the reporting period, the Krško NPP maintained the operability of emergency centres and equipment, updated emergency documentation and performed systematic monthly communication testing and checking of emergency
personnel response. The Krško NPP Emergency Plan, revision no. 26, was issued in January 2010.

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 was distributed to all households in the municipalities around the Krško NPP at the time of the national exercise in 2008.

16.4 Training and Exercises

The Krško NPP has a long tradition in systematic training of personnel for emergency response. Besides regular training, they carry out annual exercises to which other players are invited as well (see below).

The regular annual NPP exercises were carried out in December 2007, October 2008 and October 2009. The course of the accidents was simulated on the Krško NPP full scope simulator. Participants included the NPP, the SNSA and National and Regional Warning Points (CORS and ReCO).

The 2008 NPP exercise was national and included Regional and National Civil Defence Headquarters, different ministries, governmental bodies, and others. The national exercise, which was a staff exercise, was conducted on 20 and 21 October. It started with an unusual event, about which competent authorities were informed in accordance with the procedures. Adequate operating, corrective and protective measures were taken on the site and the intervention personnel and the centres for the control of the event participated. The assessment of radiological consequences was made and external institutions were activated. Very important for the decision on implementation of protective measures for residents were the meteorological conditions.

Because of the long duration of the exercise, it was carried out in shifts. All the planned goals were achieved. The exercise demonstrated good preparedness of the plant and the participating external institutions in all components of the control of emergency that were tested. Some deficiencies showed which were established in the national report, and would be solved in accordance with the action plan.

The International Atomic Energy Agency (IAEA) organized an international exercise ConvEx-3 2008 to verify the response to a simulated nuclear accident at the Mexican nuclear power plant Laguna Verde. The exercise was conducted from 9 to 10 July 2008 and lasted continuously for 48 hours. 74 IAEA member states and 10 international organizations participated in the exercise. The SNSA and the National Warning Point (CORS) also took part in this international exercise.

The SNSA actively and regularly cooperates with domestic and international organizations and emergency agencies on maintaining and updating emergency preparedness.

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 and Hungary on the early exchange of information in the event of a radiological
emergency. Emergency preparedness is a regular item on the agenda at bilateral meetings with Austria and at the quadrilateral meetings of the Czech Republic, Hungary, Slovakia and Slovenia, which are held every year.

A Slovenian delegate represents the East European Countries (EENCA) in the National Competent Authorities Coordinating Group (NCACG) in the period from 2008 to 2010. This group was established to maintain contacts among the National Competent Authorities in the period between two biennial meetings of the National Competent Authorities representatives. The National Competent Authorities Coordinating Group mainly deals with the implementation of the Action Plan for Strengthening the International Preparedness and the Response System for Nuclear and Radiological Emergencies, which was adopted by the IAEA Board of Governors in 2004.

In July 2007 and in July 2009, Slovenia was present at the fourth and fifth Meetings of Representatives of Competent Authorities identified under the Early Notification and Assistance Conventions.

Slovenia sent a participant to the IAEA Consultancy Meeting on the development of the USIE. The USIE is a new unified system for reporting emergencies, which was merged from ENAC and NEWS. Slovenia sent a participant to another IAEA Consultancy Meeting on the development of a new EPR-EMBARKING document, which would provide help to develop emergency preparedness and response for countries, which are yet to embark on nuclear power program.

The SNSA regularly and actively participates at the ECURIE meetings in order to assure the operation of the CoDecS system.

16.6 Media Alarm due to the Event in the Krško NPP on 4th June 2008

On Wednesday, 4 June 2008 at 15:07, a leak from the primary system to the containment was detected by the Krško NPP operating personnel. Since the leak was larger than allowed, the plant started controlled shutdown from 98.6% power by 5 MW/min. The generator was disconnected from the grid at 19:30 and the reactor was subcritical at 19:50.

The Krško NPP announced the unusual event on at 15:56. The Slovenian national and regional warning points and the SNSA were notified.

The SNSA inspector on duty was called first. He informed the SNSA director about the event at 16:09. The SNSA director promptly decided to partially activate the SNSA expert team for managing emergency situations.

At 17:38, the SNSA sent the first message about the event to the European Commission (EC) as an alert to the ECURIE system. At 18:00, the ECURIE office head forwarded the SNSA message to all national centres in Europe.

The SNSA prepared and exchanged a draft summary of its press release for the public with the Krško NPP at 18:08 and then issued it at 18:16. A few minutes later, the Krško NPP also issued the same press release.

Between 18:35 and 19:00, the SNSA sent the report to the IAEA and the competent authorities of Austria, Hungary, Croatia and Italy.

At around 19:30, the EC issued a press release about the event, which set off extraordinary interest all across Europe. Immediately after that, the media pressure to all competent authorities started and continued until the next day. Because of
high media pressure, the SNSA published additional press releases at the SNSA website and sent additional information to the ECURIE system.

In November 2008, a meeting of the ECURIE member states and European Commission was held in Brussels to discuss the event. It was determined that Slovenia did not need to send an alert message in this case, but on the other hand, Slovenia was following the recommendations to communicate transparently and to report minor events as well. The press release of European Commission was found to be too alarming and has started a large media alarm throughout Europe. Later, the European Commission prepared improved criteria for reporting to the ECURIE system. The criteria about when to report were elaborated in greater detail.

In the future, similar cases will be announced as information messages with a new keyword «incident». In the future, the Commission will consult with the country, where the event is taking place, before issuing any press releases.

The Slovenian government formed a commission to investigate the event. The commission concluded that the actions were in accordance with expectations, but with some deficiencies. The commission suggested that the procedures for emergency information should be improved, that emergency exercises should be carried out regularly also in the future and that the Slovenian competent authorities and the European Commission should improve the procedures for similar cases.

**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 subparagraphs (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 Legislation Framework

The procedure in the licensing process of a nuclear facility is stipulated with the 2002 Act, the Environment Protection Act (consolidated text - Official Gazette RS, No. 39/06), the new Spatial Planning Act (Official Gazette RS, No. 33/07 with changes), the Construction Act (consolidated text - Official Gazette RS, No. 102/04 with changes), new regulation JV5 the Rules on radiation and nuclear safety factors, the Decree on Categories of Projects for which an Environmental Impact Assessment is Mandatory (consolidated text - Official Gazette RS, No. 78/06) 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 above mentioned legislation provides the framework to determine which nuclear and radiation safety documentation and documentation for environmental impact assessment is necessary, which consents and licenses are issued and what is the participation of the public and/or the neighbouring states.

17.2 Impact of the Installation on Individuals, Society and Environment

According to the 2002 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 Special Safety Analysis (SSA), the Environmental Impact Assessment (EIA) and the Safety Analysis Report (SAR). The content of all three documents is similar, but their extent and scope differ, as the level of details presented increases from the SSA to the SAR and each stage is a re-evaluation of safety.

Article 64 (the location of a nuclear facility) and Article 65 (the analysis of the safety of a site for the location of a nuclear facility) of the 2002 Act determine that the selection of a site for the location of a nuclear facility shall be based on a Special Safety Analysis. The SSA 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.

The SSA shall include:

- field investigations and analysis of characteristics of the site area (e.g. geological, seismological, seismotectonic, 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 Special Safety Analysis are determined by the SNSA at the beginning of the siting process. Special Safety Analysis is a standalone document, focused on nuclear and radiation safety, but considered as a part of the Environmental Report which covers various impacts of the facility on the environment and members of the public.

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 new Regulation JV5.

According to the Spatial Planning 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 (NSP). The purpose of the NSP is to give the holistic estimation of environmental impacts. An Environmental Report is written, which gives sufficient information on whether the impacts that the facility might have on the environment and members of the public are acceptable. The Special Safety Analysis is added to the report, which covers the aspects of nuclear and radiation safety. After the preparation of the Environmental Report and the Special Safety Analysis, these documents are subject to public hearing and the consultation with neighbouring states (in the case of cross-boundary impacts) and become public documents. Public hearing must last 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 NSP is adopted with a governmental decree. Together with adoption of the NSP, 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. Similarly to the Environmental Report in the NSP stage, the EIA is subdued to public hearing and consultation with neighbouring states. Before issuing the environmental protection consent, the EARS must obtain positive opinions from competent ministries and
organizations and a preliminary consent on nuclear and radiation safety from the SNSA.

17.3 Re-evaluation of Site Related Factors

According to the 2002 Act and new Rules JV9, a nuclear installation performs a periodic safety review (PSR) at least every 10 years. With a PSR programme, a nuclear facility systematically reviews the cumulative effects of ageing, changes of the object and changes of environment parameters on the facility. Operating experiences and technical development are also taken into account. The purpose of the PSR is to systematically re-examine facility’s concordance with licensed design basis, valid international standards and good practice.

With the PSR, the operator of the nuclear installation systematically evaluates and reassess all areas of nuclear and radiation safety, including the impacts of external hazards (re-evaluated, newly emerged or potential risks), e.g. site safety.

Recent site reassessments in Slovenia include probabilistic seismic hazard analysis, fire hazard analysis and station black-out analysis. The most recent is probable maximum flood study, which re-evaluated the potential for external flooding considering new methodology according to ANSI/ANS-2.8-1992, hydrological data and new upstream hydro power plant dams. The results show that the flood protection needs to be redesigned.

17.4 Consultation with Other Contracting Parties

Public involvement in the siting process is assured 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 (NSP), Environmental Report and the Special Safety Analysis to the general public and the consultation with neighbouring states taking into account the Espoo Convention in the NSP stage of the siting. A similar procedure is followed in the process of obtaining environmental protection consent, for which an EIA is required. The public presentation must be available 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 NSP and the environmental protection consent are adopted and issued respectively after positive opinions of all competent ministries, organizations and local communities have been adopted.

In the last stage, the investor needs to obtain the construction license together with the Safety Analysis Report attached, 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 that demonstrates their legal interest has the right to participate in the licensing procedure.

In conclusion, the Slovenian regulations and practices are in compliance with the obligations of Article 17.
ARTICLE 18. DESIGN AND CONSTRUCTION

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

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

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

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

18.1 Implementation of Defence in Depth

The construction license for a nuclear facility is issued by the Ministry of the Environment 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 2002 Act). 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 new Rules JV5.

The 2002 Act and the new 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.

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, and so on.

The introduction of Severe Accident Management Guides (SAMG) has been strongly encouraged by the SNSA. Thus, many SAMGs were introduced at the Krško NPP in 2000. Also, the new Rules JV9 introduced formal requirements for SAMGs in accordance with WENRA harmonized requirements. The back-fitting of the NPP to deal with severe accidents has not formally been required. The issue has been addressed at several occasions, such as at the IAEA RAMP mission, the PSA based analyses and the PSR. Most of the issues could be closed, the wet cavity approach has been adopted and decision has been made to add an additional full scope emergency diesel generator. Since studies based on the state-of-the-art knowledge showed that steam explosions are highly unlikely to challenge the containment of the Krško NPP, no back-fitting regarding this phenomenon is needed. The issue of hydrogen is still discussed and an appropriate analysis is under way, but due to a large containment and presence of thermal recombiners, the issue is not likely to result in a substantial back-fitting.

Most important design improvements implemented in the Krško NPP based on results of deterministic and probabilistic safety assessments were:
Article 18  Design and Construction

- 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.

The last modification was implemented during this reporting period.

18.2 Incorporation of Proven Technology

The new Rules JV5 stipulate the use of proven technology as one of the fundamental design principles. Even before its admission, the SNSA stimulated the use of proven technologies by stressing its importance during modification licensing. The modifications for which the plant demonstrates 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.

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:

the initial authorization 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;

(I) 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;

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

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

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

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

(VI) 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;

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

19.1 Initial Authorization for Operation

After the construction of the facility is completed, the investor applies for the
license for the use of the facility, as stipulated by the Construction Act. Before such
license is issued, technical check and 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
concordance 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.85/09) 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 17 changes of Technical Specifications during the last 3 years that were defined as 3rd category modifications and 3 changes, defined as 2nd category modifications.

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 Updated Safety Analysis Report (USAR) comprises the Initial Test Program, which defines Preoperational Testing and Initial Startup Testing. General testing and inspection requirements for systems and components, including the Technical Specifications, are described in the appropriate USAR 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 USAR, 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.

In the field of maintenance, the Krško NPP has developed the following programs: Preventive Maintenance (separate programs for each specific set of equipment), 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: 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 3rd 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.
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 to a certain extent at the plant.

Other engineering and technical support is assured through outsourcing at Slovenian research and engineering organisations or from abroad. However, major projects require an open bidding process. The Ministry of Higher Education, Science and Technology financially supports research and development projects in the field of nuclear safety in the Republic of Slovenia through a research fund with the participation of the nuclear industry and the Slovenian Nuclear Safety Administration. In the period from 2007 to 2009, the SNSA also financially supported some projects in the field of the application of radiation monitoring, equipment ageing, and in the area of radioactive waste repositories.

19.6 Incidents, Significant to Safety

Article 87 of the 2002 Act (reporting on the operation of facility) stipulates that operator must submit exceptional 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 agencies about the accidental condition as soon as possible.

The Rules JV9 on operational safety of radiation and nuclear facilities (Official Gazette No.85/09) 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 2007 to 2009, the Krško NPP reported 20 events as requested by Technical Specification, none of which caused an unplanned shutdown or degradation of nuclear or radiological safety. Besides the above mentioned events, the Krško NPP was forced to perform a normal shutdown on 4th June 2008 due to an excessive primary system leakage.
Although the event posed a threat to nuclear and radiological safety, there were no negative consequences or any radiological releases to the environment. However, it did attract unprecedented media attraction, described in paragraph 16.6 of this report. The course of the event was under control the whole time, therefore an automatic safety system actuation was not required. All events and the proposed actions to correct the consequences of these events were monitored by the SNSA. All events were analyzed by the SNSA with engineering judgments.

On 4 June 2008 at 15:07 hours, the operators in the control room detected increased primary system leakage. The approximate calculated leakage value of 3 cubic metres per hour (m³/h) was above the limit for unidentified leakage of 0.227 m³/h as stipulated by the plant technical specifications. The leakage was confirmed by level increase in the reactor coolant drain tank and increased radiation monitoring values in the containment. The operators began to reduce power at 16:50. The plant was shut down at 19:50. In the meantime, the nuclear power plant did not enter into a condition that would require automatic safety system actuation. After entering the containment, the staff found the leakage spot on the seal seat of the valve that isolates temperature manifold 2 inch line on the primary loop. The valve was replaced with a new one. The compartments and the equipment exposed to the leaking primary coolant were cleaned and checked within the scope of the plant corrosion program. On 9 June 2008 at 5:20, the reactor was critical again. During the whole event, about 70 m³ of primary coolant was released into the containment. There was no radiological release to the environment. The received doses of the staff that performed corrective actions were within the legislative limits. On the INES scale, the event was estimated with the lowest grade 0 – no safety significance.

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 Analyze 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 handled within 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 kind of operating experiences, including other than incidents. It covers both events in the Krško NPP as well as international operating experiences, which could be applicable to the nuclear safety in Slovenia. It is described in internal procedures (Monitoring of Foreign Operational Experiences). The results of such screening and analyses are communicated internationally either through formal channels like IRS or during various international meetings and conferences. In the period from 2007 to 2009, 97 potentially interesting events were evaluated in detail for applicability in the Krško NPP.

In the area of the assessment of operating experience, the plant performance monitoring program covers about 90 indicators. The Krško NPP has been collecting performance indicators for many years and preparing annual reports that provide results for the international performance indicators defined by the World Association of Nuclear Operators (WANO).

Besides the Krško NPP set of indicators, the SNSA developed an internal set of indicators. With respect to Krško NPP indicators and yearly reporting, some SNSA indicators are evaluated through monthly or quarterly periods.

### 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 system is constructed to collect, process, store and package waste in a suitable form and minimise releases into the environment.
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 (two super compaction campaigns, In-drum Drying System, purchase of the super compactor). With the 18-month fuel cycle, the generation of radioactive wastes is additionally reduced.

To reduce the volume of solid radioactive waste to be stored, two 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. In 2006, the Krško NPP started continuous compression of radioactive waste with their super-compactor installed in the storage facility. In 2008, there were 115 standard drums with compressible and other waste. In December 2008, 250 standard drums with compressible and other waste with total mass 27.7 tons and volume 52 m³ were sent to incineration to Sweden. Secondary waste was returned to the Krško NPP in November 2009.

Incineration of contaminated blow-down ion exchange resin from the past operation is planned.

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 LILW 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 Programme of Decommissioning 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 Commission. In the 2009, the new revision of the decommissioning programme was launched.

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


- Rules on the specialist council on radiation and nuclear safety - JV1 (Off. Gaz. RS, 35/2003),
- Rules on the requirements of using ionising radiation sources in healthcare - SV3 (Off. Gaz. RS, 111/2003),
- 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 the requirements and methodology of dose assessment for the radiation protection of the population and exposed workers- UV8 (Off. Gaz. RS, 134/2003, 100/2008),
- Rules on health surveillance of exposed workers- SV6 (Off. Gaz. RS, 2/2004),
- 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 approving of experts performing professional tasks in the field of ionising radiation - SV7 (Off. Gaz. RS,18/2004),
- Rules on the method of keeping records of personal doses due to exposure to ionizing radiation - SV4 (Off. Gaz. RS,33/2004),
- 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),
- Decree on dose limits, radioactive contamination and intervention levels - UV2 (Off.Gaz.RS,49/2004),
- Rules on physical protection of nuclear materials, nuclear facilities and radiation facilities - FV1 (Off. Gaz. RS, 31/2005),
- Rules on the conditions for workers who carry out physical protection of nuclear materials, nuclear facilities or radiation facilities and on the conditions for workers who have access to nuclear materials as well as on other conditions with respect to physical protection - FV2 (Off. Gaz. RS, 36/2005 and 64/2005),
- Regulation on conditions to be fulfilled by workers performing safety-significant tasks at nuclear or radiation facilities - JV4 (Off. Gaz. RS, 74/2005),
- Rules on radioactive waste and spent fuel management - JV7 (Off. Gaz. RS, 49/2006),
- Rules on the monitoring of radioactivity - JV10 (Off. Gaz. RS, 20/07, 97/2009),
Appendices

- Decree on checking the radioactivity for shipments of metal scrap - UV11 (Off. Gaz. RS, 84/2007)
- Decree on safeguarding of nuclear materials - UV 6 (Off. Gaz. RS, 34/2008)

In addition to the above mentioned decrees/regulations, the 2002 Act has been used as a basis for the adoption of the following legal documents:

- Rules on the Conditions to be met by Primary Health Care Centres for Breast – SV 10 (Off. Gaz. RS, 110/2004),
- 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.2 Other legislation

Third Party Nuclear Liability

- Act on Third Party Liability for Nuclear Damage (Off. Gaz. SFRY, 22/1978 and 34/1979);

Decommissioning of the Nuclear Power Plant Krško


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),

Civil Protection and Disaster Relief

- Act on Protection against Natural and Other Disasters (Off. Gaz. RS, 64/94 and subsequent amendments),
Administrative

- Act on Public Administration (Off. Gaz. RS, 52/2002 and subsequent modifications),
- Act on General Administrative Procedure (Off. Gaz. RS, 80/1999 and subsequent modifications),
- Act on Administrative Fees (Off. Gaz. RS, 80/2000 and subsequent amendments),
- Decree on Administrative Authorities within Ministries (Off. Gaz. RS, 58/2003 and subsequent amendments)

Energy

- Energy Act (Off. Gaz. RS, 79/1999 and subsequent modifications);

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 Projects for Which the Environmental Impact Assessment is mandatory (Off. Gaz. RS, 66/1996 and subsequent amendments);

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);
- 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

Based on the Slovenian Constitution all announced 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,
− 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,
− 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),
− Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management,
− 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,
− 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,

B.2 Bilateral agreements

− Act ratifying the Agreement between the Kingdom of Belgium, the Kingdom of Denmark, the Federal Republic of Germany, Ireland, the Italian Republic, the Grand Duchy of Luxembourg, the Kingdom of the Netherlands, the European Atomic Energy Community and the International Atomic Energy Agency in implementation of Article III (1) and (4) of the Treaty on the non-proliferation of nuclear weapons,
− Act ratifying the Additional Protocol to the Agreement between the Kingdom of Belgium, the Kingdom of Denmark, the Federal Republic of Germany, the Italian Republic, the Grand Duchy of Luxembourg, the Kingdom of the Netherlands, the European Atomic Energy Community and the International Atomic Energy Agency in implementation of Article III (1) and (4) of the Treaty on the non-proliferation of nuclear weapons
− 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,
Appendices

- 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,
- Agreement between the Governments of the Republic of Slovenia and the Republic of Croatia on Settlement of Status and Other Legal Relations Regarding Investments
- 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)
APPENDIX II: CHALLENGES AND PLANNED MEASURES TO IMPROVE SAFETY

In 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 4th CNS review meeting.

A. Challenges

i. Lifetime Extension of the Krško NPP and Planning of the New-Builds

The Krško NPP has original design lifetime of 40 years, so it would reach the end of the original design lifetime in 2023. The application to extend the design lifetime has already been submitted to the SNSA, but it was incomplete. In the application, the Krško NPP tried to prove that it is fulfilling all requirements, as stated in Slovenian regulations, for 60 years of operation. In the same application, it is also asserting that the requirements for license renewal as defined in US NRC 10 CFR 54 are also fulfilled. The Slovenian regulations do not explicitly limit the design lifetime of nuclear power plants. Special provisions for the Krško NPP are in our most recent regulations, which define additional requirements if Krško NPP is to be granted design lifetime extension. Among others, it is stated in the requirements that the Krško NPP has to review again its ability to withstand severe accidents and, based on such review, implement all reasonable improvements. The decision on ageing management programme will most likely be issued before the end of 2010.

In October 2006, the Government of the Republic of Slovenia adopted the Resolution on national development projects for the period from 2007 to 2023, which also includes the project of building a new unit of the Krško nuclear power plant. The planned new unit shall have the capacity between 1100 and 1600 MW net, a yearly production between 7.5 and 12 TWh and shall be based on the newest technology, known as Generation III and/or Generation III+.

The possible investor into the new unit is GEN Energija d.o.o., which is also the owner of the Slovenian part of the Krško NPP (the Krško NPP is owned equally by the Republic of Slovenia and the Republic of Croatia). In years from 2007 to 2009, GEN Energija has already carried out several studies which discuss the feasibility and justification of the project of a new nuclear unit. In the beginning of 2010, the company applied to the Ministry of Economy for the energy permit for the new unit of the Krško NPP. At the moment, the adoption of a new revision of National Energy Programme of the Republic of Slovenia is in final stage. The new Energy Programme shall contain the possibility of a new nuclear power plant and will as such present a legal basis for the start of a siting process.

The SNSA is aware of the complexity of such project, and of the fact that at the moment, the SNSA does not have sufficient resources for licensing and overseeing the design, construction and operation of the possible new plant. That is why the SNSA established a special project team with the task to prepare the Administration for the possible building of the new nuclear power plant. In the beginning of 2009, the project team prepared the analysis of the licensing process, which is basically an overview of the processes of spatial planning and construction, as well as nuclear safety regulation. The purpose of the review of the whole process, from spatial planning to the issuing of the operating license, was to identify phases which will require most effort. Next step was to set the strategy for the review process and analyze and establish the basis for resource demands needed for the involvement of the SNSA and other stakeholder in the decision making in the process. This will enable establishing a qualified and effective infrastructure of the SNSA for a possible new nuclear build.
ii. Global Trends of the Sava River Temperature Increase

The water from Sava river is used for cooling Krško NPP safety systems and condensate cooling system. The operation of the Krško NPP is bound by temperature limits of the water from Sava river. The temperature limit of ultimate heat sink is set by the Krško NPP Technical Specifications to 26.7 degrees C. In case that the temperature of the river would exceed this limit, the Krško NPP is required to shutdown in 6 hours. The temperature limit of heat emission from the Krško NPP’s condensate cooling system is defined in the water usage permit for the Sava river. The limit of the water after mixing of hot water from the Krško NPP with the river is set to 28 degrees C. The temperature increase due to heat emission from the Krško NPP shall not exceed 3 degrees C.

Several studies have been performed in recent years to assess the trends of water temperature rising due to natural changes and due to human induced causes, such as the construction of the chain of hydro power plants with large accumulation basins. The effect of temperature increase was observed, especially in the conditions of low flow of the Sava river coincident with high temperature of the atmosphere. There were occasions when such temperature rise occurred, e.g. in July 2007, when maximum temperature observed reached almost 26 degrees C.

The Krško NPP reacted to these trends of water temperature rising by implementing design changes to the systems for the cooling of safety systems (Essential Service Water System - ESW) and condensate cooling system (CW). The heat load of the ESW was decreased in 2009, when the old water cooled chillers from the Chiller System, which used the ESW coolant, were removed. The new air-cooled chillers shall ensure a relief of ESW of about 150 m³/h and will allow increasing temperature limit of the ultimate heat sink. The new temperature limit for the ultimate heat sink shall be reviewed and approved by the SNSA. The Krško NPP constructed an additional cooling tower with four cooling cells. This increased the capacity as well as capability of condensate cooling system, which is now less dependent on the conditions of the Sava river (low flow, daily variations of flow, high temperature). The Krško NPP design provided cooling by the Sava river and additional 12 cooling cells. The construction of four additional cooling cells on the condensate cooling system shall assure higher energy production of the Krško NPP.

iii. Construction of Hydro Power Plants on the Sava River and Increased Likelihood of Flooding

There is an ongoing process of siting and construction of a chain of hydro power plants on the river Sava with large accumulations basins. These new facilities would have an effect on the Krško NPP safety, operation and environmental effects. A major effect on the nuclear safety of the Krško NPP is due to the flooding hazard because of river flow regulation and the possibility of river dams rupture subsequent flood wave. The mode of operation of hydro power plants can also influence the shape of flood waves. An increase of the Sava river water temperatures can also have an important influence, because the river is retained in the accumulation basins. The construction of Brežice hydro power plant on the site of the Krško NPP will cause an increase of the water level with a direct influence on the safety related Essential Service Water System (ESW).

Currently, upstream Boštanj hydro power plant is in operation since 2006, Blanca hydro power plant started its trial operation in December 2009 and Krško hydro power plant is under construction. The preparation process for the national spatial plan for the downstream Brežice hydro power plant began in 2007. For the last
plant in the chain, the Mokrice hydro power plant, the siting process started in 2009. The SNSA and Krško NPP are actively taking part in the processes for the Krško hydro power plant (concluded in 2006), the Brežice hydro power plant and the Mokrice hydro power plant. The common SNSA and Krško NPP guidelines for the spatial development focus on the requirements for assurance of flood protection for the Krško NPP, the preservation of the ultimate heat sink for cooling of the Krško NPP safety systems, the assurance of the Krško NPP external power supply, the restriction of interventions in the area of limited use of space around the Krško NPP, the assurance of the cooling of the Krško NPP condensers with the Sava river, and the prevention of the Sava river quality deterioration due to operation of the hydro power plants.

To assess the flooding hazard of Sava river and of the construction of hydro power plants on the Krško NPP, several studies have been prepared. The results of the Probable Maximum Flood study show that the nuclear safety of the Krško NPP could be threatened since the design bases for the external flood protection of the Krško NPP site were exceeded. The Krško NPP flood protection is established by flood protection dikes along the Sava river that are designed to protect the site against a ten-thousand-year flow of 4272 m$^3$/s. The flow that would exceed the ten-thousand-year flow would overflow onto the right bank of the Sava river up to the probable maximum flood, which was established in the current safety analysis report as 6500 m$^3$/s. New studies of probable maximum flood have shown that this value will be exceeded. This requires an upgrade of Krško NPP flood protection by raising the dikes or by any other means.

The study of high flow waves assessed the transfer of waves through the chain of hydro power plants. The results reflect the velocity of wave traveling through the chain and the highest flow. The study established that the spillovers from the Brežice accumulation basin bank to the right bank of Sava river are not sufficient for draining the high-flow waves of 3860 m$^3$/s onto the flooding area. Therefore, the project of Brežice hydro power plant needs take this finding into consideration and be corrected.

The results of the study of flooding waves due to dam failures show that these waves can reach a higher flow if the dam gates are opened because of human error than if the dam gates are damaged due to natural causes (e.g. seismic). The flood wave due to the dam failure of upstream hydro power plants would not exceed the design bases of Krško NPP flood protecting dikes. Therefore, no protective measures are required against such floods.

The new hybrid-hydraulic model of Krško-Brežiško polje was prepared. Its results have determined the water levels that correspond to the values of the Sava river flow on the Krško-Brežiško polje in the vicinity of Krško NPP. The flood with highest flow considered in this modeling is the Probable Maximum Flood which exceeds the design levels of current flood protection for the Krško NPP.

In response to findings that show an increased external flood of the Krško NPP, the plant has committed itself to prepare a new concept of Krško NPP flood protection and to implement appropriate actions by the end of 2010. Currently, the Krško NPP prepared project documentation for an upgrade of flood protection dikes along the Sava river and its tributary Potočnica on the left bank of the Sava river upstream from the Krško NPP. The project considers rising the dikes or constructing a wall on the top of current dikes by a maximum rise of 1,6 meters from current dikes elevation.

The upgrade of the Krško NPP flooding protection needs to take into account also the plan for the construction of a new road from Krško to Brežice and a new bridge.
iv. Modernization of the Airport

The external aircraft hazard has been evaluated for the Krško NPP for the last time in 1995 as a part of the Individual Plant Examination for External Events. Since the first PSR assigned a fairly low priority to the renewal of that evaluation, it was decided not to perform it. After the 9/11 event, the Krško NPP decided to improve its resistance to aircraft crash, following foreign best practices. The activity is still ongoing. A nearby military airfield is modernized at the moment, so that after the completion of works, it will be also used as a civil airport. As a part of the approval of the modernization, a study based on US DoE Std 3014-96 “Accident analysis for aircraft crash into hazardous facilities” has been performed. The analysis shows that the impact of civil aviation activities on the NPP is completely negligible while the potential impact of the increase in military aircraft activity is small. Nevertheless, the military activity will remain below the levels already attained in the 1990s and 1980s. It is expected that the Krško NPP will include the impact of this airfield in its future external aircraft hazard evaluation, which has not been the case so far.

v. Human Resources and Knowledge Management

Human resources and knowledge management are permanent issues, which are of utmost importance for ensuring the safe and reliable use of nuclear energy in the future. The Slovenian Government approved the programme for sustainable assurance of supporting activities in the field of nuclear and radiation safety. In this programme, the support was given to nuclear research. The projects related to the constructional properties of building materials and the knowledge development in the area of the ageing management of nuclear installations received financial support. This is one of the methods to keep the interest and knowledge of the experts needed to act on behalf of the TSOs in the nuclear area, so that they would have enough expertise when hired in the future.

The operator’s and the regulator’s staff also needs permanent training to maintain and improve their knowledge. Annual training plans were developed for all relevant staff and the knowledge is maintained by attending courses and workshops abroad. For topics of broad interest, domestic events are also organized. There is much attention paid to have as many procedures in writing and well documented as possible, since they represent a pool of knowledge also for new generations of nuclear experts.

vi. Failure of Equipment - Auxiliary Feedwater Flow Distributor Failure

During a regular outage 2007 after uninterrupted operation of 18 months, the tube sheet of the secondary side of the Steam Generator (SG) no. 2 was visually inspected. Two loose parts/objects were discovered. Based on the investigation of the design of SG, it was found out that both objects were parts of a disintegrated auxiliary feed water flow distributor. Two objects in the shape of vanes and of dimensions 150 x 70 x 2 mm were found in stuck in the region of columns 80 – 90 in the tube lane on the secondary side of SG#2.

The visual inspection that followed revealed several marks of the U–tubes – mechanical damages, which were found to be related to the two loose parts.
Approximately 50 U–tubes were affected. To get the information about the possible degradations of tube wall, an Eddy Current inspection was performed, specifically of the first two rows of the tube lane on the hot leg and on the cold leg as well as the Eddy Current inspection of the circumference of the tube bundle on the hot leg side. The inspection was carried out with the standard bobbin probe from the top of the tube sheet up to the first tube support grid. During the bobbin probe’s examination, 40 reportable indications were found. Not a single of these indications was related to the wall degradation. In addition, all tubes with indications were analyzed with the MRPC (Motorized Rotating Pancake Coil) + Point probe according to EPRI Steam Generator Foreign Object Handbook applicable for detection of “Tapered Football Shaped” Volumetric Indications with depth sizing in the freespan area. During this procedure, no additional loose parts were detected. At the end, using the MRPC +Point probe, it was estimated that 16 tubes had 19 wall degradations in the range of 32 to 36% of TWH (Through Wall Hole). As a plugging criteria, the ASME 40% criteria according to IWB-3521.1 for class 1 component was considered. The ASME 40% criteria covers all axial flaws, such as ruptures and volumetric degradations of infinite length. For AREVA NP GmbH steam generators, the design margin is even 50% of TWH. Thus, when tube wall degradation is less than 50%, the integrity of the component is not endangered. The application of the 40% of TWH criterion assures an additional margin.

It is presumed that the loose parts (vanes) had dropped from the auxiliary feedwater flow distributor following the downcomer to the tube sheet and were then following the flow to the area with low or no flow in the middle of the tube lane. It is also presumed that this happened during the shutdown for the regular outage in 2007. Otherwise, the damage would have most likely been more extensive due to larger flows and turbulences during normal on-power operations. Also, it is quite likely that in such case, the event would be detected by loose parts monitoring system (LPMS), especially if the loose parts would not stuck immediately. Namely, the LPMS is not used during shutdown due to noise effects that would cause numerous artificial alarms, but only during normal on-power operation. Based on this scenario, the Eddy Current’s inspection was carried out and within its scope, all potential tubes that could be affected were examined. The loose parts were too large to penetrate into the tube bundle. They were floating free and finally got stuck in the tube lane, so that they impacted only the U–tubes in the first rows adjacent to the tube lane. It is assumed that loose parts impacting on the U–tubes caused a plastic deformation of the tube surface with no loss of wall material.

To be on a safe side, the Krško NPP decided to plug 16 tubes, although the plugging criterion of 40% of TWH was not fulfilled. During the outage, the visual inspection of the auxiliary feed water flow distributor in the SG#1 was also performed. Some cracks on the welds of the shaped vanes were found, but the auxiliary feed water flow distributor in this SG did not disintegrate.

Both auxiliary feed water flow distributors were replaced with the new ones with a slightly different design, without shaped vanes. Namely, a more detailed thermohydraulic analysis by the steam generators’ manufacturer has shown that the vanes are not necessary. Some additional difficulties were encountered during the installation of new auxiliary feed water flow distributors – bolt dimensions, geometry. It seems that these discrepancies have also been present in the original construction, but did not contribute to the event.

The replacement of two steam generators took place in 2000, when the Siemens – Framatome steam generators were installed.
During a regular outage in 2009, the visual inspection of the auxiliary feed water flow distributor in both SG’s was performed. Auxiliary feed water flow distributors were not affected and no degradation was observed. In the future, auxiliary feed water flow distributors would not be a part of regular examination or in-service inspection.


In 2004, all Slovenian communities were invited to participate in the LILW siting process. Eight communities responded positively, while three of them withdrew immediately due to the opposition of the local public. Three most favorable sites, selected from the twelve locally acceptable sites in five communities, were proposed by the Slovene Radwaste Agency ARAO for siting and construction in July 2005 and were agreed on by the Government in November 2005.

Based on the preliminary design, three repository options were studied for a site close to the Krško NPP. Out of the three, a repository with the silos as disposal units was proposed by the ARAO as an optimal solution based on a comparative feasibility study, strategic environmental assessment and the corresponding safety case. Approximately 55 m deep and 30 m diameter silos shall be built from the surface into the poorly pervious weak rocks underlying a thin, very pervious, gravel aquifer. Subsequently, the design of the silo needed to be optimized which modified the above dimensions. The IAEA expert mission was carried out in January 2008 and the final, optimized proposal, together with safety analyses was submitted to public hearing in February 2008.

The crucial step was made when the Municipality Council of Krško granted consent to the proposal of the national spatial plan for the repository on 6 July 2009 and thus made the final decision on the behalf of the local community to allow the construction of the site in the local area.

The Decree, confirming the location intended for a low and intermediate level radioactive waste repository, was passed by the government of the Republic of Slovenia on 30 December 2009 and came into force on 15 January 2010. The procedure, which lasted for 5 years, was successfully concluded. The site, named Vrbina, is situated in the municipality of Krško, in the vicinity of the only Slovenian NPP. The construction of the repository will begin in about two and a half years and its completion will place Slovenia among the countries that have provided a long-term solution for the disposal of radioactive waste. The 2002 Act requires an operational LILW repository available by 2013. Due to one-year delay in the siting procedure, the LILW repository will probably be put in operation later than it is required by the 2002 Act.

The outline design of the repository has already been elaborated and the construction will be carried out in phases. The infrastructural and administrative sections will be the first on the list, followed by the technological part and, finally, the disposal area.

According to the Decree, the repository is designed for the disposal of LILW, resulting from the nuclear and radiation activities in the Republic of Slovenia. Two silos will have the capacity to accept as much as 9,400 m³ of low- and intermediate-level radioactive waste, which comprises half of the radioactive waste generated in the nuclear power plant in Krško during the operation and decommissioning. The site will also be used for the storage of all the institutional waste generated in Slovenia.
Due to joint ownership of the Krško NPP and 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), both countries could agree on a joint solution for the disposal of radioactive waste and finance it in equal shares or they shall finance their shares of activities.

In the case of an expansion of the Slovene nuclear program or an agreement between Slovenia and Croatia (each owning a 50-percent share in the nuclear power plant of Krško) about disposing of the entire amount of the waste, the capacity of the site can be increased, according to procedure of supplementation of the Detailed Plan of National Importance.

The Agreement requires that in case when both counterparts will not reached a decision on joint solution for the disposal of radioactive waste by the end of the regular life time of the Krško NPP, each counterpart, also the Republic of Croatia, will have to take over the half of the waste and transport it away from the location of the Krško NPP.

---

**View on the aboveground facilities of the future LILW repository (artist’s impression)**

---

**viii. Qualifications of Domestic Subcontractors**

The domestic subcontractors are only a part of the Krško NPP list of subcontractors. The Krško NPP keeps the list of subcontractors (equipments suppliers, maintenance works, construction works, plant modification design, analysis and safety evaluations, and other), which is the part of the Krško NPP QA programme. Periodically, QA audits are performed to examine the subcontractor capabilities.
The Krško NPP introduced long-term agreements with the key subcontractors for their investments in the development of new technologies, and the specific trainings for engineering and maintenance requirements of a nuclear facility. The Krško NPP tracks the realization of these investments on an annual basis. The results of such tracking show the adequate transfer of knowledge to new employees and a very low fluctuation of the expert personnel.

**B. Planned Measures to Improve Safety**

*i. Installation of a new emergency diesel generator*

As it was reported in the previous national report on nuclear safety, the Krško NPP plans to install an additional safety classified full scope emergency diesel generator. During the first Periodic Safety Review (PSR) of the Krško NPP in 2004, an updated seismic PSA study was conducted. It was evaluated that installing a third large 3.5MW 6.3kV diesel generator is the most safety-beneficial modification. The additional diesel generator will greatly increase the Krško NPP safety in case of a seismic event and also in other events with loss of offsite power. The Krško NPP will install a Class 1E 3.5MW diesel generator by 30 June 2012. The power plant has already prepared design concept, asked the Ministry of Environment and other stakeholders for design requirements and started preparing project documentation needed for a building permit.

*ii. Harmonization of Legislation with Good Practices in the EU Countries*

Slovenia has actively participated in the WENRA task force during the preparation of WENRA Reference Levels (RL) and the benchmarking of national requirements against this RL.

In last few years after adopting the 2002 Act, the renovation of the old national legal system, continued by issuing a number of envisaged regulations.

Among them, Slovenia prepared the following two new regulations in the period from 2006 to 2010,:

- Rules on radiation and nuclear safety factors (JV5)
- Rules on operational safety of radiation and nuclear facilities (JV9)

These regulations cover all WENRA Reference Levels, except Reference level D – Training. The final step of harmonization was done by the end of last year when the Rules JV5 and JV9 were issued. They were approved by governmental bodies and have been in force since November 2009.

The domain of WENRA Reference Level D is included in the Rules JV4 which was adopted in 2005, before the WENRA issued its reference levels. Presently, Rules JV4 are already updated with corresponding WENRA requirements, and will go through process of adoption in 2010.

*iii. The Krško NPP Quality Management System and Compliance with the IAEA GS-R-3*

The Krško NPP has been executing QA for more than 25 years in compliance with QA Program requirements of 10CFR50 App. B »Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants. The requirements are also the basis for Krško NPP design, procurement, component manufacture, assembling and
startup as well as operating licence. The Krško NPP has transferred the requirements to its own organization and its suppliers. This is a binding commitment deriving from contracting documents of Krško NPP-W, design bases, codes, the NPP equipment qualification method, the suppliers’ qualification method, procurement control, assured records, licensing documents and cooperation with outside institutions, such as NUPIC.

Since the Krško NPP is designed (10CFR50 App. A) and equipment is constructed (e.g. ASME B&PV Code, IEEE) in accordance with American legislation, major safety components are bound by American market which is subject to requirements and regulations of NRC in the area of nuclear safety and quality. More than 95 % of outside organizations which cooperate with the Krško NPP have the QA system and/or QA Program, which is based on the requirements of either 10CFR50 App. B or ASME NQA-1. However, they do not have the GS-R-3 integrated management system.

To meet QA requirement 10CFR50 App. B, the Krško NPP requires from its qualified suppliers to report on also defects and noncompliance detected anywhere in nuclear industry. Such reporting is in compliance with US NRC Regulations, Title 10, CFR Part 21 – Reporting on Defects and Non-compliance..

The GS-R-3 integrated management system introduces health, environment, security, quality and economy together with safety.

The GS-R-3 Safety Guide introduces a relatively new approach (year 2006) and is still being developed, compared to similar standards, and used in a small number of European NPPs. The Krško NPP is familiar with the activities between the IAEA and the ASME, which are currently ongoing in order to harmonize GS-R-3 and NQA-1 standards. Due to major differences between them, the IAEA plans to issue a new revision of GS-R-3 in 2013. Until then, the IAEA recommends to its users to supplement GS-R-3 with ASME NQA-1 requirements.

Listed below are those quality criteria, which require less or have no requirements in GS-R-3 if compared to Krško NPP QA Program in QA Plan, QD-1.

- Criterion 2 – QA Program
- Criterion 3 – Design Control
- Criterion 4 – Procurement Document Control
- Criterion 7 – Control of Purchased Material, Equipment and Services
- Criterion 8 – Identification and Control of Materials, Parts and Components
- Criterion 9 – Control of Special Processes
- Criterion 10 – Inspection
- Criterion 11 – Test Control
- Criterion 12 – Control of Measuring and Test Equipment
- Criterion 13 – Handling, Storage and Shipping
- Criterion 17 – QA Records
- Criterion 18 – Audits

GS-R-3 insufficiently covers or has no requirements for the subjects in the following areas:

- the qualification of personnel performing quality verification and control;
- qualification and certificates of auditors;
- design and software control;
- procurement document control;
the verification of suppliers’ ability, procurement changes and records on procured parts and services;
physical parts’ identification, and time control over storage use and conditions;
the QC and verification of special processes, such as welding, heat treatment, non-destructive examinations, anti-corrosion protection, etc.;
obligatory work inspection and suspension, the identification of inspection characteristics and methods, acceptance criteria, the inspection of non-conformances and proposed corrective work solutions, in-service inspection, the monitoring of structures, systems and components with the purpose to ensure continuous safety function, inspection records/minutes;
test procedures, software control and documentation procedures, test records;
maintaining calibration lists, records, certificates;
special equipment and protective area verification, special tools and equipment examination/test, training for the use of special lifting equipment;
the establishment of an organization responsible for the acceptance of records and its control as well as records storage, so that the risk of loss, damage and destroy of permanent records is prevented;
the issuing of Auditors’ Lead Auditor Report to the auditing organization, report’s contents and audit records.

Since efficient QA requires both system approach and parallel work in the areas such as planning, development of competences and quality assurance, culture and upgrade, the QA for Krško NPP operation shall continue to be based on the requirements of either 10CFR50 App. B or the only nuclear QA standard ASME NQA-1 covering the same 18 quality criteria in order to further assure the plant safety and that all safety equipment is capable of performing its safety function under design-basis conditions. As already mentioned, based on Krško NPP QA Program requirements, these standard quality requirements have been introduced in thousands of plant documents, records and processes; design specifications, procurement documents, in the storing of documents and records, plant procedures as well as in stored parts and equipment. Developed on the basis of these criteria are also modification and procurement control, technical quality requirements for purchase orders, Work Order process control, special processes control, and other.

The Krško NPP’s policy to monitor and constantly upgrade its nuclear safety and QA requirements has led to the fact that the Krško NPP has constantly been following the efforts of nuclear industry (WANO, INPO, EPRI, ASME.) and upgrading its management system to improve nuclear safety and to excel in operation.

The Krško NPP introduced an integrated management system which links together different quality systems and works as an upgrade of nuclear safety and quality requirements in its MD-1 Program “Commitments and Goals of the Krško NPP”. The Krško NPP has adopted various improvements such as safety culture, nuclear safety, activity monitoring and verification, self-assessment, plant performance indicators, corrective action program, environment protection, industrial safety, and long-term planning – cost adjustments through the integrated management system. These improvements do not only cover the GS-R-3 Safety Guide requirements but also exceeds them.
C. Special Topics

i. Periodic Safety Review

The Krško NPP Periodic Safety Review (PSR) was completed and approved in 2005. The PSR gave a good review of the plant operational and design status. It confirmed that the plant is as safe as originally intended and that there are no structures, systems or components, that could limit the life of the plant in the next ten years. This review has not revealed any major safety issues, but has nevertheless identified a number of recommendations to further enhance the plant safety.

The Krško NPP PSR resulted in the numerous corrective measures that were ranked through prioritization process. The types of available measures differ depending on the type of safety issue. Some typical deficiencies which may be identified are:

- deficiencies in information
- deficiencies in design
- deficiencies in operation
- deficiencies in safety culture

The PSR Action Plan, which was approved by the SNSA in August 2005, issues what should be implemented at the Krško NPP together with associated milestones. The milestones were assumed based on the availability of the safety and best estimate resources. Twice a year, the Krško NPP reports to the SNSA on the progress of activities and also in a month after finishing an activity. The PSR Action Plan comprises 124 actions grouped in 13 areas. By the end of 2009, 84 of these actions were completed by the Krško NPP. Most of the remaining actions will be completed during the 2010 outage and the all PSR Actions Plan must be completed by the end of 2010.

The main areas of closed activities cover:
- potential maintenance problems closure activities,
- potential seismic design problems closure activities (PSHA). In this area of activities, the SNSA agreed that the upgrades of small diesel generator for power supply of charging pump will be implemented in 2012.
- the Krško NPP operating problems closure activities,
- the Krško NPP specific mechanical analysis closure activities,
- the Krško NPP specific EOP supporting activities,
- accident analysis closure activities,

The areas that are in final stage:
- the aging management program.

The areas which are delayed:
- the supporting activities for the Krško NPP individual plant examination of external events. In this area, the actions connected with project of new upstream dams and frequency of external floods is more time consuming than expected.
- the Krško NPP regulatory compliance program closure activities. The majority of activities that are late are connected to the Environmental qualification and outage which will be in the fall of 2010.
- Potential environmental qualification problems closure activities. The activity will be completed during outage 2010.
- the Krško NPP IAEA RAMP Mission recommendations closure activities. Negotiations between the SNSA and the Krško NPP about the outcome of the analysis are in place.
The area for which the closure was postponed:
- potential design problems closure activities. The action “Electrical supply support systems – second level of undervoltage for degraded voltage” was postponed to the end of 2012.

The areas for which SNSA agreed that will not be implemented:
- the Krško NPP standard technical specifications closure activities. The Krško NPP technical specifications will not be converted to the NUREG-1431 structures and format.

**ii. Safety Management and Safety Culture**

Safety management and safety culture are complementary concepts to some extent. Safety management is focused more on visible artefacts, while safety culture is more about less exposed values and almost practically invisible basic assumptions and values.

Recognizing this, the SNSA decided to initiate, besides the safety management, the process to establish the safety culture oversight.

A common understanding is developed on the purpose of the oversight on safety culture characteristics, namely:
- to get regulator’s confidence that the licensee has implemented a process to deal with safety culture
- to avoid licensee’s complacency
- to identify the areas for improvement

In 2009, the SNSA started the more active monitoring of safety culture in the Krško NPP. The SNSA, assisted by the IAEA experts, organized the workshop, which was aimed at creating an appropriate approach to the surveillance and promotion of safety culture in the Krško NPP. The SNSA has also begun collecting observations associated with the elements of safety culture. Most of the observations came from the surveillance made during refueling and from the outage in April 2009, but there are also some observations with regard to regulatory administrative procedures, the violations of operating conditions and limitations, inspections, and other areas.

Based on the international experience feedback in safety culture oversight, the following suggestion can be drawn:

The observables on safety culture characteristics could be collected as a continuing activity during routine regulatory interactions. For that purpose, the processes shall be established to collect, to aggregate and to analyze the data. In addition, the process should be developed for addressing the regulatory body feedback to the licensee. These new processes should be explained and made visible to the licensee.

Safety culture oversight should be developed and implemented as a project. In this project, among others, the following topics should be addressed:
- knowledge, skills and training of the concerned staff,
- identification of the need for external support,
- appropriate approaches (methods, tools, etc.).

In addition, a dedicated task force (regulatory body – licensee) to further develop the safety culture activities shall be created. This task force could act as an advisory committee in performing this project.
Furthermore, it should be underlined that there is international consensus about the fact that numerical rating of safety culture has limited meaning and is consequently not recommended.

**iii. Ageing Management and Life Extension**

As part of the first Periodic Safety Review (PSR) at the Krško NPP, an Aging Management Program (AMP) was initiated. Its objective was to determine whether aging is being managed in such a way that the required safety margins are being effectively maintained. The AMP is based on the USA practice and is in accordance with the NRC requirements from the 10 CFR 54 License Renewal Rule and nuclear industry guidelines NEI-95-10 Industry Guideline for Implementing the Requirements of 10 CFR Part 54 - The License Renewal Rule, Rev.3.

The project phase of the AMP consists of Scoping and Screening of Structures, Systems and Components (SSC), Ageing Management Review (AMR) and Review of Time Limited Ageing Analyses (TLAA). The project phase of AMP was performed together by the Westinghouse and the Krško NPP experts and it was finished at the end of 2008.

In the scope of the AMP are also “passive” and “long living” SSCs. The “passive” SSCs function without any moving parts or without the change in configuration or properties. The “long living” SSCs are those that are not subject of routine maintenance or replacement based on a qualified life or specified time period. In the scope for AMR, there are totally 6531 mechanical, 1498 electrical and 694 civil components.

In the frame of AMR, each component was reviewed to find out whether ageing effects are managed in a satisfactory manner with the existing plant activities and to identify any improvements needed. All applicable issues defined in NUREG 1801 Generic Aging Lessons Learned (GALL) were analyzed in detail.

The review of the TLAA includes the identification and evaluation of plant-specific aging analyses which consider ageing effects and involve time-limited assumptions defined by the current operating term, for example, 40 years, 36 EF PY, 400 cool-downs, and other. Each of the identified TLAA s were reviewed to find out whether a particular TLAA will remain valid for the period of extended operation or if any additional activities for ageing management have to be introduced.

Based on AMR and the review of the TLAA, an action plan was created to develop new or revise existing plant programs and to introduce necessary new activities.

After the finishing of AMP project phase, the Krško NPP prepared the proposal of TS and USAR amendment which includes the change of design lifetime from 40 to 60 years. An application for the approval of this proposal was filed to the SNSA in March 2009.

The SNSA approval of this application depends mainly on the independent expert opinion which is in preparation. The expert opinion will take into account requirements from RG-1.188 Standard format and the content for applications to renew nuclear power plant operating licenses, NUREG-1800 Standard Review Plan for License Renewal Applications for Nuclear Power Plants, NUREG-1801 Generic Aging Lessons Learned and other requirements based on the USA practice.

The SNSA approval of the above mentioned application will certify the technical ability of the plant for operation beyond 40 years. In addition, the plant safety is being verified in detail by the PSR on a 10-year basis. A successfully performed PSR is a condition to prolong the operation license for the next 10 years.
iv. Application of Probabilistic Safety Analyses (PSA)

Following the initial development that included general aspects, such as the training of the SNSA staff on the use of PSA results, the presentations of the Krško NPP risk profiles as well as specific method for the PSA based event analysis, the next development was focused on the development of the tools needed for both risk monitoring and risk informed decision support. The SNSA incorporated those tools in the electronic database system for presentation of all required data which are necessary for regulatory work.

The tool called ISSVA has been built into the InfoURSJV system. The ISVVA is a tool with a user-friendly interface, where the PSA results are presented with comments and interpretations. Moreover, risk measures are colored in accordance with the risk significance and presented in a graphical way. The main databases of the ISVVA are:

- PSA models,
- Important calculations,
- Initiating event categories,
- Accident sequences,
- Important components.

The PSA models database includes information about all the Krško NPP models, such as the basic description of the PSA model, the total core damage frequency (CDF), and the distribution of the CDF through each initiating event. It also enables the comparison of the Krško NPP PSA models by initiating events CDFs.

The Important calculations database comprises the PSA calculations and analysis done by the SNSA PSA team. These calculations are divided into different categories, i.e. “Event analysis”, “On-Line Maintenance (OLM)” and “Different configurations”. Depending on the type of the calculation (e.g. initiating event analysis or configuration analysis), different risk measures (CDF, ΔCDF, CCDP) are given for each calculation together with the interpretation of the result. For easier understanding of their importance, the PSA results are colored according to their significance (from green – less important, through yellow and orange to red – very important). A connection to a detailed calculation report is given, and in the case of an event analysis, also the connection to an event description is within reach of a mouse click.

In the Important components database, there is information about the system that the specific component belongs to, basic events related to it, and the importance measures of the component, i.e. Fussel – Vesely, F-V (Fractional Contribution, FC) and Risk Achievement Worth, RAW (Risk Increase Factor, RIF), and other. There are also connections to the events related to the component, connections to the references in Technical Specification, Safety Analysis Report and other documents, as well as connections to the descriptions of the accident sequences that a specific component is related to.

The Accident sequence database contains all accident sequences from the model. Each element of the accident sequence database contains the description of the accident sequence, risk measure (CDF), description of top events and success criteria, and connections to the minimal cut sets (MCS).

In the Initiating event categories database, all initiating events categories (internal initiating events) are described. For each of them, the risk measure is given as well as the connections to the accident sequences related to them.
Currently, the ISVVA is being used for different applications in the field of risk informed decision making, for instance the SNSA inspection allocation, determination of risk significance of inspection findings, event analysis, controlling over on-line maintenance, modification assessments, as well as the issuing of permissions and concordances. For the SNSA applications, The Krško NPP PSA model is used.

The Krško NPP is using the PSA for modification support, refueling outage management, the support to plant programs and activities, on-line maintenance support and for MSPI (Mitigating Systems Performance Indicator).

Many upgrades and updates of the plant PSA were done during the last three years:

- model upgrades/updates:
  - internal flooding,
  - human error analysis,
  - parameter uncertainty analysis,
  - the incorporation of CET into the RS PSAP model,
  - LERF uncertainty,
- other updates:
  - component failure rates.