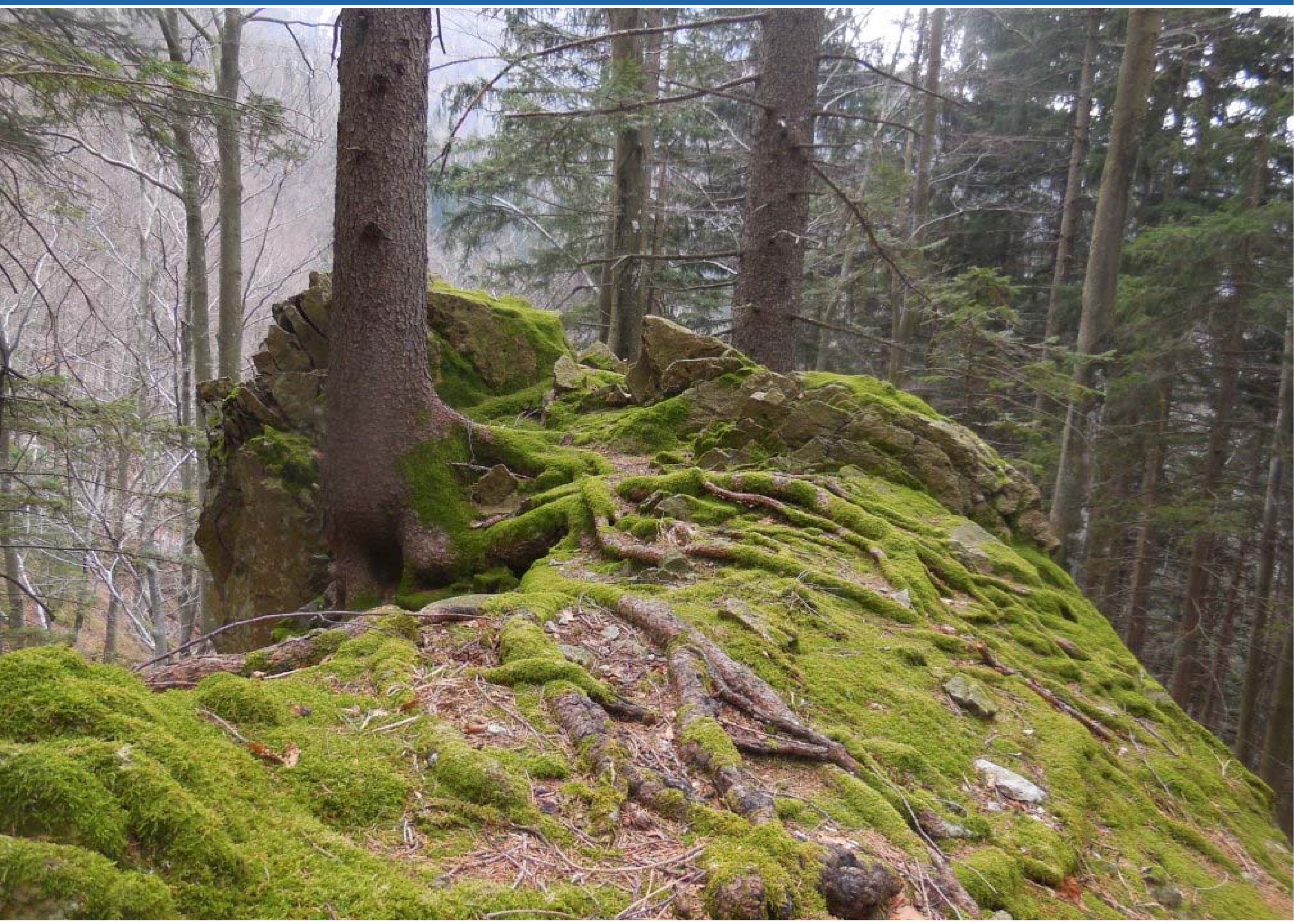
REPUBLIC OF SLOVENIA
MINISTRY OF THE ENVIRONMENT AND SPATIAL PLANNING
SLOVENIAN NUCLEAR SAFETY ADMINISTRATION

Annual Report 2014 on Radiation and Nuclear Safety in the Republic of Slovenia



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July 2015

Prepared by the **Slovenian Nuclear Safety Administration** in cooperation with:

The Slovenian Radiation Protection Administration;
The Administration of the Republic of Slovenia for Civil Protection and Disaster Relief;
The Ministry of Infrastructure and Spatial Planning;
The Administration of the Republic of Slovenia for Food Safety, Veterinary and Plant Protection;
The Ministry of the Interior;
The Agency for Radwaste Management;
The Nuclear Insurance and Reinsurance Pool;
The Fund for Financing the Decommissioning of the Krško Nuclear Power Plant;
The Krško Nuclear Power Plant;
Žirovski Vrh Mine d.o.o.;
Jožef Stefan Institute; and
The Institute of Occupational Safety.

The report was approved by the Expert Council for Radiation and Nuclear Safety on 27 May 2015.

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SUMMARY

In the field of nuclear safety and radiation protection, the year 2014 was one of the quietiest years in recent years. At the Krško Nuclear Power Plant there were no obstructions worth mentioning. It operated the whole year without interruption. For the first time the Krško NPP exceeded the magical limit of 6 TWh of electrical energy produced due to a year of no outages and enough water from the Sava river. There were no deviations from normal operation that would need to be reported to the Slovenian Nuclear Safety Administration. In the autumn the owners of the Krško NPP aproved an investment in the safety upgrades programme in accordance with requirements on the basis of the lessons learned from the Fukushima accident.

After the fuel damage identified during the 2013 outage, the SNSA carefully monitored the implementation of corrective actions. By the end of the year there were no indications of any leakage of nuclear fuel and there were no problems due to electromagnetic interference, which could have caused the automatic shutdown in November 2013.

In 2014, the Second Periodic Safety Review of the NPP, which has to be performed once every ten years by each nuclear facility, was completed. After a detailed examination, which lasted several years, no deficiencies were identified that would require immediate action. An improvement plan was made to address the identified discrepancies. Confirmation of the results of the periodic safety review entails an extension of the operating license for the next ten years.

Activities for the construction of the future radioactive waste repository have moved from the stalemate, as the Minister for Infrastructure signed an investment programme in the summer. Field research has been carried out and the designer was selected.

The intergovernmental Slovenian-Croatian commission, which should monitor the performance of the contract on the ownership of the Krsko NPP, has not met since 2010, which leads to delays in taking important decisions.

Disposals sites at the former Žirovski Vrh uranium mine survived an extremely powerful storm in autumn that resulted in only minor damage to overlays and drainage devices at the Jazbec disposal site. Unfortunately, due to a lack of funds, remediation has not been implemented yet at the disposal site Boršt, where a few years ago a problem with long-term landslide movement became apparent. ARAO is preparing for long-term monitoring control and maintenance of the disposal site Jazbec.

The "Jozef Stefan" Institute has increased the range and number of research studies at the TRIGA research reactor. At the same time, it completed a ten-year Periodic Safety Review, which confirmed the adequacy of the nuclear safety and extended the operating license for ten years. The Reactor Physics Department is active and successful in international research circles.

In 2014, there were no major problems at the organisations that carry out radiation practices. At the same time, there were also fewer interventions with regard to finding sources of ionizing radiation in the field.

In September 2014 an International IRRS Follow-up Mission found that most of the recommendations and proposals of the previous mission in 2011 had been fulfilled, but some of them remain unresolved, inter alia, ensuring sufficient funds for the work of the SNSA and for the development of the Slovenian nuclear profession and delays in the construction of the repository for low and intermediate level waste (LILW).

Due to the resignation of the government in the spring and subsequent summer elections, the adoption of amendments to the Ionising Radiation Protection and Nuclear Safety Act has stalled. The process of adopting the amendments to the Act resumed after the formation of the new government and will be completed in 2015.

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1 INTRODUCTION

This report is prepared annually in accordance with the provisions of the Ionising Radiation Protection and Nuclear Safety Act. It summarises all developments related to nuclear and radiation safety. The report is endorsed by the Slovenian Government and is thereafter sent to the National Assembly of Republic of Slovenia. It is also the main method of communicating recent developments in the area of ionising radiation protection and nuclear safety to the general public. It has been issued since 1985. This English version is the essential publication for the presentation of these activities in Slovenia to the international public.

In creating the report, the Slovenian Nuclear Safety Administration (SNSA) performs the role of editor, while the content of the report is also provided by other state bodies whose competences include ionising radiation protection and nuclear safety, as well as other institutions in this area. Of these, the most important are the Slovenian Radiation Protection Administration (SRPA), the Administration of the Republic of Slovenia for Civil Protection and Disaster Relief (ACPRD), the Ministry of Infrastructure and Spatial Planning, the Administration of the Republic of Slovenia for Food Safety, Veterinary and Plant Protection, the Ministry of the Interior, the Agency for Radwaste Management (ARAO), the Nuclear Insurance and Reinsurance Pool, the Krško Nuclear Power Plant (Krško NPP), the Žirovski Vrh Mine d.o.o., Jožef Stefan Institute (JSI), the Institute of Occupational Safety (IOS), and the Fund for Financing the Decommissioning of the Krško Nuclear Power Plant and Disposal of Radioactive Waste from the Krško NPP, and others.

The year 2014 was quiet, therefore we can summarise that the fundamental objective of nuclear and radiation safety was definitely achieved:

The protection of people and the environment from unnecessary harmful effects of ionising radiation.

Together with this report, which is aimed at the wider interested public, an extended version in Slovenian has been prepared. The extended report includes all details and data that might be of interest to the narrower group of professionals. It is available on the SNSA website at http://www.ursjv.gov.si.

2 OPERATIONAL SAFETY

2.1 Operation of Nuclear and Radiation Facilities

2.1.1 Krško Nuclear Power Plant

The Krško NPP operations were stable in 2014 and no significant events occurred that would threaten nuclear safety. Annual production of electricity exceeded 6 TWh for the first time due to favorable weather conditions. In the middle of the year the second periodic safety review, which lasted several years, was completed. No significant safety issues were identified, therefore Krško NPP may continue to operate until 2023, when the next such review will be completed.

In 2014 the owners of the NPP – GEN energija, d. o. o. and Croatian HEP, d. d. – commissioned a study of the economics of the further operation of the facility. The study showed that the energy from the Krško NPP remains competitive despite the investment in the safety upgrading programme and the possibly lower price of electricity on the market. On this basis, the owners decided to support the operation of the Krško NPP beyond 2023.

2.1.1.1 Operation and Performance Indicators

In 2014, the Krško NPP produced 6,369,631.8 MWh (6.4 TWh) gross electrical energy from the output of the generator, which corresponds to 6,060,821.8 MWh (6.1 TWh) net electrical energy delivered to the grid. It was the first time that the plant produced more than 6 TWh of electricity. The major reasons for this were that there were no refueling outages in 2014, it was a rainy year, due to which the flow of the Sava river was abundant throughout the year and no power reductions were necessary, and there were no equipment failures.

The plant operated throughout all 8760 hours. The most important performance indicators of the Krško NPP are shown in Table 1, while changes over the years are described in the following parts of this report. The performance indicators confirm that the plant's operation is stable and safe.

Table 1: The most important performance indicators for 2014

Safety and performance indicators	Year 2014	Average (1983-2014)
Availability [%]	100	86.8
Capacity factor [%]	103.89	84.9
Gross production [GWh]	6,369.63	5,098.58
Fast shutdowns – automatic [number of shutdowns]	0	2.34
Fast shutdowns – manual [number of shutdowns]	0	0.16
Unplanned normal shutdowns [number of shutdowns]	0	0.75
Planned normal shutdowns [number of shutdowns]	0	0.78
Event reports [number of reports]	0	4.19
Duration of the refuelling outage [Days]	0	50.6

The operation of the Krško NPP in 2014 is shown in Figure 1, which is typical for a year with no outage and no other shutdowns. Small changes in power are the result of the regular testing of the turbine valves.

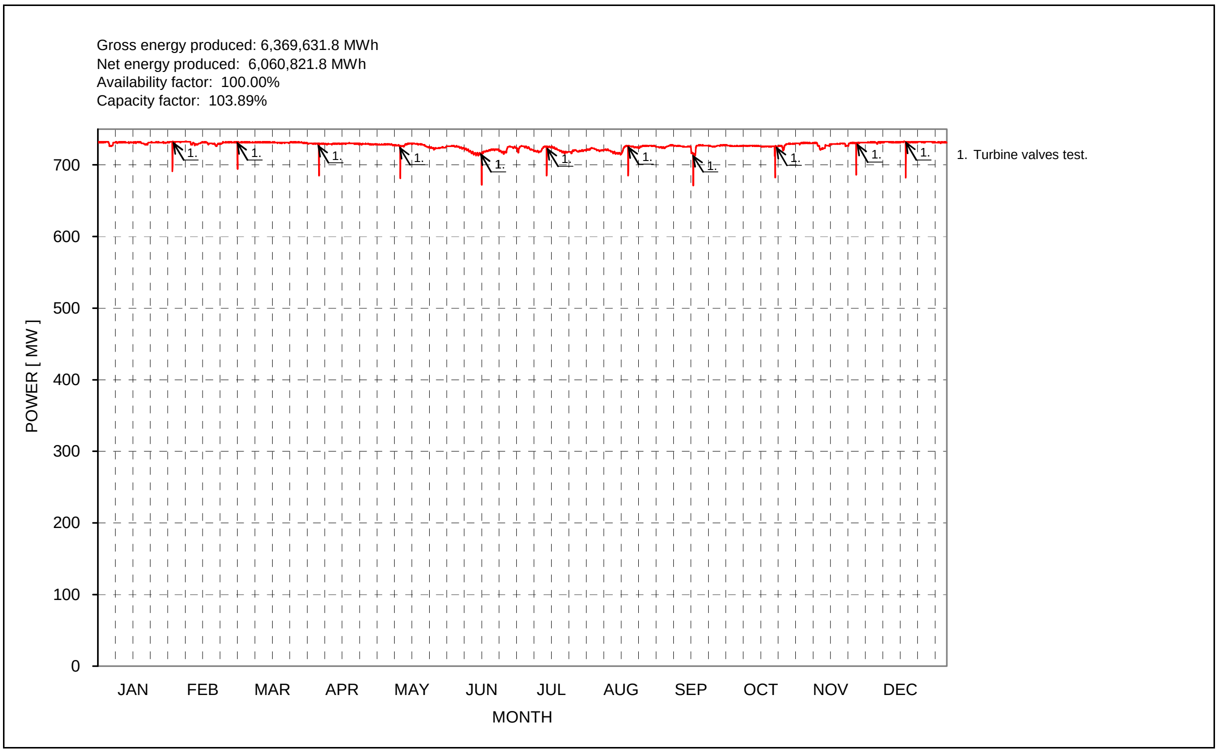

Figure 1: Operating power diagram of Krško NPP in 2014

Figure 2 shows the number of fast reactor shutdowns. It can be seen that this number has stabilised over the years (less than one fast shutdown per year in the last 20 years). There were no shutdowns in 2014.

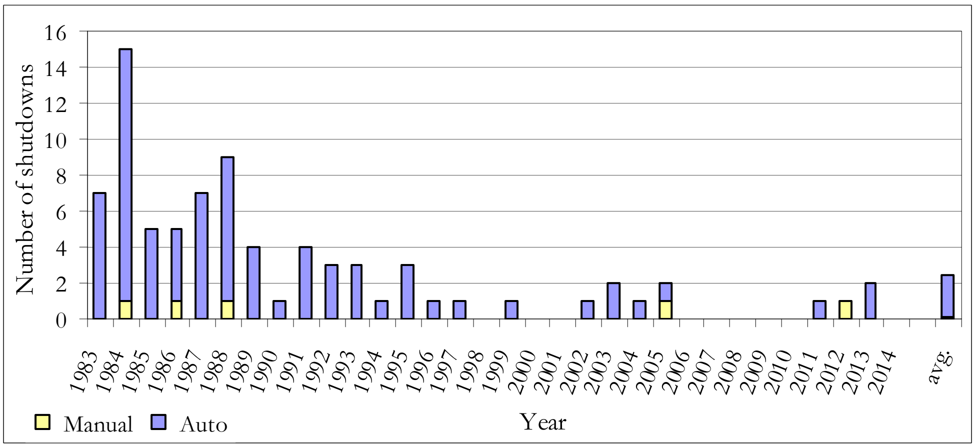

Figure 2: Fast reactor shutdowns – manual and automatic

Figure 3 shows the number of abnormal events. The year 2014 was the first year in the history of plant with no abnormal events. The Krško NPP is obliged to report to the regulatory body all events that could reduce the level of nuclear safety.

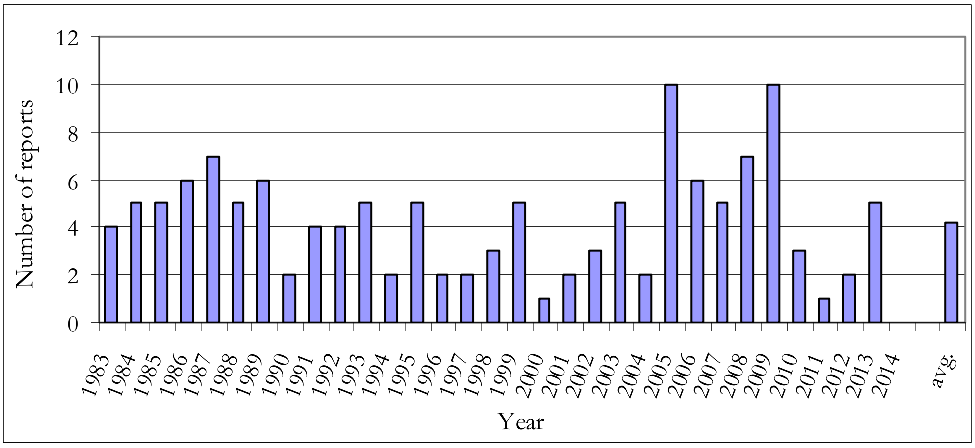

Figure 3: Number of abnormal events

Figure 4 shows the capacity factor. The capacity factor is a quotient between the actual produced electrical energy and the energy that could be produced if the plant had operated at maximum capacity. The value in 2014 was 103.89%, which is the plant's record value. For calculating this factor the reference maximum capacity is used, which is the theoretical plant's capacity during the worst weather conditions. Since the Krško NPP mostly operates with higher capacity the value of this factor can be higher than 100%.

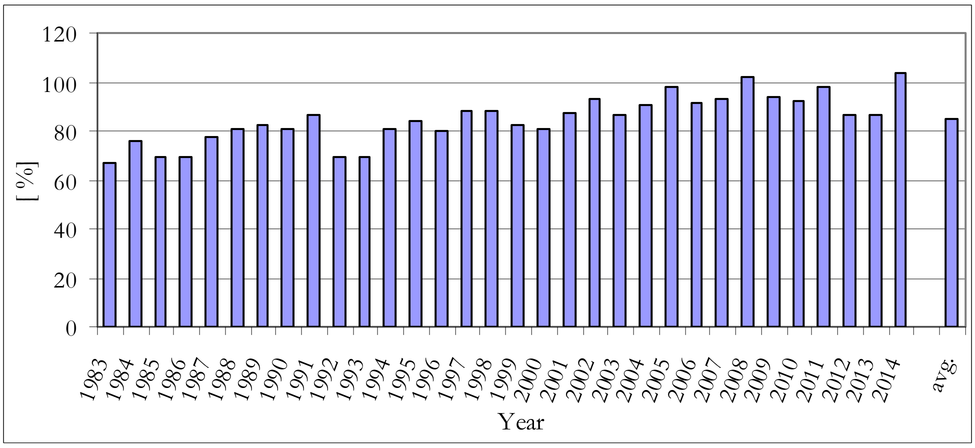

Figure 4: Capacity factor at the Krško NPP

Figure 5 presents data on different means of electrical energy production in Slovenia, specifically electricity production in nuclear, hydro, thermal, and solar power plants. In 2014, the production of electrical energy reached a record value of 16.5 TWh, mostly due to the record production of the Krško NPP and hydro power plants.

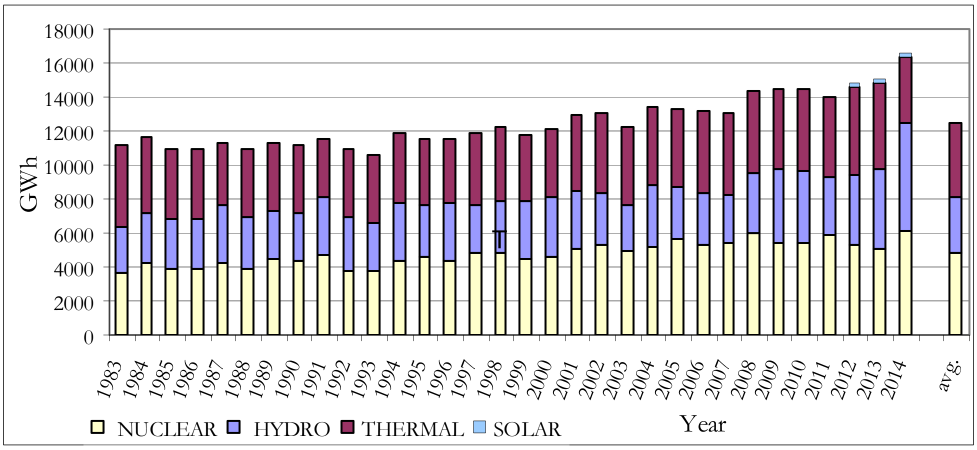

Figure 5: Production of electrical energy in Slovenia

The collective exposure to radiation is shown in Figure 6. The low value of this factor indicates the high efficiency of the radiation exposure control. In 2014, there was no refueling shutdown, thus the value of the factor, 106.1 man mSv, is comparable to other years with no outage.

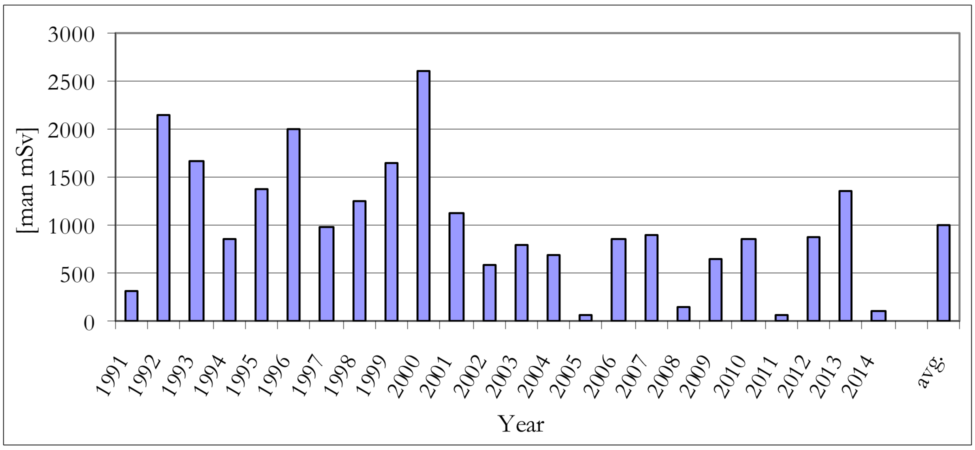

Figure 6: Collective exposure to radiation in the Krško NPP

Figure 7 shows the unavailability factor of the safety injection system. In 2014, the value of this factor was 0.0027, which is better than the Krško NPP's goal value taken from the industry in the United States. In 2014, this system was unavailable only during the planned online maintenance.

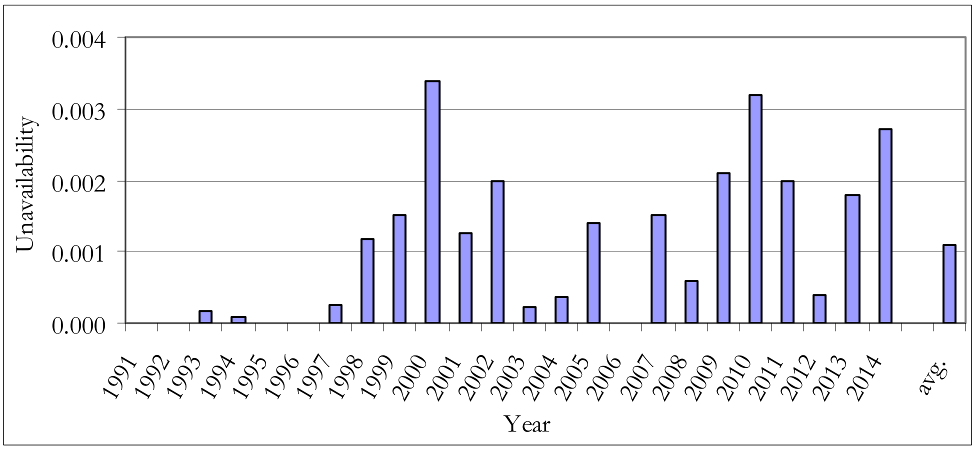

Figure 7: The unavailability of the safety injection system

The unavailability factor of the emergency power supply (the emergency diesel generators), is shown in Figure 8. This system is important when the normal off-site and on-site power supplies are not functioning. The operability of the diesel generators has been stable in recent years. In 2014 this system was completely available, thus the value of this factor is 0.

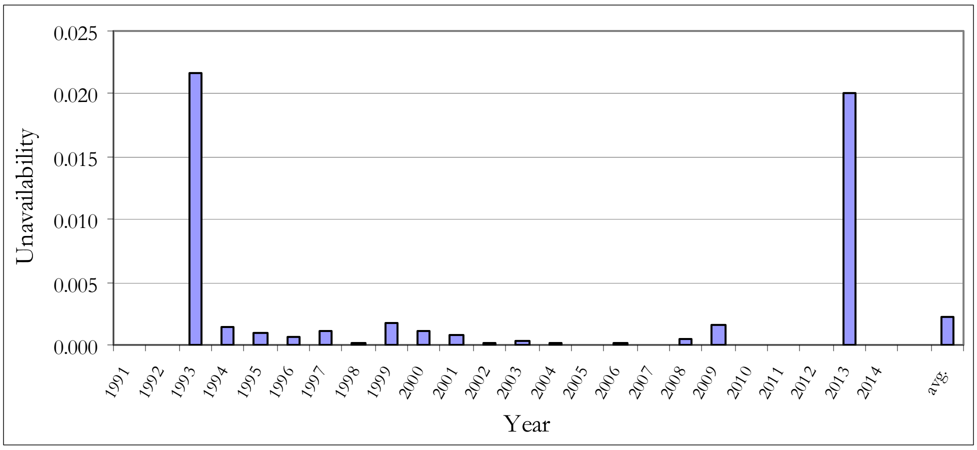

Figure 8: The unavailability of the emergency power supply

In Figure 9, the unavailability factor of the auxiliary feedwater system is shown. This system is used to supply water to steam generators when the main feedwater system is unavailable. In 2014, the value of this indicator was 0.001, which is below the average value. In 2014, the system was unavailable only during the planned online maintenance.

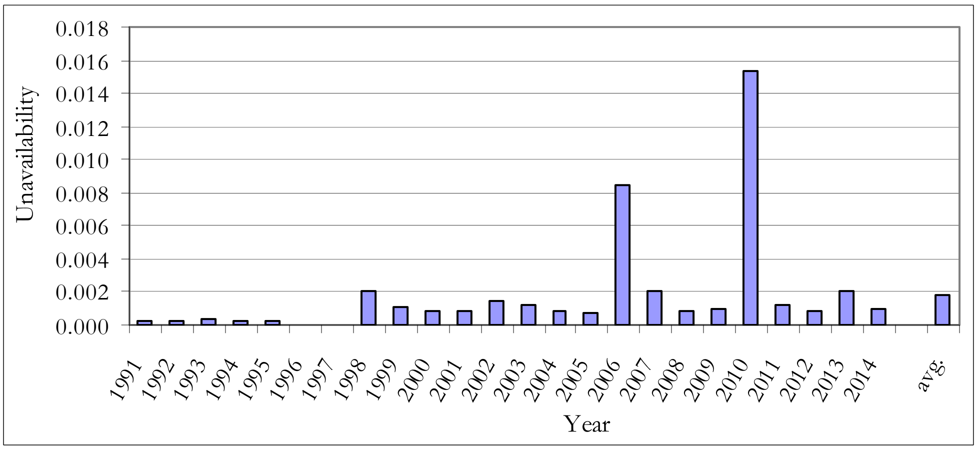

Figure 9: The unavailability of the auxiliary feedwater system

2.1.1.2 SNSA Oversight of the Krško NPP through Safety and Performance Indicators

In 2014, the SNSA monitored a set of 36 safety and performance indicators (hereinafter SPIs). The SPIs help to recognise very early eventual problems that can have influence on nuclear safety. The set of SPIs includes margins for warnings and alarms. The Krško NPP has time to prepare corrective actions that prevent further worsening of the situation. The SNSA collects information once per month and informs the Krško NPP of the situation regarding the SPIs.

In 2014, the SPIs did not show significant negative trends. The Krško NPP and the SNSA carefully monitored the SPI regarding the activity of the primary cooling system. Possible damage to fuel elements, such as those that were found during the 2013 outage, would be reflected in the value of the SPI. No indications of fuel damage were found during 2014.

2.1.1.3 Abnormal Events in the Krsko NPP

Event reporting is defined by the Rules on the Operational Safety of Radiation or Nuclear Facilities and Technical Specifications. These rules define the list of events that have to be specially reported by nuclear power plant operators.

In 2014, were no events at the Krsko NPP that had to be specially reported.

2.1.1.4 Periodic Safety Review

A Periodic Safety Review (PSR) is an intense systematic review of all operational and safety aspects of the NPP and must take place once every ten years. In accordance with the Ionising Radiation Protection and Nuclear Safety Act, it is a condition for continued operation every ten years.

At the beginning of 2014 the SNSA reviewed all the reports on the PSR2 by the NPP carried out from 2010 to 2013. The final report of the NPP on the periodical review concludes that there are no major irregularities, that the plant is safe, as was planned, and would operate safely. It also identified areas in which improvements could be introduced, especially regarding procedures, control, and qualification, the aging of materials, planning for emergencies, improving the design bases, and in the field of plant safety analyses (deterministic and probabilistic analyses and analyses of potential threats and hazards). The report contains 397 recommendations for improving the situation in the power plant, of which 20 have already been realised, 225 of them are to be implemented, and 152 will be re-evaluated in the context of the third periodic safety review in ten years. The implementation plan contains a plan of activities and deadlines for the implementation of individual recommendations.

On 30 May 2015, the SNSA approved the PSR2 and the resulting implementation plan, which must be implemented by the NPP by 30 May 2019.

At the end of 2014, the NPP reported on the progress of the implementation of the implementation plan changes and improvements. A total of 78 actions had been completed, among them 59 out of 71 actions scheduled for completion in one year, 12 out of 83 actions scheduled for completion in three years, and 7 out of 71 actions scheduled for completion in five years.

2.1.1.5 Nuclear Fuel Integrity and Reactor Coolant Activity

The year 2014 comprised a part of fuel cycle 27, which started on 18 November 2013 and will last 18 months, until the refuelling outage in April 2015. In 2014, there were no shutdowns of the plant.

The reactor core consists of 121 fuel assemblies. Of the 56 new fuel assemblies in the cycle 27 core, 20 are 4.4% enriched and 36 are 4.8% enriched. In this cycle the core also contained four fuel assemblies with seven stainless steel dummy rods that were inserted to prevent fuel rods being damage, such as happened in the previous fuel cycle.

The condition of the fuel assemblies in the reactor (fuel cladding integrity) is monitored indirectly through measurements of specific activities of the reactor coolant. Isotopes of xenon, krypton and iodine show fuel defects; from measurements of specific activities of iodine isotopes, the defect size and coolant contamination can be estimated. From specific activities of cesium isotopes, the burn-up of damaged fuel can be estimated. In the event of fuel rod cladding degradation, solid particles can be detected in the coolant.

With the start of cycle 27, the failed fuel action plan was upgraded to comprise five action levels based on the estimated number of damaged fuel assemblies and specific activities of iodine isotopes. Every action level includes corrective and preventive actions in the event of the degradation of fuel assembly conditions and in the event of open defects in the fuel rods, as observed in fuel cycle 26.

In fuel cycle 27, high specific activities of xenon and iodine isotopes were measured until the end of the year 2014, which is a consequence of tramp uranium remaining in the primary circuit due to open defects in fuel rods in the previous cycle. The analyses that applied the correction for the primary circuit contamination showed that there were no leaking fuel rods in the cycle 27 reactor core in the year 2014.

The Fuel Reliability Indicator (FRI) is an indicator of fuel damage and is used for comparison with nuclear power plants around the world. An FRI value equal to or below $5 \cdot 10^{-4}$ µCi/g ($1.85 \cdot 10^{-2}$ GBq/m^3) represents fuel with no damage according to internationally adopted criteria. Exceeding this limit is not a criterion for deeming there to exist open defects of fuel rods. Figure 10 shows the FRI values for individual fuel cycles. In fuel cycle 27, the FRI values with a correction for the primary circuit contamination reached values $1 \cdot 10^{-6}$ µCi/g, i.e. significantly below the limit for leaking fuel. Figure 10 shows the previous cycle with several damaged fuel assemblies.

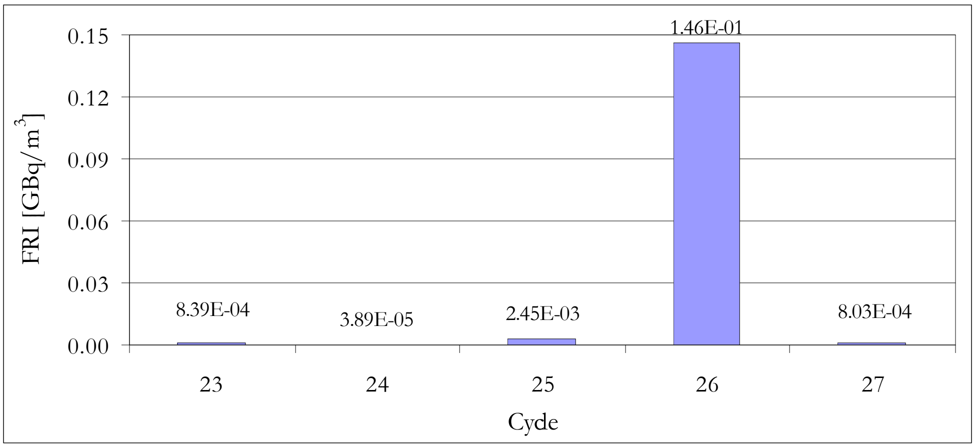

Figure 10: Fuel Reliability Indicator (FRI) for the last 5 fuel cycles (cycle 27 started in the year 2013 and will end in the year 2015)

Root cause analysis of fuel leakage and proposed corrective actions

A root cause analysis of fuel leakage in cycle 26 was prepared by the fuel provider Westinghouse. The cause for open defects of fuel rods is baffle jetting, which produced strong vibrations of fuel rods. The fuel provider estimated that the causes for other tight defects of fuel rods were grid-to-rod fretting or debris fretting.

An independent expert opinion on the fuel provider's root cause analysis was prepared that confirmed the conclusions and proposed corrective actions to eliminate the causes of fuel damage.

The proposed corrective action to eliminate the cause of open fuel defects is upflow conversion. This consists of reversing the coolant flow direction in the space behind the reactor vessel baffle plates and in this way the baffle jetting is eliminated. Installation of this design modification is planned for the 2015 outage.

One long term action is to increase the robustness of the fuel assembly against defects caused by vibrations from grid-to-rod fretting or caused by debris fretting. This action is to be implemented by the year 2016.

In 2014, the fuel assemblies were modified by the application of a protective layer of zirconium oxide to the bottom part of fuel rods cladding. This protective layer improves the resistance of fuel to the possible debris in the reactor coolant system.

In order to increase the resistance of the fuel to baffle jetting in fuel cycle 27, the replacement of 7 fuel rods with stainless steel dummy rods was performed in 4 fuel assemblies.

2.1.1.6 The Safety Upgrade Program

In September 2011, only a few months after the Fukushima accident, the SNSA issued a decision by which it ordered the Krško NPP to perform the Safety Upgrade Programme (SUP) based on the lessons learned from the event. The plant performed the analysis of needed improvements and started implementing them in February 2012. The fundamental objective of the SUP is to enhance the plant's capabilities to prevent radiological releases to the environment even in the case of the worst possible internal or external events.

In 2013, during the preparation of the tender for the largest part of the SUP, the Krško NPP, due to several reasons (the magnitude of the project, the complexity of the design documentation, the delivery times of some of the main components, as well as the inclusion of the Krško NPP in the Public Procurement in the Water, Energy, Transport and Postal Services Act), managed to obtain a delay of 8 months in relation to the original plan, making it impossible to finish the SUP by the deadline. Thus in September 2013 the Krško NPP applied for a SUP deadline extension until end of 2018. The SNSA approved the deadline extension in October 2013.

Then, in the beginning of 2014, the Krško NPP notified the SNSA that the implementation of the SUP by the end of 2018 was going to be challenging due to financial constraints. Namely, the two owners of the Krško NPP (the Slovenia’s state-owned GEN Energija d.o.o. and Croatia’s stated-owned HEP d.d.) became unwilling to finance the SUP. The main reason for that was the historically low price of electricity, due to which the owners started to doubt whether the plant could, after the implementation of the project, still continue to provide electricity at a competitive price. The owners ordered a financial viability study, which was completed in the second half of 2014. The results of the study showed that even after the implementation of the SUP or even lower electricity prices on the market, the Krško NPP's electricity would still be very competitive. It also confirmed that the prolongation of operation beyond the original design lifetime ending in 2023 would be an economically sensible solution. Based on the study's results, the owners approved the implementation of the SUP, but with somewhat different dynamics. The Krško NPP announced a new application (expected in the middle of 2015), by which it will apply for a longer deadline for the most demanding parts of the SUP.

At the end of 2014, the SUP was divided into three phases:

Phase 1, which was implemented in 2013:

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

Phase 2, which will be implemented by the currently valid deadline – the end of 2018:

- Additional flood protection of the nuclear island;
- The installation of a pressurizer PORV bypass qualified for severe accidents;

- Procurement of a mobile heat exchanger capable of a fast connection to the reactor or the spent fuel pool;
- Installation of a fixed spray system for the spent fuel pool capable of connection to the various mobile sources of coolant water;
- Upgrading of the Bunkered Building 1 (BB1) electrical power supply;
- Installation of an emergency control room;
- Installation of additional independent instrumentation for severe accidents;
- Upgrading of support centers for severe accidents;

Phase 3, for which the Krško NPP will apply for deadline extension:

- Installation of an alternative heat sink;
- Installation of additional pumps for injecting into the secondary and primary systems, the spent fuel pool, the containment and reactor coolant pump seals, with dedicated reservoirs of borated and unborated water.

Post-Fukushima Action Plan

In December 2012 the SNSA prepared the complete action plan of measures based on lessons learned from the Fukushima accident in March 2011. The document was prepared in English and published on the SNSA web page. The action plan contains measures aimed at reducing the risk from the external and other hazards that could affect the Krško NPP location.

The core of the Slovenian action plan is the Safety Upgrade Programme (SUP), which is described in more detail in previous chapter. Beside the SUP, the SNSA also identified eleven other measures intended to enhance severe accident preparedness. Among them are legislative changes, additional international peer review missions, additional studies, enhancement of emergency preparedness, and improvement of the safety culture within the operator and the regulatory body.

The Slovenian action plan was peer reviewed together with the plans of EU Member States, Switzerland and Ukraine at an ENSREG workshop in April 2013 in Brussels. The implementation of most of the action plan measures already started in 2013 and continued in 2014.

In December 2014, the SNSA published on its website the updated action plan, which will be subject to another international peer review at the April 2015 ENSREG workshop in Brussels.

2.1.1.7 Modifications in the Krško NPP

Technical improvements and modifications

The SNSA devotes a great deal of attention to reviewing modifications and improvements in the Krško NPP. The modifications and improvements result from international practice, operational experience and the newest insights in nuclear technology. Modifications can strongly influence the safety of nuclear objects and therefore must be rigorously controlled and appropriately documented.

In 2014, the SNSA approved 8 modifications and agreed to 17 modifications. During the preliminary safety evaluation, the Krško NPP found no open safety issues for 10 modifications. Therefore, the NPP only informed the SNSA of those 10 changes. As of 31 December 2014, there were 16 active temporary modifications. 16 active temporary modifications were opened and 18 were closed in 2014. Among active modifications, 3 temporary modifications were approved in 2011 or earlier.

In 2014, the Krško NPP issued the 21st revision of the "Updated Safety Analysis Report", which took into account the changes approved up to 1 November 2014.

A list of modifications since 2000 approved by the SNSA or those of which the SNSA was informed can be found on the SNSA website at:

www.ursjv.gov.si/si/jedrski_in_sevalni_objekti/nuklearna_elektrarna/spremembe_v_nek/

2.1.1.8 External influences on operational safety

The hydro power plants (HPPs) on the lower Sava River have an influence on the flooding hazard of the Krško NPP because of the faster transfer of flood waves, the decrease in the flooding areas along the Sava riverbed upstream from the Krško NPP, dam rupture waves, operational waves (sudden opening of dam gates) and floating sediment that can harm the cooling systems of the Krško NPP relevant for safety. The effect of the Brežice HPP will be the most important because of the higher level of the Sava River at the Krško NPP due to the accumulation basin, which will require extensive modifications of the Krško NPP systems. The influence of the Mokrice HPP on the Krško NPP is small and could be of relevance to the flooding and seismic safety of the Krško NPP.

In 2014 a permit of use for the HPP Krško and the environmental consent for the area of the Brežice HPP were issued. In the process of preparing the national spatial plan (NSP) for the area of the Brežice HPP the SNSA issued consent to an infrastructural arrangements project and a construction permit was issued for the dam structure that is already in the construction phase. In 2014, the project for Mokrice HPP and the NSP for the connecting road from Krško to Brežice were in preparation. The process for the preparation of the NSP for HPPs in the Ljubljana and Litija sector of the river Sava commenced and the SNSA issued appropriate guidelines for its preparation.

Seismic Safety of the Krško NPP

In 2014, the Krško NPP prepared a special study: Assessment of the capacity of the Krško NPP to resist permanent ground deformations due to potential surface faulting, which studied the influence of the worst-case earthquake on the Essential Service Water system (ESW). ESW is important for supplying water in the event of emergency. Results of the analysis indicate that there is a high probability that the integrity of the pipe would be preserved during above mentioned earthquake. High stresses in the yielding range cause local plastic deformation and distortion of some of the pipe's sections. Very high bending moments are noted, which could cause the bolts of flanges to yield or crack.

The following study was also performed: Characterization of the Libna Feature, Proposed Krško 2 Nuclear Power Plant, Rev. 0 (Rizzo, 2013). The purpose of the study was to identify and characterise faults within the vicinity of potential sites for the potential Krško 2 NPP (potentially active faults). The scope of the study primarily focused on the Libna fault and the postulated Stara Vas fault. The main conclusion is that the Libna fault could not be designated as a capable fault.

The SNSA is of the opinion that on the basis of the current knowledge there is no reason to take any immediate action in relation to the seismic safety of the Krško NPP. The SNSA requires that the Krško NPP constantly improve its capabilities to cool the reactor core in any situation by making arrangements for the delivery of the necessary electrical power and water supply to support cooling under any circumstances.

2.1.1.9 Inspection reviews

In 2014, the SNSA performed 60 inspections of the Krško NPP. Two of them were unannounced.

The SNSA inspection in 2014 did not identify substantial deviations in the NPP operation from laws and regulations. In some cases the SNSA inspectors found inconsistencies in fulfilment of the provisions of the Rules on Radiation and Nuclear Safety Factors and the Rules on Operational Safety of Radiation or Nuclear Facilities. Inspection supervision of the condition and surveillance testing of safety-related equipment showed that there were no major deficiencies or failures in 2014. Identified problems related to the equipment were analysed and resolved in due time within the implementation of the Krško NPP corrective programme.

Due to the identified increased number of leaking fuel elements in the 26th fuel cycle, the SNSA inspection service carried out stricter supervision over the activity of the reactor coolant during operations in the 27th fuel cycle.

Inspection reviews confirm that the Krško NPP operated safely in 2014, i.e. without causing harm to people and the environment. The SNSA inspection service assessed the activities of most organisational units of the NPP as good. Inspection reviews showed a high level of safety culture regarding the majority of experts, which is reflected in the high quality of the activities carried out, where safety was a priority. It is also reflected in the identification of potential problems based on its own and foreign operational experiences and in the tendency towards the implementation of appropriate corrective measures.

Radiation protection of exposed workers is also supervised by the Slovenian Radiation Protection Administration (SRPA). In 2014, the SRPA did not carry out an inspection of Krško NPP, but it confirmed 12 assessments of the protection of workers exposed to radiation.

2.1.2 The TRIGA Mark II Research Reactor in Brinje

The operator of the TRIGA Mark II Research Reactor is the Jožef Stefan Institute (JSI) and operation is carried out by the personnel of the Reactor Infrastructure Center (RIC).

Operation

In 2014, the reactor operated for 142 days and released 96.7 MWh of heat during operation. The operation was carried out according to the programme that is approved for each week by the head of the RIC and the JSI radiation protection service. The reactor operated in stationary mode and in pulse mode – 22 pulses were performed. The reactor was mostly used as a neutron source for neutron activation analysis, for irradiation of electronic components and for educational purposes. A total of 579 samples were irradiated in the carrousel and the channels, as well as 48 in the pneumatic post.

In the Hot Cell Facility (OVC) of the Department of Environmental Sciences, the JSI radiation protection service and the ARAO regularly carried out radioactive waste treatment and preparation for the purpose of radioactive waste storage.

In 2014, there were five automatic reactor shutdowns, one of which was caused by operator error, two due to extraction of a sample, one due to disturbances in safety channel number 2, and one due to loss of electric power supply. The operator error occurred because the person responsible forgot to move the power switch of the linear channel. The reactor power at that event was 1 W. An automatic shutdown occurred twice while samples were being extracted – the first time in the linear channel and the second time in safety channel number 2. In both cases the shutdown was a consequence of the sample affecting the reactivity. The disturbances in safety channel number 2 that produced one automatic shutdown were caused by an isolation amplifier that was later replaced with a new one.

There were no violations of the operational limits and conditions from the Safety Analysis Report in 2014. There were also no events that required reporting to the SNSA in 2014.

Operational indicators for acquired doses of the operating staff and experimenters show values far below the regulatory limits. The collective dose in 2014 was 363 man μSv for operating staff and 567 man μSv for personnel carrying out the research work at the reactor (operating staff, members of the JSI radiation protection service, experimenters).

Nuclear Fuel

In 2014, a total of 84 fuel elements were located on the reactor site. There were no spent fuel elements. All fuel elements were standard elements with 12% uranium content and 20% enrichment. Control measurements of radioactivity in the reactor building and in the reactor coolant showed that no fuel elements were damaged. The JSI reported on the fuel balance monthly to EURATOM and the SNSA. In November 2014 the EURATOM performed an inspection of the nuclear material status and the inspection findings showed no anomalies.

Staff Training

An RIC employee extended the operator license for the TRIGA research reactor operator in November 2014. In December 2014, an exercise on the use of inhalation protection equipment during an emergency with increased airborne radioactivity was carried out. Three operators succesfully completed the training for manipulating a forklift truck and two for manipulating the bridge crane. Exercises were carried out twice on safety while working with the forklift truck and twice for safety while working with the bridge crane.

Modifications, Inspections of the Systems, Structures and Components of the Nuclear Facility, Fire Safety and Physical Security

In 2014, nine reactor core modifications were made for the experimental purposes of the nuclear physics department.

Three temporary modifications were implemented. The modification to install a bubbles formation system in the core for use in practical reactor exercises was determined to have a minor impact on nuclear safety. The SNSA approved this temporary modification until 30 June 2014.

Temporary modifications with no impact on nuclear safety were the removal of a thermal column collimator and measurement of the temperature profile inside the reactor tank.

All the modifications were approved by the head of the RIC. The Reactor Safety Committee approved the pulsing operation in November 2014 when 22 pulses were performed for practical exercises for students. The SNSA was notified of the pulsing operation.

The RIC personnel, the JSI technical services, the JSI radiation protection service and the authorised external organisations conducted periodic inspections and supervisions of the safety-relevant structures, systems and components (SSC). The inspection did not find any deficiencies.

Periodic Safety Review

In 2014, the periodic safety review of the nuclear facility that comprises the TRIGA research reactor and the hot cell facility was completed. The operator issued topical reports on the review of safety factors. The report on the periodic safety review was issued as a summary report with an action plan for implementation of modifications and improvements. The SNSA approved the report on 24 December 2014 and by a decision required the operator to implement the action plan of modifications and improvements in the next 5 years.

Review of the Safety Analysis Report

In 2014, an administrative procedure was conducted to upgrade the Safety Analysis Report of the TRIGA Mark II Research Reactor and it has not been completed yet. The chapters on safety analyses, operational limits and conditions and the aging management programme were in the process of preparation and expert review. Revision of these chapters was also one of requirements of the INSARR mission that visited the reactor in the year 2012.

2.1.3 The Central Storage for Radioactive Waste in Brinje

The Central Storage for Radioactive Waste (CSRW) in Brinje is managed by the Agency for Radwaste Management (ARAO).

The CSRW operated safely; there were no recorded incidents or accidents. All periodic preventive maintenance inspections and testing of CSRW structures, systems and components as well as of the operability of measurement equipment were carried out as planned.

As the operator of the nuclear facility, in 2014 the ARAO prepared and revised the strategy to ensure the safety of the CSRW – the settings of the SSCs, the security classification and security features. The ARAO also prepared and revised the control for the aging of the SSCs and the physical protection plan for the CSRW. All documents were sent to the SNSA. At the end of 2014 the SNSA received an application for approval of the content, scope and timetable for the implementation of the first periodic safety review of the CSRW facility. The authorised content, scope and timetable will be the basis for the initiation of the periodic safety review of the CSRW facility, which is planned for the next three years.

In 2014, two employees finished training for work in the Radiation Protection Unit. Training had already begun in 2013. Both workers have been employed by the ARAO for many years.

The acceptance of radioactive waste in the CSRW in 2014 and the inventory of the waste stored at the end of 2014 is described in more detail in Chapter 5.4.1.

In 2014, the SRPA did not carry out an inspection of the ARAO or the CSRW, but it confirmed one of the assessments of the protection of workers exposed to radiation. In November the SNSA performed a periodic unannounced inspection of the operational monitoring of radioactivity at the CSRW. The SNSA inspectors concluded that the radioactivity monitoring programme in the area of the CSRW has been carried out in accordance with the requirements of the legislation and requests were made to the ARAO that all measurements made have to be included in the annual report on radioactivity monitoring and to ensure at least one independent measurement of emissions and immissions annually.

2.1.4 The Former Žirovski Vrh Uranium Mine

In the area around Žirovski Vrh the excavation of uranium ore took place between 1982 and 1990 and uranium concentrate was processed from it. Mill tailings were disposed of in the Jazbec mine waste disposal site and hydrometallurgical tailings were disposed of at the Boršt site. In 1990, after the exploitation of uranium ore was temporarily halted and a subsequent decision on permanent cessation was made, the process of the remediation of such mining and its consequences started. In 2014, the Jazbec mine waste disposal site completed a transitional period of five years of monitoring the environmental impacts, while this has not been completed yet with regard to the Boršt disposal site. More information on remediation activities due to the former mining activities at Žirovski Vrh can be found in Chapter 5.5.

In 2014, the SNSA issued a permit for the closure of the Jazbec mine waste disposal site. With this the conditions for further procedures related to the transfer of management to the ARAO were satisfied.

2.2 Radiation Practices and the Use of Radiation Sources

The Ionizing Radiation Protection and Nuclear Safety Act stipulates advanced notification of the intention to carry out a radiation practice or intended use of a radiation source, the evaluation of the radiation exposure of workers, a mandatory licence to carry out a radiation practice and a licence for the use of a radiation source or certificates of registration of radiation sources and the programme of radiological procedures for use in medicine. The competent authority for licensing in the fields of industry and research is the SNSA, while the competent authority in the field of medicine and veterinary medicine is the Slovenian Radiation Protection Administration (SRPA).

One of the licensing documents is an evaluation of the protection of workers exposed to radiation, which has to be approved by the SRPA. In the document, the nature and extent of the radiation risk of exposed workers, apprentices and students are assessed in advance. In addition, based on this assessment, a programme for the optimisation of radiation protection measures in all working conditions is drawn up. The document must be prepared by the applicant, who is obliged to consult an authorised radiation protection expert. The evaluation can also be prepared by an authorised expert in this field. In 2014, the SRPA approved 191 such evaluations.

2.2.1 Use of Ionising Sources in Industry, Research and Education

At the end of 2014, 154 organisations in industry, research and the state administration in the Republic of Slovenia were using 276 X-ray devices; 768 sealed sources were being used in 79 organisations. As many as 51 radioactive sources were stored at 17 organisations, which are intended to be handed over to the ARAO in the future.

In 2014, 63 licences to carry out radiation practices, 87 licences for the use of a radiation source, 15 certificates of the registration of radiation sources, 10 approvals for external operators of radiation practices, 4 decisions on the termination of the validity of licences to carry out radiation practices, 3 decisions on sealing an X-ray device and 1 decision on unsealing an X-ray device were issued by the SNSA. The SRPA approved 58 evaluations of the protection of workers exposed to radiation and 12 approvals for operators of radiation practices in nuclear and radiation facilities.

The maintenance and updating of the registers are crucial for efficient control of radioactive sources.

Ionisation smoke detectors, utilising isotope ^{241}Am, form a special group of radiation sources. According to the registry of radiation sources, there were 25,033 ionisation smoke detectors being used at 288 organisations at the end of 2014. 276 ionisation smoke detectors were also stored at the users' premises.

2.2.2 Inspections of Sources in Industry, Research and Education

In 2014, SNSA inspectors conducted 54 inspections. Nine of them were interventions. Inspections took place in industry, and at faculties, research institutes, ministries and other institutes where sources are used, as well as at scrap yards.

Inspectors paid special attention to industrial radiography. In 2014, an SNSA inspector issued a fine to a company carrying out such practice. Namely, in 2013 the operator did not follow his prescribed emergency response plan. As a result, during the radiography process exposures of individuals above the prescribed occupational annual dose limit were detected. The SNSA inspector also prohibited the use of an x-ray machine due to the fact that the safety systems of its enclosure were malfunctioning. X-ray machines used in industrial radiography produce high dose rates and proper functioning of safety systems is required.

The SNSA inspectors systematically inspected safety measures related to the use of high activity sources. In 2014, they also continued to inspect licensed providers who performed measurements of radioactivity of secondary metal raw material shipments. As a rule, consignments are checked at entrance as well as at exit points.

In addition, the SNSA inspection unit performed seven inspections related to the use of smoke detectors using a source of ionising radiation. Among these inspections, one was related to the investigation of the inappropriate dismantling of about 20 such smoke detectors. They were dismantled from a primary school and kindergarten building. During the construction of an extension to the building these sources were completely lost, i.e. they were without any control. This case demonstrates that owners of such smoke detectors as well as others involved in the construction of buildings, e.g. investors, engineering bureaus, construction workers and their subcontractors, are not aware of appropriate use of such detectors. They are also not aware of the risks associated with inappropriate handling of radioactive waste.

As already mentioned above, in 2014 the SNSA inspection unit conducted nine interventions. The number of interventions which required a prompt response is close to the number of interventions in the past, i.e. in 2012 altogether 13 interventions took place, of which 10 in 2013. The number of interventions has slowly declined over the last five years. When responding, the inspector follows internal written procedures and cooperates with the Agency for Radwaste Management, qualified experts and others involved in the control of sources of ionising radiation or radioactive waste. In 2014, the SNSA preparedness was influenced by financial restrictions. These restrictions were also present in 2013.

Interventions requiring urgent safety measures can be categorised into three groups.

- Two interventions were related to sources of ionising radiation used in Slovenia in the past or sources used today.
- Altogether five interventions were linked to the transport of sources or radioactive waste.
- In 2014, two interventions were related to the suspicion that inappropriate handling of sources was taking place. Subsequently this suspicion was not confirmed.

Interventions from the first group are the most demanding, requiring a high level of expertise. They are related to sources or radioactive waste in Slovenia. One of these interventions is related to a damaged smoke detector with a source of ionising radiation. The damage was caused by an industrial truck. Measurement of contamination was preformed by a qualified expert, while the radioactive waste was handled by the Agency for Radwaste Management.

The second group of interventions comprises cases related to the transport of wagons or trucks loaded with scrap metals and one case related to a shipment of goods through the Port of Koper. In one case a radium dial was identified. This radioactive waste was stored by the Agency for Radwaste Management. In three cases scrap was returned to the consigner in the state of origin, namely in Bosnia and Herzegovina, India and Romania. In one case the waste was handled by Italian experts.

Radiation protection of workers is also inspected by the SRPA. No inspection of users of sources in industry, research and education was performed in 2014. In February 2014 the SNSA issued one decision on an offence to an industrial company due to violations of the requirements when dealing with an incident in October 2013.

2.2.3 Use of Radiation Sources in Medicine and Veterinary Medicine

The Slovenian Radiation Protection Administration (SRPA) is responsible for the administration and inspection of practices involving radiation in medicine and veterinary medicine.

X-ray Devices in Medicine and Veterinary Medicine

According to the records of the SRPA, 937 X-ray devices for medicine and veterinary medicine were installed as of the end of 2014; 80 of them were not in use. The categorisation of X-ray devices based on their purpose is given in Table 2.

Table 2: Number of X-ray devices in medicine and veterinary medicine by purpose

Purpose	Status 2013	New	Written off	Status 2014
Dental	469	33	14	488
Diagnostic	260	9	7	262
Therapeutic	10	2	0	12
Simulator	3	1	0	4
Mammography	38	4	8	34

Purpose	Status 2013	New	Written off	Status 2014
Computer tomography CT	25	3	1	27
Densitometers	46	1	1	46
Veterinary	62	5	3	64
TOTAL	**913**	**58**	**34**	**937**

In the field of the use of X-ray devices in medicine and veterinary medicine in 2014, the SRPA granted 106 licences to carry out a radiation practice and 189 licences to use X-ray devices. Also, 131 confirmations of the programmes of radiological procedures and 114 confirmations of the evaluation of the protection of workers exposed to radiation were issued.

In medicine, 461 X-ray devices were used in private dispensaries and 412 in public hospitals and institutions. The average age of X-ray devices was 9.6 years (9.5 years in 2013 and 9.1 years in 2012) in the public sector and 9.9 years (9.8 in 2013 and 9.2 years in 2012) in the private sector. The average age of these veterinary X-ray devices was 14.5 years (13.5 in 2013 and 13.8 years in 2012) in the public sector and 9.4 years (9.6 years in 2013 and 8.0 years in 2012) in the private sector. A detailed classification of X-ray devices in medicine and veterinary medicine according to their ownership is given in Table 3.

Table 3: Number of X-ray devices in medicine and veterinary medicine by ownership

Owner-ship	Diagnostic		Dental		Therapeutic		Veterinary		Total	
	No. (%)	**Age (years)**	**No. (%)**	**Age (years)**	**No. (%)**	**Age (years)**	**No. (%)**	**Age (years)**	**No. (%)**	**Age (years)**
Public	297 (80%)	9.9	102 (21%)	8.9	13 (100%)	7.4	10 (16%)	14.5	422 (45%)	9.7
Private	75 (20%)	10.5	386 (79%)	9.6	0	0	54 (84%)	9,4	515 (55%)	9.7
Total	**372**	**10.0**	**488**	**9.5**	**13**	**7.4**	**64**	**10.2**	**937**	**9.7**

All X-ray devices are examined by approved radiation protection experts at least once a year. The devices are classified, with regard to their quality, into the following groups: fully functional, servicing required, decommissioning proposed, and not functional. The analysis of the data for X-ray devices is presented in Figure 11, which shows that more than 95% of devices were classified as "fully functional" in the last five years.

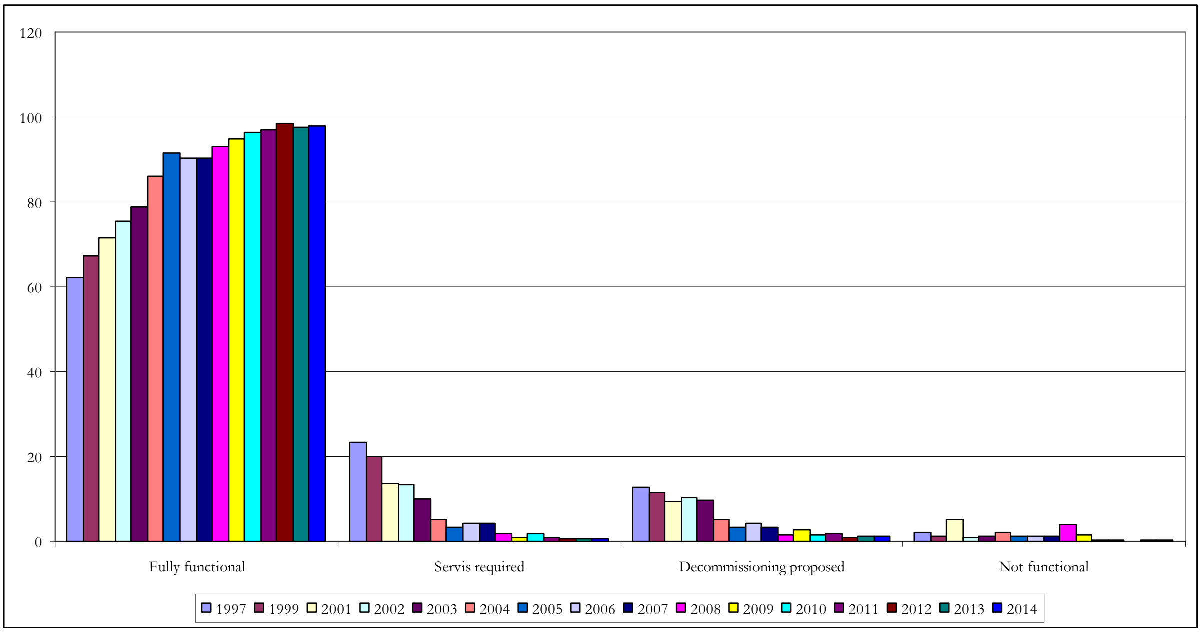

Figure 11: Percentage of diagnostic X-ray devices according to their quality in the period 1997–2014

In 2014, 13 in-depth inspections of the use of X-ray devices in medicine and veterinary medicine were carried out, of which two inspections were in the latter field. In six cases, based on the findings of the inspection, the inspection decision was issued with requirements that needed to be fulfilled in order to comply with the valid regulations. In 4 cases, the equipment was sealed to prevent the potential use of equipment kept in reserve.

Based on a review of the inspection reports on X-ray devices for medical use sent to the SRPA by approved technical support organisations, 6 inspections were conducted during which the SRPA requested that the user provide evidence that the noted shortcomings had been eliminated. There were 25 cases in which the user was asked to present evidence relating to the termination of the use of an X-ray device and 111 cases involving the requirement to comply with the applicable legislation.

Unsealed and Sealed Radiation Sources in Medicine and Veterinary Medicine

Seven hospitals or clinics in Slovenia, namely the Clinic for Nuclear Medicine of the University Medical Centre Ljubljana, the Institute of Oncology, the University Medical Centre Maribor, and general hospitals in Celje, Izola, Slovenj Gradec and Šempeter near Nova Gorica use unsealed sources (radiopharmaceuticals) for diagnostics and therapy in their nuclear medicine departments.

In these nuclear medicine departments, altogether 6,731 GBq of isotope ^{99}Mo, 3,119 GBq of isotope ^{18}F, 1,225 GBq of isotope ^{131}I, and minor activities involving the isotopes ^{123}I, ^{177}Lu, ^{201}Tl, ^{90}Y, ^{111}In and some other isotopes are used for diagnostics and therapy. Isotope ^{99}Mo is used as a generator of the isotope technetium ^{99m}Tc, which is used for diagnostics by nuclear medicine departments. From the initial activity of ^{99}Mo, approximately three times higher activity of ^{99m}Tc can be eluted in one week.

Sealed sources for therapy are used at the Institute of Oncology and the Clinic of Ophthalmology, and for the irradiation of blood components at the Blood Transfusion Centre of Slovenia.

Sealed sources with low activity are used for the operational testing of various devices and measurement equipment in some nuclear medicine departments. The SRPA registry shows that there are still 1,933 ionisation smoke detectors with ^{241}Am in 18 medical facilities. The Institute of Oncology uses two sources of ^{192}Ir and three sources of ^{90}Sr. At the Clinic of Ophthalmology they use four sources of ^{106}Ru for treating eye tumours. At the Blood Transfusion Centre of Slovenia a device is used for the irradiation of blood components.

Sealed sources of minor activities are used for the operational testing of various devices and measurement equipment at some nuclear medicine departments

In 2014, the following documents with reference to the use of unsealed and sealed sources in medicine were issued: 9 licences to carry out a radiation practice, 14 licences to use a radiation source in medicine, 4 confirmations of radiological procedure programmes, 1 permit for the import of radioactive material and 49 statements on the shipment of radioactive materials from EU Member States.

Medical departments with unsealed and sealed radiation sources were surveyed (once or twice annually, depending on the source type) by the approved experts for radiation protection and medical physics at the Institute for Occupational Safety (ZVD). No major deficiencies were found in 2014 and no dose constraint or dose limit was exceeded.

In addition to the expert reviews made by the ZVD, the SRPA inspectorate also carried out two inspections, one at the Institute of Oncology and one at the University Medical Center Maribor. The inspection at the Institute of Oncology addressed medical examinations of exposed workers, the use of personal dosimeters, access to the controlled area in the Brachytherapy Department and the appropriate permissions to use the source ^{90}Sr. A warning was issued with regard to the offence as well as decision with a deadline for obtaining the relevant permits for that source. The inspection at the Nuclear Medicine Department of the UKC Maribor dealt with the use of personal dosimeters for extremities and surface contamination, which was measured by the ZVD. There was no need for any enforcement provisions.

Neither unsealed nor sealed radioactive sources were used in veterinary medicine in 2014.

In the field of the transport of radioactive materials used in medicine and veterinary medicine, one certificate of eligibility for a foreign contractor carrying out a radiation practice was issued as well as three three permits to import radioactive sources.

2.2.4 The Transport of Radioactive and Nuclear Materials

The transport of radioactive and nuclear materials is regulated by the Act on the transport of dangerous goods. All road transport of such materials has to be carried out in accordance with the provisions of the European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR).

In 2014, the SNSA issued one approval for transport under special arrangement to the Agency for Radioactive Waste for transport of spent sealed source from the producer SILKEM, d.o.o., to the Central Storage Facility in Brinje.

The Ionizing Radiation Protection and Nuclear Safety Act, which was amended in 2011, now defines the transport of radioactive materials as a radiation practice. Thus, the transport of radioactive materials is allowed only if a licence to carry out a radiation practice has been obtained. As of the entry into force of the amendments, the SNSA systematically treats such transportation as a radiation practice, as regards prolonging or amending a licence or issuing a new licence for carrying out a radiation practice for carriers of such materials and companies that use radioactive sources in the field.

In 2014, the SNSA carried out three procedures for the approval of packaging for the transport of radioactive material.

2.2.5 Import/shipment into, transit and export/shipment out of radioactive and nuclear material

The SNSA and the SRPA issue permits for the import and export of radioactive and nuclear materials outside the EU and approve prescribed forms (declaration of shipment) for the shipment of radioactive material between EU Member States.

In 2014, the SRPA issued one permit for the import of radioactive sources from non-EU countries and approved 49 applications of consignees of radioactive material in medicine and veterinary medicine. Each isotope from an individual producer intended for the same end user is counted separately.

In 2014, the SNSA approved 8 applications of consignees of radioactive material from other EU Member States. The SNSA also issued five permits for the import of radioactive material; two permits for export of radioactive material; three permits for multiple import of radioactive material; one permit for multiple export of radioactive material; one permit for multiple shipments of contaminated equipment between other EU Member States; two permits for multiple import and export of contaminated equipment and one permit for the import of nuclear material – fresh nuclear fuel.

In 2014, the SNSA did not issue any permits for the transit of radioactive material or for the transit of nuclear material.

The shipment of radioactive waste and spent nuclear fuel between EU Member States as well as between EU Member States and third countries is regulated by Council Directive 2006/117/EURATOM on the supervision and control of shipments of radioactive waste and spent fuel. In 2014, the SNSA issued one authorization for the shipment of radioactive waste for treatment in Sweden.

In 2014, the SNSA for the second time reported to the European Commission according to Article 20 of the pertinent directive.

2.2.6 Achieving goals under the Resolution on Nuclear and Radiation Safety

The Resolution on Nuclear and Radiation Safety in the Republic of Slovenia for the period 2013–2023 determined the following broad-ranging goals in the field of nuclear and radiation practices:

Goal 1

Nuclear and radiation facilities and operators fulfil the statutory requirements, ensure continuous improvement of nuclear and radiation safety, and monitor international improvements in the field.

Realization in 2014

All nuclear and radiation facilities in the state (Krško NPP, the TRIGA research reactor, the Central Storage for Radioactive Waste in Brinje, the mine disposal and mill tailings site) fulfilled the statutory requirements and fostered the improvement of nuclear and radiation safety.

The Periodic Safety Reviews at Krško NPP and the TRIGA research reactor were completed in the year 2014. Both facilities began comprehensive safety improvements. On the basis of stress tests, the Krško NPP slowed down their implementation, since the owners wanted to be certain of the economic viability of the safety improvements that were to follow in the future. The findings of the special economic study alliaviated the concerns, so the improvement programme can proceed smoothly in accordance with the decisions issued by the SNSA.

3 RADIOACTIVITY IN THE ENVIRONMENT

Protection against ionising radiation is implemented for three categories: radiation workers, patients undergoing medical diagnostics that use radiation, and the general population. Protection of the population is ensured by the competent authorities by measuring radioactivity throughout Slovenia, with special attention devoted to the protection of populations living in the vicinity of nuclear and radiation facilities.

The main purposes of radioactivity monitoring in the environment are to monitor the levels of radioactive contamination, to monitor trends in the concentrations of radionuclides in the environment, and to provide timely warnings in the event of a sudden increase in radiation levels in Slovenia.

Radiation protection of the population is ensured through the online monitoring of external radiation levels and radioactivity in the environment, as well as through continuous control of radioactivity in drinking water, food, feed, and products in general use on the basis of laboratory measurements.

Supervision of nuclear and radiation facilities is carried out through operational monitoring; the programme for such is drawn up by the competent authority, whereas the operator is liable for the implementation of this programme. The control of emissions from all facilities and the extent of radioactivity in the surrounding areas are covered by this programme. Sampling and measurements of samples are carried out by accredited technical support organisations, which are in turn authorised by the competent administrative authorities.

Radioactivity released into the environment by the nuclear power plant in Krško, the former uranium mine at Žirovski Vrh, the TRIGA Research Reactor and the Central Storage for Radioactive Waste, which are both located in Brinje near Ljubljana, is monitored. The doses received by the population living in the vicinity of these nuclear and radiation facilities which emit radioactive substances into the environment are estimated on the basis of measured or modelled data. The doses received by the population should be lower than the dose constraints set by the competent administrative authority.

The monitoring of radioactivity in the environment that is a result of global contamination from the Chernobyl nuclear accident and past nuclear testing has been carried out in Slovenia for over five decades and mainly involves tracking the long-lived fission radionuclides ^{137}Cs and ^{90}Sr by different transmission pathways.

The monitoring of exposure to natural sources of radiation, especially radon, is carried out under the Government's programme of systematic inspection of the working and living environment and raising awareness of measures to reduce exposure due to the presence of natural radiation sources.

This chapter contains a summary of reports on the state of environmental radioactivity on the territory of Slovenia in 2014.

3.1 The Early Warning System for Radiation in the Environment

An automatic online warning system for environmental radioactivity has been established in Slovenia. It is intended to immediately detect elevated radiation levels in the environment and is one of the key elements of the warning and emergency response during nuclear or radiological emergencies. In the event of elevated levels of external radiation and air concentrations of radioactive particles, soil, drinking water, food, and feed would be contaminated due to the subsequent deposition of radioactive particles on the ground. Automatic probes for real-time measurements of external radiation are positioned around Slovenia. They are managed by the

Slovenian Nuclear Safety Administration (SNSA), the Krško Nuclear Power Plant and Slovenian thermal power plants. Data are collected at the SNSA, where they are constantly analysed, archived and made available to the public on the internet. If the values are elevated, an automatic alarm is sent to the officer on duty.

In 2014, there were no events that triggered an alarm due to increased radiation in the environment.

Since 1997, the SNSA has been sending data from the Slovenian early warning system to the European EURDEP system, based at the Joint Research Centre in Ispra (Italy), where data from the majority of European national early warning networks are collected. Through this arrangement, Slovenia also gained access to real-time data on external radiation from other participating countries. Additionally, the Slovenian data are exchanged daily with the centres in Vienna (Austria), Zagreb (Croatia), and Budapest (Hungary).

3.2 Monitoring Environmental Radioactivity

Monitoring of the global radioactive contamination due to atmospheric nuclear bomb tests (1951–1980) and the Chernobyl accident (1986) has been carried out in Slovenia for almost five decades. Primarily, two long-lived fission radionuclides, ^{137}Cs and ^{90}Sr, have been monitored in the atmosphere, water, soil and drinking water, as well as in foodstuffs and feedstuffs. Other natural gamma emitters are also measured in all samples, while in drinking water and in precipitation the levels of tritium (^{3}H) are additionally measured.

The results of the measurements for 2014 showed that concentrations of both long-lived fission products in samples of air, precipitation, soil, milk, foodstuffs of vegetable and animal origin, and feedstuffs continued to slowly decrease and were in most cases already lower than before the Chernobyl accident. On average, the fallout of these radionuclides in Slovenia due to the Chernobyl accident was five times higher (20–25 kBq/m^2) than from all preceding nuclear weapon tests together. The highest ground contamination was measured in the Alpine and forest regions, which indirectly contributes to the increase in the amounts of this radionuclide in Alpine pastures (in milk and cheese) and in the forest ecosystem (in forest fruits, mushrooms, game). The concentrations of tritium in liquid samples (surface water, precipitation, drinking water) decrease very slowly, only a few percent per year.

In Slovenia, the consequences of the releases resulting from the nuclear accident in Fukushima on 11 March 2011 were negligible. Only short-term values of the isotopes ^{131}I and ^{134}Cs in the atmosphere and in precipitation were measurable.

The biggest contribution to the radiation exposure of the public due to environmental contamination by artificial radionuclides comes from external radiation and from food ingestion. The inhalation dose from aerosols with fission radionuclides is negligible. In 2014, the effective dose from external radiation of ^{137}Cs (mainly from the Chernobyl accident) was estimated at about 6.4 μSv, which is 0.26% of the dose received by an average adult in Slovenia from natural background radiation. This value is slightly smaller than the value that was measured and calculated for the previous year (6.2 μSv).

The annual dose from the ingestion pathway (consumption of food and drinking water) was 1.1 μSv, which is comparable to doses in previous years. The dose for 2008 was higher due to the higher average values of the radionuclide ^{90}Sr in the selected samples of vegetables sampled in regions with higher Chernobyl contamination (Figure 12). The contribution of ^{90}Sr to the annual dose due to ingestion is 53%; the contribution of ^{137}Cs to the annual dose is 45% while the contribution of ^{3}H to the annual dose is 2%. The annual contribution due to the inhalation of these radionuclides is only about 0.001 μSv, which is negligible when compared to radiation exposure from other transfer pathways. The effective dose from drinking water was also estimated, taking into account artificial radionuclides. Calculations have shown that on average this dose was around 0.037 µSv per year. The annual limit value of 0.1 mSv per year due to natural and artificial radionuclides in drinking water from local water supplies was not exceeded in any sample.

In 2014, the total effective dose of an adult in Slovenia arising from the global contamination of the environment with artificial radionuclides was estimated at 6.4 µSv, as shown in Table 4. This is approximately 0.27% of the dose compared to the annual exposure of an adult in Slovenia received from natural radiation in the environment (2,500–2,800 µSv). In the regions with lower radioactive contamination of the soil, such as Prekmurje and the Coastal-Karst region, the corresponding dose is lower, while it is higher in the Slovenian Alpine region.

Considering all the doses specified in this chapter, it should be taken into account that these values are extremely low and cannot be measured directly. The final results are calculated by using mathematical models and are based on measurable quantities of radionuclides, most of which are also low. The measurement uncertainties are therefore considerable and in some cases results differ considerably from year to year. Most importantly, these values are far below the limit values.

Table 4: Radiation exposure of the adult population in Slovenia due to global contamination of the environment with artificial radionuclides in 2014

Transfer pathway	Effective dose [µSv per year]
Inhalation	0.001
Ingestion:	
drinking water	0.037
food	1.1
External radiation	6.4*
Total (rounded)	**7.5****

* This applies to central Slovenia; the value is a bit lower for the urban population and higher for the rural population.

** Radiation exposure from natural radiation is 2,500–2,800 µSv per year.

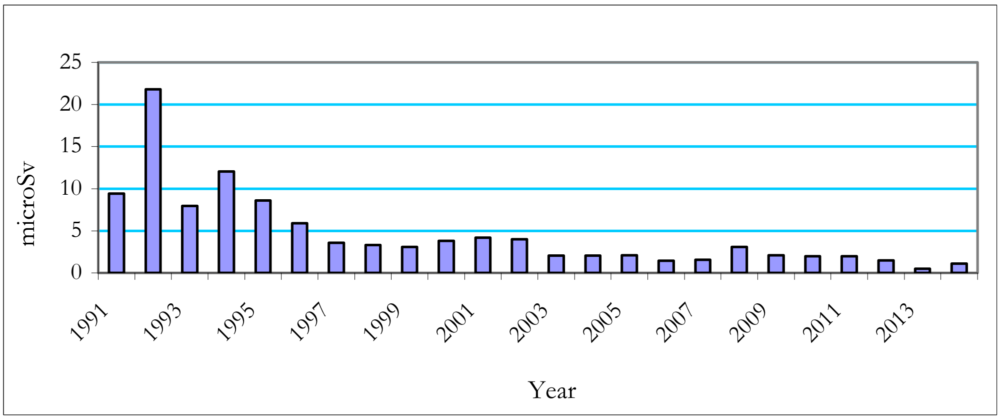

Figure 12: Annual effective doses of members of the public received by ingestion due to global radioactive contamination of the environment with the radionuclides ^{137}Cs and ^{90}Sr in Slovenia

The reason for the high value in 1992 was that game foodstuffs were taken into account when the dose estimation was calculated. Without those samples, the effective dose for that year would have been lower than 10 μSv.

3.3 Operational Monitoring in Nuclear and Radiation Facilities

Each installation or facility that may discharge radioactive substances into the environment is required to be subjected to regulatory control. Radioactivity measurements in the surroundings of the installations must be performed already in the preoperational period, during operation, and for a certain period after the installation ceases to operate. The goal of operational monitoring is to establish whether the discharged activities are within the authorised limits, whether radioactivity concentrations in the environment are inside the prescribed limits, and whether the radiation doses received by the population are lower than the prescribed dose limits.

3.3.1 The Krško Nuclear Power Plant

The radiological situation in the surroundings of the nuclear power plant is monitored by the continuous measuring of gaseous and liquid radioactive discharges and by carrying out radioactivity measurements of environmental samples. The measured values of analysed radionuclides in environmental samples (in air, soil, surface and underground water, precipitation, drinking water, agriculture products, and feedstuffs) during the normal operation of the plant are low, usually considerably lower than the detection limits of analytical procedures. The impacts of the nuclear power plant on the environment are therefore evaluated only on the basis of data on gaseous and liquid discharges. These discharge data are used as an input for modelling the dispersion of radionuclides in the environment.

Low results of the measurements in the environment of the nuclear power plant during normal operation confirm that radioactive discharges into the atmosphere and in aquifers were low. In the event of an emergency, the established monitoring network allows the immediate sampling and analysis of contaminated samples.

In 2014, independent monitoring confirmed that the measurements of discharges performed by the Krško NPP were fully consistent with the results of measurements carried out by the laboratories of the authorised performers of radioactivity monitoring, i.e. the Jožef Stefan Institute (JSI) and the Institute of Occupational Health (IOS).

3.3.1.1 Radioactive Discharges

The activity in gaseous releases is mostly produced by noble gases. In 2014, the total activity of noble gases released into the atmosphere was 1.07 TBq, which resulted in a public exposure of 0.06 μSv or 0.12% of the limit. Releases were lower than in the previous year, whereas their values are much lower than the prescribed limit values. The released activities of iodine isotopes in 2014 were 29.8 MBq (calculated for ^{131}I), which is 0.05% of the annual limit and is one order of magnitude lower than in 2013. Lower releases are the result of the fact that the problems with worsened integrity of nuclear fuel during the 26th fuel cycle in 2014 were mostly eliminated. The activity of released radioactive dust particles was 0.23 MBq, which is approx. 0.001% of the annual limit and is comparable to 2013. Due to discharges of tritium (^{3}H) into the atmosphere, a slight increase in the activity of ^{3}H gas emissions was observed from one year to the next due to improvements in the sampling method and laboratory analysis. The release level of ^{3}H has slowly been stabilised, as expected. The activity of ^{14}C corresponds to the values that are typical for years without refuelling outages.

In liquid discharges from the plant into the Sava River, ^{3}H, bound to water molecules, predominated. Total ^{3}H activity released in 2014 was the lowest in recent years, 1.73 TBq, which is 3.9% of the annual regulatory limit (45 TBq), because there was no refuelling outage in 2014. Due to its low radiotoxity, this radionuclide is radiologically less important despite having a higher activity compared to other radioactive contaminants. The activity of other radioisotopes in liquid discharges was similar to in the previous year and amounted to 48.4 MBq or 0.05% of the annual limit (100 GBq). Regular monitoring of radioactive discharges did not provide measurements of ^{14}C in liquid discharges until 2013, when the "Rudjer Bošković Institute" systematically began to measure the ^{14}C activity in the quarterly composite samples of the WMT#2 waste monitoring tank. The total discharged activity released into the Sava River in 2014 was 1.69 GBq, which is more than in 2013, but is consistent with the estimates made on the basis of the literature and international practice (1.8 GBq/year).

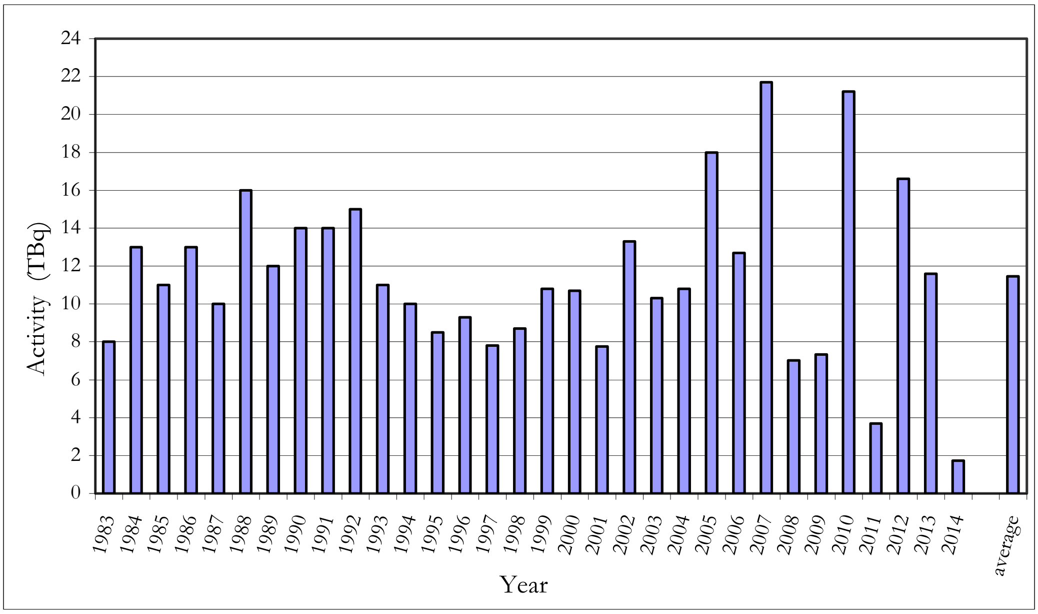

Figure 13: Activity of the released ^{3}H in liquid discharges

3.3.1.2 Environmental Radioactivity

The programme for monitoring environmental radioactivity from the above-mentioned discharges comprises the following measurements of the concentrations or content of radionuclides in environmental samples:

- in air (aerosol and iodine filters);
- in dry and wet deposition (dry and wet precipitation);
- in the Sava River water, sediments and water biota (fish);
- in tap water (Krško and Brežice), wells and underground water;
- in food of vegetable and animal origin (including milk);
- in soil on cultivated and uncultivated areas; and
- measurements of ambient dose equivalents at several locations.

Concerning the impact of the Krško NPP, it should be noted that the presence of the radionuclides ^{137}Cs and ^{90}Sr is a consequence of global contamination and not a result of plant operations. The impact of liquid discharges of tritium from the NPP on wells in 2014 could not be detected, as was the case in previous years. An exception is a sample taken in April. However, when interpreting the wells data it is necessary to take the monthly shift into account due to the time of the sampling, as samples are taken in the middle of the month. The most likely reason for this is that the amount of tritium released from the NPP in 2014 was significantly lower than in previous years. The concentrations of other artificial radionuclides discharged into the Sava River (^{60}Co and others) were below the detection limits in all samples. The measured concentrations of radioisotope ^{131}I into the Sava River could be caused by discharges from nuclear medicine clinics in Ljubljana and Celje, not by the operations of the nuclear power plant.

3.3.1.3 Exposure of the Public

Dose assessment of the public was based on model calculations made by contractors. The calculated dispersion factors for atmospheric discharges, based on realistic meteorological data, showed that the most important pathways for public exposure were the ingestion of food with ^{14}C, external radiation from clouds and deposition, and the inhalation of air particles with ^{3}H and ^{14}C. The highest annual dose was received by adult individuals due to the intake of ^{14}C from vegetable food (0.04 µSv), while a ten-fold lower dose (0.0068 µSv) was also received due to the inhalation of ^{3}H. The dose assessment of liquid discharges in 2014 showed that their additional contribution to the population exposure was very low – 0.65 µSv per year, which is more than in previous years. Namely, since 2013 the model includes ^{14}C, which started to be systematically measured in liquid discharges. The levels of external radiation in the immediate vicinity of some structures of the NPP were higher than in the natural surroundings, but the plant's contribution is barely measurable at the perimeter fence. It was estimated that the plant-related external exposure was less than 0.5 µSv per year. This estimation is similar to those in recent years and it is now based on more realistic data than in the first period of plant operation, when the estimated values of the external dose were at least one order of magnitude higher.

Table 5 shows that the estimated total effective dose of an individual who lives in the surroundings of the Krško NPP is less than 0.7 µSv per year. The contribution of ^{14}C ingestion was higher than in 2013. This value represents 1% of the authorised limit value (a dose constraint of 50 µSv per year) or 0.03% of the effective dose received by an average Slovenian from natural background radiation (2,500–2,800 µSv per year).

Table 5: Assessment of the partial exposures of an adult member of the reference public group due to atmospheric and liquid radioactive discharges from the Krško NPP in 2014

Type of exposure	**Transfer pathway**	**Most important radionuclides**	**Effective dose [µSv per year]**
External radiation	Cloud immersion	Noble gases (^{41}Ar, ^{133}Xe, ^{131m}Xe)	0.0005
	deposition	Particulates (^{58}Co, ^{60}Co, ^{137}Cs, etc.)	3.5E-9
Inhalation	Cloud	^{3}H, ^{14}C	0.0068
Ingestion (atmospheric discharges)	Vegetable food	^{14}C	0.04*
Ingestion (liquid discharges)	Drinking water (the Sava River)	^{3}H, ^{137}Cs, ^{89}Sr, ^{90}Sr, ^{131}I, ^{14}C	0.65
Total Krško NPP in 2014			**< 0.7***

* The total amount is conservative, since all contributions cannot be simply summed up due to different reference groups of the population.

3.3.2 The TRIGA Research Reactor and the Central Storage for Radioactive Waste at Brinje

The TRIGA Research Reactor and the Central Storage for Radioactive Waste are both located at Brinje near Ljubljana. The samples irradiated in the reactor are analysed in the laboratories of the Department of Environmental Science of the Jožef Stefan Institute, which are located by the reactor building. Therefore, potential radioactive discharges at this location come from the operation of the reactor, from the Central Storage for Radioactive Waste and from the work in the laboratories. The operation of the facilities was stable and there were no incidents that resulted in radioactive material being released into the environment; thus the results of the operational monitoring for 2014 are essentially the same as for the previous year.

Environmental monitoring of the TRIGA Research Reactor comprises measurements of atmospheric and liquid discharges and measurements of radioactivity levels in the environment. The latter are carried out to determine the environmental impact of the installation and include measurements of radioactivity in the air and underground water, as well as measurements of external radiation, radioactive contamination of the soil, and the radioactivity of Sava River sediments.

Measurements of radioactive aerosol discharges into the atmosphere showed results below the detection limit. Discharges of ^{41}Ar into the atmosphere, calculated on the basis of the reactor operation time, were estimated at 0.7 TBq in 2014, which is comparable to previous years. The measurements of specific activities in the environment showed no radioactive contamination from the operation of the reactor. The external dose due to radiation from the cloud on an individual due to ^{41}Ar discharges was estimated, similar to previous years, at 0.01 μSv per year under the assumption that the individual spends 65 hours per year at a distance of 100 m from the reactor when mowing grass or ploughing snow and that he stays in the cloud only 10% of his time. An inhabitant of Pšata village who lives at a distance of 500 m from the reactor receives 0.36 μSv per year. A conservative assumption was used for the dose assessment for individuals concerning liquid discharges. If river water is ingested directly from the recipient Sava River, the annual exposure is estimated at less than 0.01 μSv per year. The total annual dose for an individual, irrespective of the pathway, is still one hundred times lower than the authorised dose limit (50 μSv per year). The total annual dose of an individual from the public in 2014, irrespective of the model used, is still more than a thousand times lower than the effective dose from the natural background in Slovenia (from 2,500 to 2,800 μSv per year).

The programme for monitoring the environmental radioactivity of the Central Storage for Radioactive Waste at Brinje comprised mainly control measurements of radioactive atmospheric discharges (radon and its short-lived progeny from the storage, dug into the ground, coming from the stored 226Ra sources), radioactive wastewater from the drainage collector and direct external radiation on the outside parts of the storage. Environmental concentrations of radionuclides were measured in the same way as in previous years, namely in the underground water from two wells, as external radiation at several different distances from the storage, and as dry deposition on soil near the storage.

The estimated average radon emission in 2014 was 6 Bq/s, which is, taking into account the measuring uncertainty, similar to the emissions in 2009–2013 (Figure 14). The increase of radon (222Rn) concentrations in the vicinity of the storage was not measurable and was therefore estimated by a model for average weather conditions to be around 0.32 Bq/m^3 at the fence of the reactor site. In the wastewater from a drainage collector, the only artificial radionuclide measured was again ^{137}Cs, which is a consequence of global contamination and not of storage operation. Among artificial radionuclides, only the presence of ^{241}Am was detected in the wastewater in the underground reservoir, at 0.53 Bq/m^3, which is far lower than clearance levels and also lower than the derived concentrations for drinking water.

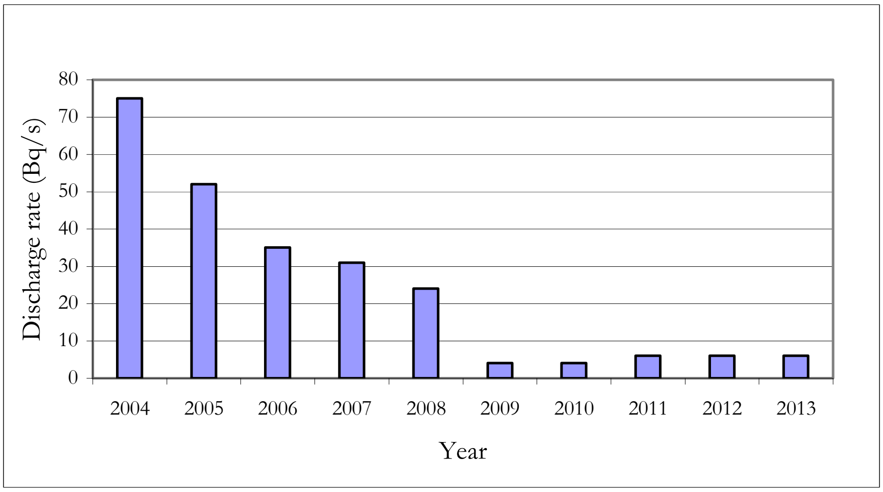

Figure 14: Emission rates of ^{222}Rn from the Central Storage for Radioactive Waste at Brinje

For the dose assessment of the most exposed members of the public, the inhalation of radon decay products and direct external radiation were taken into account. The most exposed members of the reference group are the employees of the reactor centre, who could potentially be affected by radon releases from the storage. In 2014, they received an estimated effective dose of 0.81 μSv, according to the model calculation. A security officer received 0.38 μSv per year from his regular rounds, while the annual dose received by a farmer adjacent to the controlled reactor area was estimated to be only about 0.02 μSv. These values are comparable with those in 2013 and are much lower than in 2008, due to lower radon releases. Moreover, they are much lower than the authorised dose limit for individuals from the reference group of the population (100 μSv per year). The annual dose collected by an individual from the natural background is 2,500–2,800 μSv.

3.3.3 The Former Žirovski Vrh Uranium Mine

The monitoring of environmental radioactivity consists of measuring radon releases, liquid radioactive discharges and concentrations of the radionuclides in the environment. An integrated programme of measurements has been implemented, including the radionuclide-specific activities of the uranium-radium decay chain in the environmental samples, including the concentrations of radon and its decay products in the air, and external radiation. Measurement locations are set mainly in the settled areas in the valley, up to 3 km from the existing mine radiation sources, from Gorenja Vas to Todraž. For the evaluation of the impact of uranium mining and milling, the relevant measurements of radionuclides of natural origin are carried out at reference points outside the influence of mine and disposal site discharges (as an approximation of natural radiation background). From the ratio of the radon concentration in the Jazbec disposal site in the period between the closure of the mine and the starting of decommission and remediation works (1991–1995) and the average contribution of the radon from the mine in Gorenja Dobrava during this period, it can be concluded on the contribution of radon originating from the mine in Gorenja Dobrava in the current year.

Measurements of external gamma radiation in the vicinity of mine disposal site and hydrometallurgical tailings disposal sites were also performed in 2014, in accordance with the monitoring programme. In 2014, the first year of long-term monitoring and maintenance of the Jazbec disposal site, and the fourth year following the closure of the Boršt disposal site, the monitoring programme was scheduled in accordance with the Safety Report for the Jazbec and Boršt disposal site.

The safety report for the Jazbec disposal site sets out the parameters to be monitored by radiological monitoring. These parameters are determined on the basis of the analysis of the monitoring results from the previous period. Since the operator did not perform the analysis for the Jazbec disposal site in 2014 and due to limited financial assets, the monitoring in 2014 was performed to a lesser extent that did not allow for the verification of all emissions from individual facilities. For this reason, the discharges from the sanitised pit and the Jazbec disposal site were not checked.

The most important part of the programme in 2014 was measuring the radon concentration and radon short-lived progeny.

The radioactivity of surface waters has been slowly but steadily decreasing in recent years, especially ^{226}Ra concentrations in the main stream, Brebovščica, which are already close to the natural background level (with a single sample value of 5.4 Bq/m^3 in 2014). Only the concentration of uranium in the Brebovščica stream (with a single sample value of 234 Bq/m^3 in 2014) is noticeably increased, since all liquid discharges from the mine and from both mining disposal sites flow into this stream.

In 2014, the mine's contribution of radon ^{222}Rn from the disposal sites and the mine to the natural concentrations in the environment is estimated at around 2.3 Bq/m^3.

In 2014, the measurements of radioactivity in fish samples were again performed after last being sampled in the year 2010. Measurements showed negligibly increased values of ^{226}Ra relative to the reference location. The contractors found that by using the gamma spectrometry method alone, the increase in ^{210}Pb levels in fish from the surrounding of the former mine with respect to the fish from the reference location could not be detected.

The calculation of the effective dose received by the population took into account the following exposure pathways: the inhalation of long-lived radionuclides from the decay series of uranium, radon and its short-lived progeny, ingestion without water contribution, and external gamma radiation. The radiation exposure of an adult member of the public living in the vicinity of the mine was estimated at 0.058 mSv for 2014, which is a less than in the previous year. The exposure is low because the remediation at the mine disposal sites at the Jazbec and Boršt sites was completed and represents approximately one-fifth of the effective dose estimated in the last decade of the 20th century. However, the most important radioactive contaminant in the mine environment still remains radon ^{222}Rn with its short-lived progeny, which contributed 0.049 mSv or 85% of the additional exposure in this environment (Table 6).

Table 6: The effective dose received by an adult member of the public living in the surroundings of the former uranium mine at Žirovski Vrh in 2014

Transfer pathway	Important radionuclides	Effective dose [mSv]
Inhalation	– aerosols with long-lived radionuclides (U, ^{226}Ra, ^{210}Pb) – only ^{222}Rn – Rn – short-lived progeny	0.00 0.0012 0.049
Ingestion	– drinking water (U, ^{226}Ra, ^{210}Pb, ^{230}Th) – fish (^{226}Ra and ^{210}Pb) – agricultural products (^{226}Ra and ^{210}Pb)	(0.0107)* 0.0008 0.0065
External radiation	– immersion and deposition (radiation from cloud and deposition) – deposition of long-lived radionuclides (deposition) – direct gamma radiation from disposal sites	0.0008 – –
Total effective dose (rounded):		**0.058 mSv**

* Dose due to the ingestion of water from the Brebovščica stream is not included in the dose assessment because the water is not used for drinking, watering of animals, or irrigation.

The total effective dose for an adult in 2014 due to the contribution of the former uranium mine is 50% lower than in 2007 and amounted to less than one-tenth of the general limit value for the population, which is 1 mSv per year. The estimated dose received by a 10-year-old child was 0.075 mSv and 0.130 mSv by a 1-year-old child. These values represent about 2% of the natural background dose in the environment of Žirovski Vrh during the operation of the mine (5.5 mSv). Annual changes in effective doses due to the mine contribution are shown in Figure 15.

Measurements of the radioactivity and dose estimations for the last several years have shown that the environmental impacts and exposure of the population have decreased due to the cessation of uranium mining and the remediation works that have already been carried out. The estimated dose exposure is one-third of the authorised dose limit of 0.3 mSv per year.

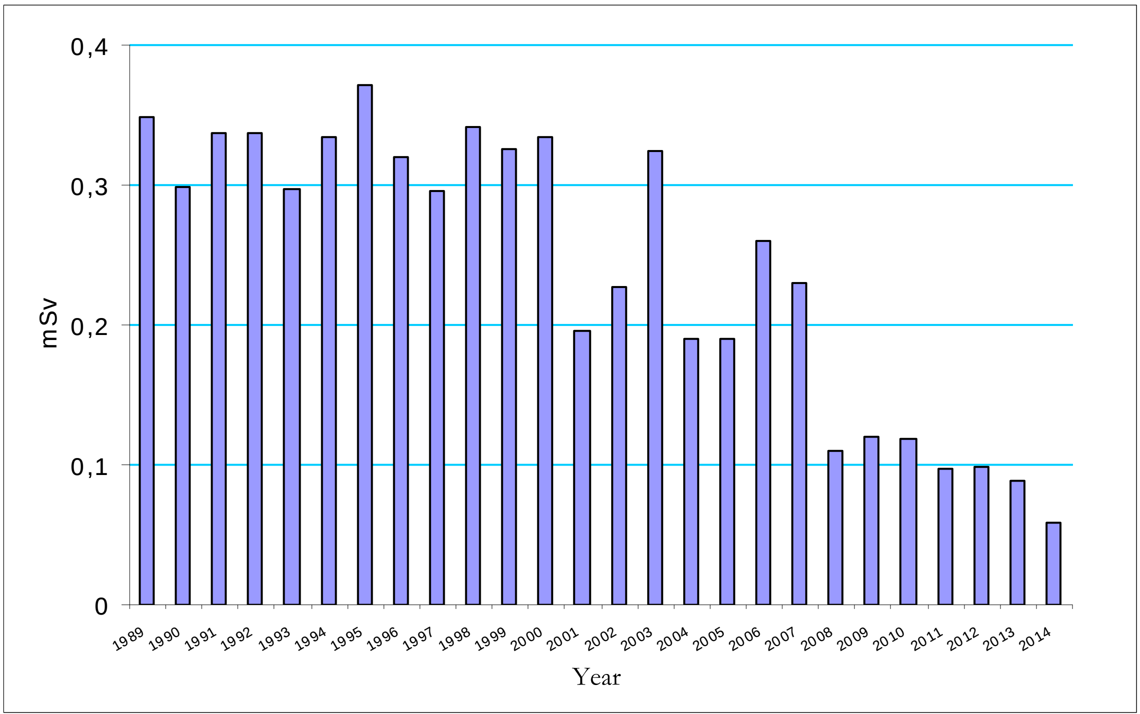

Figure 15: Annual contributions to the effective dose received by an adult member of the public due to the former Žirovski Vrh uranium mine in the period 1989–2014

3.4 Radiation Exposures of the Population in Slovenia

Every person on Earth is exposed to natural and artificial radioactivity in the environment. A great part of the population receives radiation doses from radiological examinations in medicine, while only a small part of the population are exposed occupationally due to their work in radiation fields or with radiation sources. The term external radiation means that the source of radiation is located outside the body. Internal radiation occurs when radioactive material enters the body by inhalation, the ingestion of food and drink, or through the skin. The data on population exposure are presented below, while occupational exposures (to artificial and natural sources), as well as medical exposures, are presented in Chapter 4.

3.4.1 Exposure to Natural Radiation

The average annual effective dose from natural sources received by a single individual on Earth is 2.4 mSv, varying from only 1 mSv to up to 10 mSv at some locations. The average annual dose from natural radiation sources received by an average member of the public in Slovenia is about 2.5 to 2.8 mSv. Higher values are found in areas with higher concentrations of radon in living and working environments. From the existing data on external radiation and radon concentrations in dwellings and outdoors, it can be estimated that most of the radiation, about 50%, comes from inhaling indoor radon and its progeny (1.2–1.5 mSv per year) in residential buildings. The annual dose from the intake of radioactivity with food and water is about 0.4 mSv. The annual effective dose due to external radiation from soil radioactivity, building materials in dwellings and cosmic radiation together was estimated to be from 0.8 to 1.1 mSv in Slovenia.

3.4.2 Measurements of Radon in Living and Working Environments

In 2014, the Slovenian Radiation Protection Administration (SRPA) continued to implement the government programme adopted in 2006 for systematic examination of living and working environments, as well as to raise the awareness of the population regarding measures to reduce exposure due to the presence of natural radiation sources. Again, the main focus was on determining the exposure to radon because this radioactive noble gas is generally the main source of natural radiation in living and working environments. On average, it contributes more than half of the effective dose received by individuals from all natural sources of ionising radiation. It penetrates premises mainly on the ground level through various openings, such as manholes, drains, cracks or tears in the floor.

Through this programme, 111 rooms in 78 buildings were measured for radon and its progeny, mostly in kindergartens and schools. The average radon concentrations exceeded the threshold for the living environment (400 Bq/m^3) in 34 rooms of kindergartens and schools out of a total of 97, and the threshold for a working environment (1000 Bq/m^3) in 3 rooms of other institutions out of a total of 14. Effective doses received by staff and children were estimated on the basis of the measurement results and the occupancy time in these buildings. Seven of the estimated annual doses exceeded the threshold of 6 mSv for members of the public. The highest estimated dose was around 35 mSv. In 25 cases, the estimated annual doses were between 2 and 6 mSv, in 21 cases between 1 and 2 mSv, and in 49 cases less than 1 mSv.

In 2014, the SRPA conducted seven in-depth inspections of legal entities that operate facilities with increased levels of radon. A decision ordering measures to reduce radon radiation exposure was issued in four cases.

3.4.3 Radiation Exposure of the Population Due to Human Activities

The exposures of particular groups of the population that are a consequence of radioactive discharges from these facilities are described in Chapter 3.3. (Operational Monitoring). In Table 7, the annual individual doses are given for the maximally exposed adults from the reference groups for all objects in consideration. For comparison, an average annual dose received by individuals stemming from the global radioactive contamination of the environment (nuclear tests and the Chernobyl accident), is also shown. The highest exposures of the population are recorded for individuals living in the surroundings of the former uranium mine in Žirovski Vrh. The exposures were estimated as amounting to a maximum of 5% of the exposure from natural sources in Slovenia. In no case did the exposure of members of the public exceed the dose levels defined by the regulatory limits.

The population is exposed to radiation also due to other human activities. These exposures come mainly from deposited materials with enhanced natural radioactivity and originate from past industrial or mining activities, related mostly to the mining and processing of raw materials containing uranium or thorium.

Table 7: Exposures of adult individuals from the general population due to the operation of nuclear and radiation facilities and due to general contamination in 2014

Source	**Annual dose [mSv]**	**Regulatory dose limit [mSv]**
Žirovski Vrh Uranium Mine	0.058	0.300*
Chernobyl and nuclear weapon tests	0.03	/
Krško NPP	< 0.0007	0.050**
The TRIGA Research Reactor	0.00036	0.050
The Central Storage for Radioactive Waste	0.00002	0.100

* Limitation after the final remediation of the disposal sites.

** Due to radioactive discharges.

4 RADIATION PROTECTION OF WORKERS AND MEDICAL EXPOSURES

Due to occupational exposure, individuals can receive substantial doses of radiation. Therefore, organisations that carry out radiation practices should optimise work activities to decrease the dose of ionising radiation to a level as low as reasonably achievable (ALARA). Exposed workers take part in regular medical surveillance programmes and have to receive adequate training. Employers have to ensure that the dose of ionising radiation is assessed for every worker performing specific activities.

The Slovenian Radiation Protection Administration (SRPA) manages the Central Records of Personal Doses (CRPD). All approved dosimetry services report monthly to the CRPD on the external exposure of all exposed workers and annually or semi-annually for internal exposures to radon.

The approved dosimetry services for 2014 were the Institute of Occupational Safety (IOS), the Jožef Stefan Institute (JSI), and the Krško Nuclear Power Plant (Krško NPP) for external exposure, and IOS for radon exposure in mines and Karst caves. Currently, 13,055 persons have a record in the central registry, including those who have ceased to work with sources of ionising radiation. In 2014, the dosimetric service at the IOS took measurements of individual exposures for 3,956 workers, whereas the JSI monitored 906 radiation workers and the Krško NPP monitored 678 radiation workers. The Krško NPP performed individual dosimetry for 424 plant personnel and 254 outside workers, who received an average dose[1] of 0.20 mSv of ionising radiation. As for other work sectors, workers in industrial radiography received the highest average annual effective dose of 0.76 mSv from external radiation, while employees in medicine received an average of 0.2 mSv. The highest average value among these, 0.59 mSv, was recorded for workers in nuclear medicine.

In 2014, the highest collective dose from external radiation was received by workers in the medical sector (264 man mSv), followed by workers in the Krško NPP (105 man mSv). Krško NPP did not have an outage in 2014. The total exposure of workers in industry was 43 man mSv.

Since 2010, the data on doses received by radiation workers who took part in NPP outages abroad and data on doses of Adria Airways flight personnel who are exposed to cosmic radiation have been included in the CRPD. In 2014, the collective dose for 20 workers in foreign NPPs was 54 man mSv (an average dose of 2.7 mSv). During Adria Airways flights, 213 workers were exposed to cosmic radiation, receiving an average dose of 1.23 mSv and a collective dose of 261 man mSv.

The highest doses are received by workers exposed to radon and its progeny. In 2014, two out of 170 tourism workers in Karst caves received an effective dose over 20 mSv. 9 workers received a dose between 15 and 20 mSv, 19 workers received a dose between 10 and 15 mSv, 31 workers received a dose between 5 and 10 mSv, 56 workers received a dose between 1 and 5 mSv, and 53 workers received a dose less than 1 mSv. The highest individual dose was 21.7 mSv. The collective dose was 825 man mSv, with an average dose of 4.85 mSv. Tourist workers in Karst caves are the category of workers most exposed to ionising radiation in Slovenia. Collective dose and individual doses are higher than in previous years due to the elevated concentration of radon in Postojna Cave as a consequence of the changed hydrological conditions due to floods in early spring 2014.

[1] Average doses in this chapter are calculated with regard to the number of workers who received a dose above the minimum detection level.

The findings of a study on the exposure of individuals in Karst caves, financed by the SRPA, show that the doses of tourism workers in Karst caves due to radon exposure assessed according to the ICRP 65 (International Commission for Radiation Protection) are underestimated. Due to the high unattached fraction of radon progeny, the ICRP 32 model should be used and an approximately twice higher dose factor should be taken into account. Therefore, doses from radon and its progeny are assessed according to the ICRP 32 model in this report. Doses calculated in such manner are thus twice as high as those calculated according to the ICRP 65 model.

At the Žirovski Vrh Uranium Mine, 8 workers received a collective dose of 0.67 man mSv, whereas the average individual dose was 0.08 mSv.

The distribution of workers in different work sectors by received dose interval (mSv) is shown in Table 8.

Table 8: The number of workers in different work sectors by dose interval (mSv)

	0- MDL	MDL≤E<1	1≤E<5	5≤E<10	10≤E<15	15≤E<20	20≤E<30	E≥30	Total
Krško NPP	144	508	26	0	0	0	0	0	678
Industry	388	79	14	0	0	0	0	0	481
Medicine and veterinary medicine	2643	972	57	1	0	0	0	0	3673
Flights	0	42	171	0	0	0	0	0	213
Other	471	237	17	3	0	0	0	0	728
Radon	0	61	56	31	19	9	2	0	178
Total	**3646**	**1899**	**341**	**35**	**19**	**9**	**2**	**0**	**5951**

MDL – minimum detection level

E – effective dose in mSv received by an exposed worker

Training of Exposed Workers Using Sources of Radiation

The education level of workers using sources of radiation is in accordance with regulations. Minor deficiencies were found regarding the timely refreshment of knowledge and skills in the field of ionising radiation protection. Training, refresher courses and tests were carried out by the approved technical support organisations, namely the IOS and the JSI. In 2014, a total of 1,111 participants attended courses on ionising radiation protection.

Targeted medical surveillance

Medical surveillance of radiation workers was performed by the physicians of five approved institutions:

- The Clinical Institute of Occupational, Traffic and Sports Medicine, Ljubljana,
- The IOS, Ljubljana;
- Aristotel, d.o.o., Krško;
- Health Centre Krško; and
- The Škofja Loka Health Centre.

Altogether, 3,001 medical examinations were carried out. Among the examined workers, 2,657 fully satisfied the requirements for working with sources of ionising radiation, whereas 301 fulfilled the requirements with limitations. 8 candidates did not fulfil the requirements temporarily and 2 did not fulfil the requirements. In 33 cases the evaluation was not possible.

Diagnostic reference levels for diagnostic radiological procedures

X-ray examinations that are implemented in accordance with good radiological practice provide a radiogram that contains all the information necessary for a correct diagnosis at the lowest exposure to patients. In 1996, the International Commission on Radiological Protection introduced the concept of diagnostic reference levels (DRL) to promote the optimisation of radiological procedures. The level of patients' exposure during an individual examination in each radiology department or when using a single X-ray device can be assessed by comparing the average exposure in this department or X-ray device to a DRL value obtained on the basis of the relevant regional or local data.

By using the DRL, exposure decreases and radiological practice improves. Their use is more efficient when national values of DRL are set. Thus, following a five-year data collection project on the exposure of patients undergoing X-ray examinations in Slovenia, DRL values for fifteen X-ray examinations were presented in 2006. Due to changes in technology and professional guidance, it is necessary to regularly review diagnostic reference levels. Therefore, in 2014, the SRPA continued to collect data on the exposure of patients, on the basis of which the national DRL will be updated in the near future. In this aspect, Slovenia has joined the project of the International Agency for Atomic Energy (IAEA) to establish DRLs for paediatric patients in radiological procedures with computer tomography. Additionally, Slovenia will be involved in establishing international DRLs regarding specified interventional procedures with particular attention devoted to paediatric patients.

When issuing a license for radiation practices or a license for the use of a radiation source in medicine, the level of exposure for each X-ray device or a group of such devices is compared to DRL values. If the average exposure for each examination is greater than the DRL, the SRPA requires the optimisation of that radiological procedure. Although this process is important for all radiological procedures, greater attention is paid to procedures with high patient exposure, e.g. interventional procedures and computer tomography. In the scope of this, in 2014 intervention protocols in two institutions were improved, which considerably reduced the exposure of patients in these high dose radiological procedures.

In nuclear medicine, rather than a diagnostic reference level, the recommended activities of the administered radioisotope are used. Due to the small number of departments of nuclear medicine in Slovenia, developing national values is not sensible, so international recommendations, mainly the recommendations of the ENMA, the European Association of Nuclear Medicine, are used instead, taking into account the technical characteristics of each imaging device. The SRPA checks typical amounts of administered activity when approving the programmes of radiological procedures. In addition, in 2011 systematic reviews of typical values of administered activity for all major examinations in all seven nuclear medicine departments were also conducted within the framework of the "Dose DataMed2" project.

4.1 Exposure of patients during radiological procedures

The use of ionising radiation in medicine is the main contributor to population exposure due to the use of artificial sources of ionising radiation. Slovenia assessed the contribution to the total dose received by patients in diagnostic procedures in medicine in 2010 and 2011 within the framework of the project Dose DataMed2, which was carried out under the guidance of the European Commission. The results of the study show that the average inhabitant of Slovenia receives about 0.7 mSv per year from medical procedures. The most important contribution comes from computer tomography (CT), which contributes about 60% of the total dose. Classical X-ray diagnostics contributes about 20%, while interventional procedures and examinations in nuclear medicine contribute approximately 10%. The results show that the exposure of the population in Slovenia is slightly below the European average, which is 1 mSv per year per capita.

Due to the increasing role of X-ray diagnostics in modern medicine and on the basis of trends in other developed countries, a further increase in population exposure is expected due to medical use of ionising radiation. Therefore, the SRPA carries out activities to improve the application of the principles of justification and optimisation, with particular attention devoted to examinations with computed tomography and interventional procedures. In the scope of this, the SRPA is actively taking part in establishing the Clinical Institute of Radiology at University Clinical Centre Ljubljana as an international competence centre for quality in diagnostic and interventional radiology with the aim to act as a reference centre for other institutions in Slovenia. These activities are carried out in the framework of IAEA project No. RER-6-028.

5 MANAGEMENT OF RADIOACTIVE WASTE AND IRRADIATED FUEL

In Slovenia, the only high-level radioactive waste (HLW) is the spent nuclear fuel (SNF) from the Krško NPP and the TRIGA Research Reactor. The greatest amount of low- and intermediate-level radioactive waste (over 95%) is generated from the operations of the Krško NPP. The rest is produced in medicine, industry and research activities. A special category of waste is spent sealed radioactive sources, produced by small holders, which are stored in the Central Storage for Radioactive Waste at Brinje.

5.1 Irradiated Fuel and Radioactive Waste at the Krško NPP

5.1.1 Management of Spent Nuclear Fuel

In recent years, the volume of low and intermediate level waste was reduced by compression, super-compaction, drying, incineration, and melting. The total volume of waste accumulated by the end of 2014 amounted to 2,258 m^3 with the total gamma and alpha activity of the stored waste amounting to $1.93 \cdot 10^{13}$ Bq and $2.59 \cdot 10^{10}$ Bq, respectively. In 2014, the equivalent of 177 standard drums containing solid waste was stored. As of 31 December, the total gamma and alpha activity of stored radioactive waste was $5.72 \cdot 10^{9}$ Bq and $6.24 \cdot 10^{6}$ Bq, respectively.

Figure 16 shows the accumulation of low- and intermediate-level radioactive waste in the Krško NPP storage. Periodical volume reductions, which are a consequence of compression, super-compaction, incineration and melting, are marked. After 1995, the accumulation of waste volume was reduced as a result of a new in-drum drying system (IDDS) for evaporator concentrate and spent ion exchange resins.

In 2006, a super-compactor was installed in the storage facility at the Krško NPP, which thus began the continuous super-compaction of its radioactive waste. In 2014, 48 standard drums with other waste were super-compacted. Super-compacted radioactive waste has been stored in seven tubular containers.

Waste for incineration and melting is temporarily transferred to the Decontamination Building due to the lack of space in the storage facility near the super-compactor. In 2014, 350 packets of combustible waste were sent for incineration to Sweden, 316 packets of these were compressible, 4 were other packages and 30 packages of dried spent ion exchange resins from the secondary circuit. At the end of the year, 42 compressible packages had ready been stored in the Decontamination Building for the next shipment to Sweden.

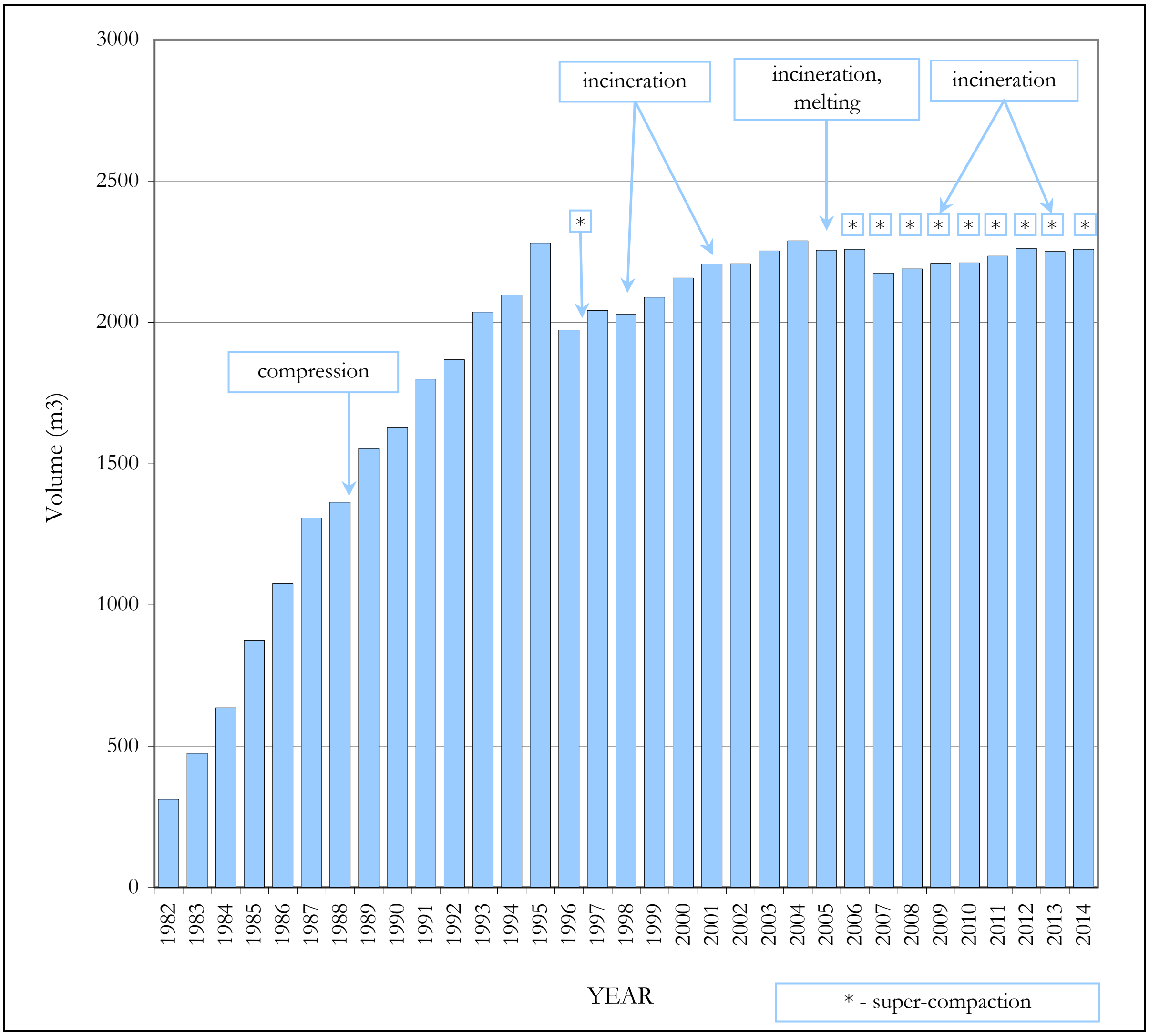

Figure 16: Accumulation of low- and intermediate-level radioactive waste in the Krško NPP storage

In 2014, the Krško NPP began to design a facility for the manipulation of the equipment and shipment of radioactive cargoes. It is planned to be located at the site between the solid radwaste storage facility, the auxiliary building and the fuel handling building. With the construction of the new facility, the plant will be provided premises for the storage of drums in the process of manipulation and the preparation for transport, collection, and sorting of radioactive waste. There will also be space provided for their preparation prior to packing, packing and compaction, super-compaction, radiological measurements and radiological monitoring of shipments, a mobile unit for drying the concentrate, storage of scaffolding, maintenance of shock-absorbers, workshops and warehouses for maintenance staff, and improved processing and reuse of primary water.

In 2014, the NPP obtained the appoval from the SNSA in the process of obtaining a construction licence. The construction licence was issued on 16 June. Due to complications with the public tendering, the delay in the construction is expected to be about one year.

5.1.2 Management of Spent Nuclear Fuel

All spent fuel in the Krško NPP is stored in the spent fuel pool with 1,694 cells. There was no outage in 2014. In November 2014, a shipment of fresh fuel arrived at the NPP. The number of annually spent fuel assemblies and the total number of such elements in the pool are shown in Figure 17.

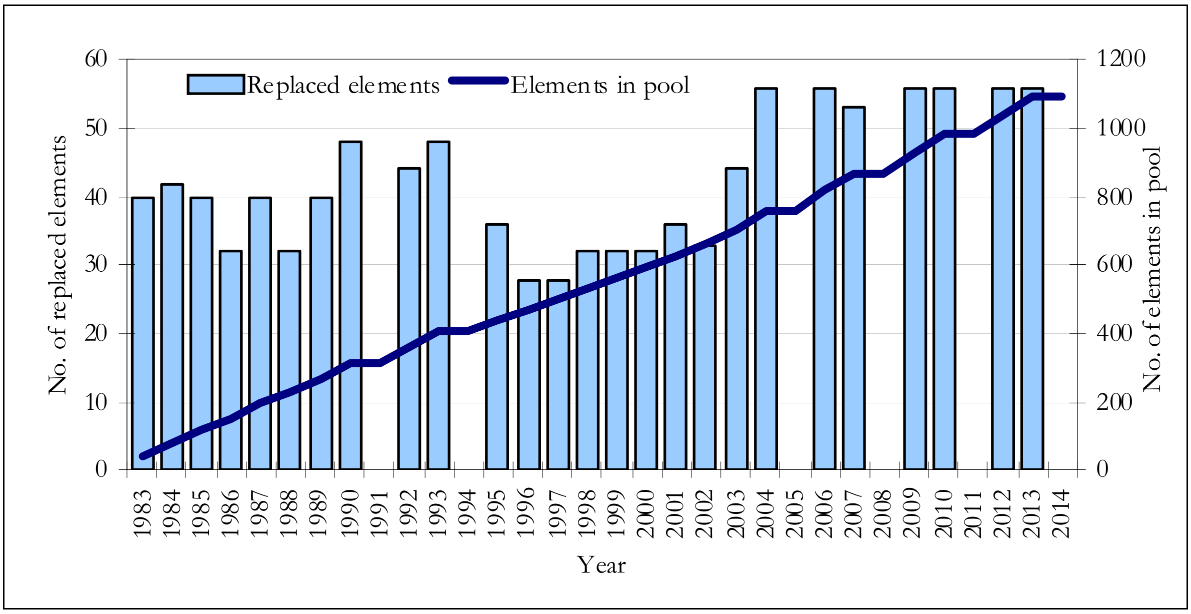

Figure 17: The number of annually spent fuel assemblies and the total number of such elements in the pool of the NPP

Based upon the "lessons learnt" after the Fukushima accident, the Krško NPP has decided to transfer as soon as possible a part of its spent fuel from the pool to dry storage. In June 2014, four potential suppliers ("turn-key projects") were invited to present tenders and approaches with regard to capabilities regarding the transport of spent nuclear fuel and the dry storage thereof. Based upon their approaches, the Krško NPP is to decide which of the proposed manners of storage is the most suitable. The project has to be continued in 2015.

5.2 Radioactive Waste at the Jožef Stefan Institute

In 2014, approximately 200 litres of radioactive waste were produced during the operation of the reactor, as well as from the work in the hot cell and controlled areas of the Department of Environmental Sciences. At the end of the year, this waste was still stored in the hot cell facility. The Radiation Protection Unit of the Institute plans to hand the waste over to the Central Storage Facility at Brinje, managed by the ARAO.

There are 7 drums of metal and wood contaminated with naturally occurring radioactive material (NORM) temporarily stored at the location of the Reactor Centre in Brinje. The waste material was produced during the decontamination and decommissioning of buildings used for the processing of uranium ore, which took place from 2005 until 2007. A decision on conditional clearance was issued by the SNSA for this material and for another 12 drums of other waste material contaminated with natural radionuclides. However, the mentioned 7 drums could not be cleared because scrap metal and wood is not allowed to be disposed of in any municipal landfill.

JSI will explore the possibility of changing the manner of management of waste materials and, if necessary, to propose the amendment of the authorisation of conditional clearance of a radioactive substance to the extent that it relates to the pertinent material.

5.3 Radioactive Waste in Medicine

The Institute of Oncology in Ljubljana has appropriate hold-up tanks to decrease the activity of waste liquids through decay. The tanks are emptied every four months after approved radiation protection experts carry out preliminary measurements of specific activities. Adequate temporary storage of radioactive waste has also been arranged in the new building of the Institute of Oncology. Sealed radioactive sources that are no longer in use were returned to the producer or handed over to the Central Storage in Brinje. Short-lived solid radioactive waste is temporarily stored in a special storage for decay and is then disposed of as non-radioactive waste. However, the Clinic for Nuclear Medicine at the University Medical Centre in Ljubljana has not yet built a system for holding liquid waste. In the course of the renovation of the University Medical Center, the Clinic intends to build new premises with an appropriate system for holding liquid waste. Since only outpatient treatment is carried out in other Slovenian hospitals, patients leave the hospital immediately after receiving a therapeutic dose and therefore the hold-up tanks are not necessary.

5.4 The Commercial Public Service for Radioactive Waste Management

5.4.1 The Commercial Public Service for Radioactive Waste from Small Producers

The Agency for Radwaste Management (ARAO) is responsible for providing the public service of radioactive waste management. The public service includes:

- collecting radioactive waste from small producers, in the event of accidents or when the waste holder cannot be identified;
- transport, radioactive waste treatment for storage and disposal, storage and disposal;
- managing the collected radioactive waste in the prescribed manner;
- managing the Central Storage for Radioactive Waste in Brinje.

Within the public service of the management of radioactive waste from small producers, in 2014 the ARAO ensured regular and smooth collection of radioactive waste at its place of origin, its transport, treatment and preparation for storage and disposal, and management of the Central Storage Facility, as described in Chapter 2.1.3.

For processing the radioactive waste, the ARAO can independently use the premises of the hot cell facility at the Jožef Stefan Institute.

In 2014, the CSRW accepted 116 packages of radioactive waste from 87 producers, namely four packages of solid waste, 12 packages of sealed radiation sources, 93 packages of ionisation smoke detectors and 1 package of liquid waste. The total volume of stored radioactive waste was 2.3 m^3. At the end of 2014, there were 823 packages stored as follows:

- 440 packages of radioactive waste (solid waste, sorted according to compressibility, combustibility, shape and size);
- 189 packages of sealed radiation sources; and
- 194 packages of ionisation smoke detectors.

The total activity of 92.3 m3 of stored radioactive waste at the end of 2014 was estimated at 3 TBq, with a total weight of 50.9 tonnes.

In 2014, almost 80% of the accepted radioactive waste was ionisation smoke detectors. Their volume will be significantly reduced after treatment in the hot cell when the smoke detectors are processed; only the radioactive components will be stored in the CSRW and the non-radioactive components are expected to be unconditionally cleared.

An additional three packages of radioactive waste arising from the processing of smoke detectors were accepted at the CSRW. The treatment was carried out by the ARAO at the premises of the OVC in 2014, which were added to the packages resulting from the processing from the previous years. In 2014, approximately 50 liters of radioactive waste from the treatment of radioactive smoke detectors were created. The formation of secondary and operational waste, such as contaminated equipment (swabs and gloves) and contaminated housings of smoke detectors, which did not meet the criteria for unconditional clearance, were treated in the OVC. The volume of such waste was extremely small, about 80 liters. The volume of the three packets is 0.44 m^3, the weight was of 119 kg and the activity was about 2 GBq.

ARAO took possession of and transported to the hot cell 1 package of liquid radioactive waste with a total volume of 118 litres from the Faculty of Medicine of the University of Ljubljana. The liquid waste will be solidified and stored in the CSRW at the beginning of 2014. The solidified liquid radioactive waste from the Faculty of Medicine will be safely stored in the CSRW at the beginning of 2015.

5.5 Disposal of Radioactive Waste

On 31 December 2009, the Decree on the Detailed Plan of National Importance for the LILW repository in Vrbina in the Krško Municipality was adopted, which was a huge success for the ARAO and for the whole country. The procedures for obtaining the permits for the construction and design of the repository were extremely slow in the next five years. In 2014, this project awaited two very important decisions. In January 2014, the "Agency contract on the provision of services on behalf of and for the account of the Republic of Slovenia in the area of activities related to the placing of national infrastructure – the LILW repository – and obtaining building permission for its construction" was signed between the Republic of Slovenia and ARAO. The contract determined the legal and formal relationship between the state as the investor and the ARAO as the agent of the state which on behalf of and for the account of the state heads this investment. The second important decision was the confirmation of the investment programme for the repository for low and intermediate level waste. In early July, the Minister of Infrastructure signed a Decision approving the Investment Programme for the LILW Repository in Vrbina in Krško Municipality, rev. C, December 2013, which is the basis for the change in the development programmes of the state budget. The decision also approved the implementation of the investment.

Due to late adoption of the work programmes and financial plans (PDFN) of the ARAO and the Fund for Financing the Decommissioning of the Krško Nuclear Power Plant, the Contract on financing the project by means of the Fund for Financing the Decommissioning of the Krško NPP was signed at the end of June 2014. The activities planned for 2014 therefore commenced only in the second half of the year.

As a consequence, there was a delay in project implementation and a low level of realisation of the tasks foreseen in the work programme and in the financial plan for 2014. The major problem was the suspension of field investigations, which were initiated in 2013 and suspended in December 2013 due to funding not being delivered.

In the context of location preparation, one objective was to ensure acquisition of the land for construction of the repository for low- and intermediate-level waste. After obtaining authorisations to carry out such purchases in June 2014, issued by the Government of the Republic of Slovenia on the basis of an agency contract, the ARAO started to purchase land in

Vrbina in Krško Municipality. By the end of the year, 30 contracts had been concluded with the co-owners, which is approximately 92% of the land needed for the construction of the repository.

In 2014, execution of major research on the geosphere and hydrosphere continued. This was halted at the end of 2013 because further funding was not guaranteed. Continuation of the project was enabled in July 2014, when the financial conditions were fulfilled. The main objective of the research studies was to provide the necessary input data for the design and preparation of safety analyses for a repository. Research studies were conducted in accordance with the contractual deadlines agreed upon at the end of 2014, when a final report on their implementation was submited. The report will be reviewed and updated at the beginning of 2015.

In 2014, a study on the optimisation of the non-disposal part of the LILW repository Vrbina, Krško, was completed. Further work is needed in the preparation of the relevant documentation and design bases of the repository. The study will also provide the basis for the preparation of project documentation. A public tender for the selection of a designer for the preparation of the project and other documentation was successfully carried out. The contract therewith was signed at the beginning of November. Since the project documentation is on a critical path, work began immediately and very intensely, at first by harmonising the input parameters and subsequently by harmonising the design solutions.

In the field of safety analyses and waste acceptance criteria, the second phase of the project continued in 2014. Reports covering the assessment of all of the proposed improvements of the LILW repository were completed. A new revision of the acceptance criteria in relation to the new development and a new report on the inventory were prepared, while the preparation of the Preliminary Disposability Assessment report, which assessed the individual waste streams with respect to the criteria of acceptability, began.

In 2014, preparation of the project basis for the phase of obtaining environmental consent and preparation of the reference documentation that will serve as the basis for the drafting of a safety report, as required by the respective legislation and other regulations and recommendations, continued.

In 2014, a public tender for the selection of the author of the environmental impact report was successfully carried out, while a contract with the contractor was signed at the end of 2014. In parallel with the environmental impact assessment, an assessment of transboundary impacts in accordance with the Espoo Convention will be held.

According to current plans, the repository would be built and start its trial operation in spring 2020.

5.6 Remediation of the Žirovski Vrh Uranium Mine

The remediation of the Žirovski Vrh uranium mine has been in progress since 1992. Both the uranium processing plant and the mine, together with the various accompanying objects, have been successfully decommissioned.

The majority of technical work on both disposal sites was successfully concluded, but a non-stable landslide beneath the Boršt disposal site has prevented its final closure. The rock beneath the hydrometallurgical tailings at the site has been sliding despite the completed remediation work at the site; the sliding is larger than is accepted and determined in the safety analysis report, thus for the Boršt site further remedial actions are required, while the closing work at the Jazbec has been finished.

In 2014, the company RŽV, d.o.o., carried out ongoing activities during the fifth year of the transitional period of the Boršt disposal site and long-term management of the Jazbec disposal site: sampling, measurements, control of the overall state, maintenance, collecting and storing of information, record keeping, preparation of reports for the authorities, etc.

Maintenance works included the cleaning of channels for the storm water outlet at both disposal sites, removal of bushes along both disposal sites and infrastructure facilities, and mowing the grass on the surfaces of the disposal site and along the side such.

Assessment of the overall state of the remediated mine facilities was performed and even intensified at the request of the mine inspectorate because the rock base of the Boršt disposal site is still moving. The request of the mining inspector to complete the mining project by implementing the emergency drainage measures to reduce the level of groundwater was, however, not fulfilled due to lack of funds. These measures should be implemented in the future as continued movements could result in the damage of already implemented measures (the collapse of the drainage system, damage to the cover ...).

An inspection of the concrete lining of the passageway of the tunnel, the shotcrete lining of the entrance of the tunnel, and the landslide beneath the Boršt disposal site was carried out. In addition a functioning of the drainage wells was observed and the movement of the landslide was measured by a special extensometer placed in a tunnel. Shifts on the surface of the Boršt disposal site were constantly monitored by a GPS system and regularly reported to the Inspectorate for Energy and Mining and the SNSA.

There were no extraordinary events during the performance of activities on site. In 2014, there were two extreme weather events: heavy icying (accumulation of ice on trees) in February and flooding in October. During the icying the guardrails of both landfills were damaged, while the consequences of the heavy rains in October were blocked inflow of object B, a damaged road to the landfill, a damaged landfill guardrail, a filled culvert in trench 2, the erosion of the ditch embankment of trench 2, and in two places a demolished channel slope, which is an integral part of the cover landfills. The SNSA required an analysis of the event which has not been finished by the end of 2014.

Monitoring the stability of the Jazbec site and the Boršt site is an important task within the overall monitoring of the disposal site. After the final settlement of both disposal sites and the end of remediation activities the conditions for continuous monitoring using GPS system as well as for appropriate periodic geodetic monitoring were achieved. Some precise geodetic measurements were performed in 2014.

Financing the activities of the RŽV from the budget was governed by a contract for temporary financing. The programme for monitoring environmental radioactivity in 2014 was fully implemented. Details on the monitoring can be found in Chapter 3.3.3. Some analyses that were in the programme for 2013 but which could not be realised due to a lack of funds were carried out in 2014. Remediation of the consequences of the icying and the consequences of the heavy rain in October are planned to be completed as soon as the conditions for the safe and technically viable implementation of the remedial works are in place.

In June 2011, RŽV d.o.o., submitted to the SNSA an application for approval of the closure of the Jazbec disposal site. During the administrative procedure the parties were heard and by the end of 2012 all necessary amendments of the safety analysis report had been implemented. In March 2013, the SNSA issued a permit for the closure of the Jazbec site. In the authorisation process for the closure the SNSA decided also to terminate the status of the radiation facility and, based on a previous governmental decision, to issue a decision that the facility becomes the infrastructure facility of national importance. RŽV d.o.o., however, appealed both decisions. The appeal on the decision on status of the facility was rejected by the second-instance body, the Ministry of Agriculture and the Environment, while the appeal against the permission to close the Jazbec site was approved in part and the SNSA had to reconsider it. In December 2013, RŽV d.o.o. filed an application for a new small disposal site for handling occasional remaining amounts of tailings in the future. This new application was joined with the already ongoing administrative procedure for reissuing permit for closure. After almost a year in December 2014, RŽV d.o.o., however, withdrew its application for a new small disposal site for mining-contaminated materials, so the SNSA was finally able to issue a permit for the closure of the Jazbec site in December 2014. By that the conditions for transfer of responsibility for long-term surveillance and maintenance of the Jazbec disposal site from RŽV d.o.o. to the ARAO have been met.

In 2014, the SRPA did not carry out inspections at the Žirovski Vrh uranium mine.

5.7 The Fund for Financing the Decommissioning of the Krško NPP and for the Deposition of Radioactive Waste from the Krško NPP

The Fund for Financing the Decommissioning of the Krško NPP and for the Management of Radioactive Waste from the Krško NPP (hereinafter "the Fund") was established pursuant to the Act on the Public Fund for Financing the Decommissioning of the Krško Nuclear Power Plant and the Disposal of Radioactive Waste from the Krško NPP (consolidated text – Official Gazette RS, Nos. 47/03, 68/08, 77/08 – ZJS-1, hereinafter: the Fund Act).

Until March 2003, the contribution to the Fund was paid by Krško NPP. After the amendments to this Act were adopted the company GEN energija, d.o.o., is liable to pay contributions to the fund.

In 2004, the "Programme for the Decommissioning of the Krško NPP and the Disposal of Low- and Intermediate-Level Waste and Spent Fuel" (hereinafter "the Programme") was prepared. It determined the new levy per kWhe to be paid. The Government of the Republic of Slovenia was informed of the Programme at its 93rd regular session on 7 October 2004. The Programme was approved on 4 March 2005 during the 7th session of the Interstate Commission for Monitoring the Inter-governmental Agreement between the Government of Slovenia and the Government of Croatia. Since April 2005, the company ELES GEN, d. o. o., (in July 2006 renamed GEN energija, d.o.o.), is paying into the Fund EUR 0.003 per kWhe electrical energy produced in the NPP and sold in Slovenia.

Since 1998, the Fund has been co-financing the "Work Programme of the Agency for Radwaste Management", namely the projects concerning the safe management of low- and intermediate-level radioactive waste. In 2014, the Fund paid to ARAO a total of EUR 4.1 million, namely:

- EUR 1.2 million to finance ARAO's activities related to the preparation and implementation of projects for the management of low- and intermediate-level radioactive waste; and
- EUR 2.9 million as compensation to local municipalities.

From 1998 until the end of 2014, the Fund paid a total of EUR 33.76 million to the ARAO for the activities implemented by the ARAO. This amount includes compensation to the local municipality of Krško totalling EUR 14.6 million.

In accordance with Article 11 of the Decree on the criteria for setting the compensation level payable for limited use of land within the area of the nuclear facility (Official Gazette RS, Nos. 134/2003 and 100/2008), the Fund is obliged to pay compensation for the limited use of land within the area of the nuclear facility. In 2014, ARAO paid EUR 2.9 million to the municipalities of Krško, Brežice, Kostanjevica na Krki and Kozje as compensation for the limited use of land. Since 2004, municipalities have received EUR 26.5 million as compensation for the limited use of land.

The contribution is defined on the basis of levying half of the electrical energy produced in Krško NPP. The company GEN energija, d. o. o., paid a total of EUR 9.07 million into the Fund in 2014. With that contribution, the company fully and within the agreed deadline fulfilled all obligations to the Fund deriving from the contribution for decommissioning. In comparison to 2013, 19.87% more funds were paid. In 2014, the Krško NPP reached a record in yearly production of electrical energy as there was no outage in the plant for the year. From 1995 to 2014 the Fund received a total of EUR 161.2 million from the Krško NPP and GEN energija, d.o. o.

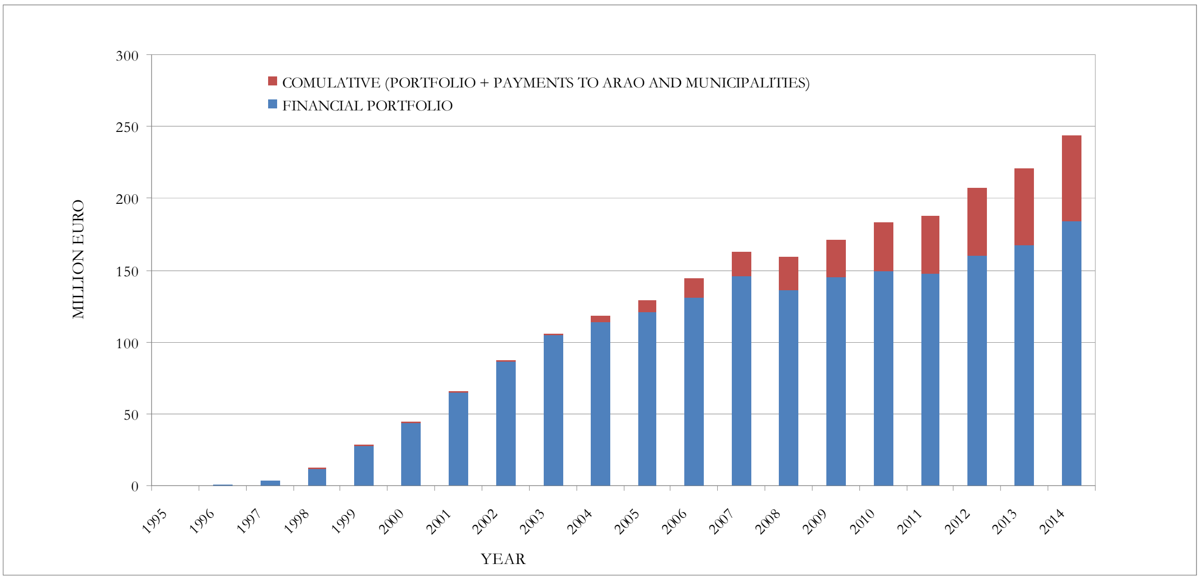

Figure 18: Total assets of the Fund in euro millions as of 31 December 2014

Figure 18 shows the assets of the Fund as of 31 December 2014, where EUR 184 million represents the financial portfolio (the data relates to the book value and does not include unallocated funds, interest accrued, interest purchased and dividends in the amount of EUR 2.3 million) and EUR 60.3 million represents payments to the ARAO and municipalities. (Assets paid to co-finance the ARAO's activities and assets paid to municipalities as compensation for the limited use of land in the amount of EUR 60.3 million are not valorised.)

Payments to the ARAO and municipalities represent almost one-third of the Fund's financial portfolio.

Concerning the actual structure of investments in 2014 in comparison to the end of 2013, the share of state securities increased by 4.69 percentage points. In investment equity mutual funds and ETFs, the share increased by 3.31 percentage points. The share of deposits decreased by 6.3 percentage points. There was a slight decrease also in the share of bonds that are 100% state-owned (1.5 percentage points) and in corporate bonds (0.94 percentage points).

As of 31 December 2014, the Fund managed EUR 184,019,142.22 of financial investments in securities. 13.23% of this sum was invested in banks in the form of deposits, CDs and MM Funds; 46.51% in state securities; 10.11% in bonds that are 100% state-owned; 3.31% in corporate non-financial bonds; 2.32% in corporate financial bonds; 5.32% in bond funds; 17.61% in mutual funds (equity and mixed funds) and ETFs; and 1.58% in stocks. The structure of the financial portfolio does not take into account the unallocated funds in the transactional account amounting to EUR 12,109.54. The amount of EUR 184,019,142.22 relates to book value and does not include interest accrued, interest purchased and dividends in the amount of EUR 2,303,282.77. Taking into the account the amount mentioned and the funds in the transactional account, the assets of the Fund at the end of the year amounted to EUR 186,334,534.53.

In its investment policy for 2014, the Fund mainly planned investments in government securities and deposits.

In 2014, the Fund created EUR 14.1 million of income, which is at the same level as in 2013. The expenses reached EUR 7.5 million, which was 40.83% lower than planned and 9.29% higher than in 2013. The Fund had a surplus of income over expenses in the amount of EUR 6.59 million, which is 134.53% more than planned. This surplus derived from lower expenses in 2014.

In 2014, the Fund received EUR 98.3 million from repayments of granted loans (due and sold investments) and assets from sold capital shares. Received repayments of granted loans and assets from sold capital shares were 2.71% higher than planned. The granted loans (new investments) and the increase in capital shares amounted to EUR 104.9 million, which is EUR 6.64 million more than the received repayments of granted loans.

In 2014, the yield of the portfolio, calculated on the bases of the internal rate of return (IRR), was 8.64%.

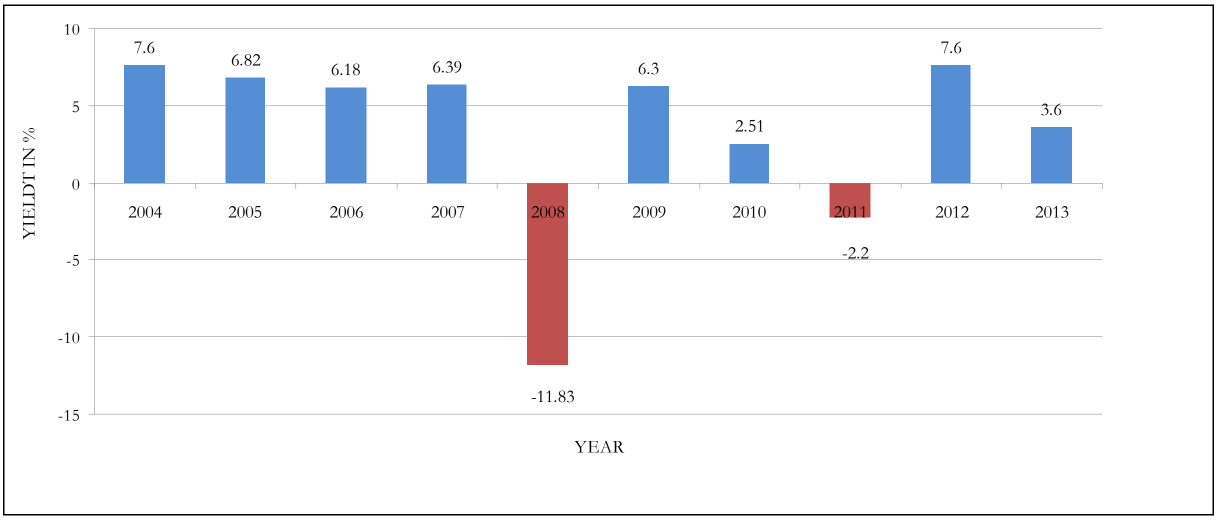

Figure 19: The yield of the portfolio of the Fund from 2004 to 2015 in %

Figure 19 shows the yield of the portfolio of the Fund from 2004 to 2015. In 2008 all equity securities, investment and mutual funds that are listed on the stock exchange or their market price is publicly available, were valorised to fair value according to the Accounting Act. This valorisation was in accordance with amendments to the Rules on Breaking Down and Measuring Revenues and Expenses of Legal Entities under Public Law (Official Gazette RS, No. 120/2007). In 2010, debt securities were valorised for the first time, which was also in accordance with the above-mentioned Rules.

The expenses of managing the portfolio in relation to the financial portfolio amounted to 0.22%.

Primarily, the Fund must ensure the security of its assets (with a conservative investment policy), but at the same time it has to monitor the situation on the financial markets and fulfil the obligations defined by law. All important risks were successfully managed also in 2014.

In twenty years of operation the Fund has successfully performed its function, which is also evident from the income statement. At the end of 2013 the book value was EUR 167.6 million; however at the end of 2014 it was EUR 184.0 million. The portfolio of financial investments increased by EUR 16.4 million.

6 EMERGENCY PREPAREDNESS

Emergency preparedness is an essential part of the comprehensive system for ensuring a high level of nuclear and radiation safety. During a nuclear or radiological emergency, all competent organisations in Slovenia must be prepared to take appropriate actions according to emergency plans.

The response to a radiation emergency in Slovenia is defined in the National Radiation Emergency Response Plan. The Administration for Civil Protection and Disaster Relief (ACPDR) has a leading role in dealing with emergencies, whereas the Slovenian Nuclear Safety Administration (SNSA) gives advice and makes recommendations.

6.1 The Slovenian Nuclear Safety Administration

At the SNSA, responsibility for emergency preparedness and response falls under the Emergency Preparedness Division. The division's primary functions are:

- providing training, staff and the appropriate response of the SNSA emergency team;
- maintaining the team's documentation and procedures;
- maintaining the team's equipment and keeping the emergency centre operational.

The SNSA's capability to act is ensured by the regular training of emergency team members, the response verification and exercises, regular checks of computers and other equipment and participation in international activities, as well as through regular reviews of all associated organisational regulations and guidelines.

In 2014, the SNSA carried out 122 training sessions, running to a total of 236 hours, approximately 26 hours per employee. The SNSA also participated in the 2014 national Krško NPP exercise, the internal radiological exercise "Fire accident in CSRAO" and several international ConvEx exercises.

The SNSA regularly maintains and develops the Interministerial Communication System in the Event of Emergency, called MKSID, which allows 29 leading responsible organisations to communicate on a national level. Analysis after the exercise "Posavje 2013" showed that the number of organisations using MKSID should be increased, which was realised in 2014.

6.2 Administration of the RS for Civil Protection and Disaster Relief

In accordance with statutory powers, in 2014 the Administration for Civil Protection and Disaster Relief (ACPDR) maintained and ensured preparedness as well as developed procedures for the effective response of the system for protection against natural and other disasters to nuclear or radiological emergencies.

In the context of preparedness for nuclear or radiological accidents, in 2014 the ACPDR, with individual contractors, continued coordination of emergency response plans in the event of a nuclear or radiological emergency and activities within the national plan.

In cooperation with the municipalities of Krško and Brežice, the ACPDR continued with the implementation of a new concept that involves the pre-distribution of potassium iodide tablets in the event of a nuclear or radiological emergency for all households living in the area 10 km around the Krško NPP. ACPDR also maintains the website www.kalijevjodid.si, where visitors can get more information about such tablets, the iodine thyroid blocking protective action and pre-distribution.

In 2014, the Interministerial Commission for coordinating the implementation of the national radiation plan continued its work. It monitored two working groups that were established in 2013.

The working group for preparing the basis for threat assessment in the event of a nuclear accident at the Krško NPP had the task of studying the existing planning basis and giving a proposal for amendments and changes, taking into account past nuclear accidents, international guidelines, especially the recently issued document of the International Atomic Energy Agency EPR-NPP, as well as dose calculation models. The report will be the basis for risk assessment and an input for updating national threat assessment and revision of the national radiation emergency plan.

The second working group is to solve the problem of emergency monitoring. Its task was to study the current situation in this area in the event of a nuclear or radiological emergency, identify problems, solve them, or propose a solution, taking into account past nuclear and radiological accidents, exercises, and especially the RANET exercise in Fukushima and INEX 4. The Interministerial Commission has already received the report of the working group with the identified problems and proposed solutions, which will be considered in 2015.

6.3 The Krško NPP

In 2014, the activities of the Krško NPP in the area of preparedness for emergencies included:

- training, drills and exercises;
- maintenance of support centres, equipment and communications;
- updating the document "Krško NPP Protection and Rescue Plan", procedures and other documentation;
- replacing staff and appointing new members to the emergency organisation.

Training of licensed personnel whose activities are related to nuclear safety, and personnel who have to refresh their knowledge in line with Slovenian legislation was fully performed as planned.

Furthermore, the staff of Krško NPP actively cooperated with the planners and providers of protection and rescue services at the local and national levels, as well as with the administrative authorities, namely the SNSA and the ACPDR.

In 2014, the Krško NPP mobile unit conducted six exercises in the field with measurements and equipment testing. The Krško NPP mobile unit performed gamma spectrometry comparative measurements of charcoal and particulate filters in cooperation with the company Analytics in June 2014. The Krško NPP mobile unit conducted a joint regular exercise in cooperation with the ELME (the mobile radiological laboratory of the Jožef Stefan Institute) in 2014 as well.

6.4 The National Exercise Krško NPP 2014

The Krško NPP operational exercise 2014 was conducted from 26 to 27 November 2014 in accordance with the decision of the Government of Republic Slovenia dated 26 August 2014.

The exercise was theoretical and practical. In the theoretical part, the effectiveness and consistency of arrangements in the plans at all levels were verified. The exercise was conducted in real time for the declaration of an emergency, alert, site emergency and general emergency. Real weather was considered. The practical part was to check the current arrangemets regaring potassium iodide tablet distribution taking into account the agreed weather conditions.

All organisations involved in response to a nuclear accident at the Krsko NPP in accordance with emergency response plans took an active part in the exercise: civil protection commanders, deputies and staff at local, regional and national levels, the NPP, the municipalities of Krško, Brežice, Sevnica and Kostanjevica, ministries and government services. The International Atomic Energy Agency and the competent authorities of Italy (ISPRA – the National Institute for Environmental Protection and Research) and Croatia (the State Office for Radiological and Nuclear Safety) also participated in the exercise.

Residents of local communities in the area 10 km around the Krško NPP were informed again about the actions to be taken according to the declared emergency level. All households in the communities received the informative publication "How to act in the event of emergency at the Krško NPP".

6.5 Achieving the Goals of the Resolution on Nuclear and Radiation Safety

Goal 10

In the use of nuclear energy and radiation activities in the Republic of Slovenia it is appropriety taken care of emergency preparedness and response so that in such cases the impact on people and the environment is minimal.

Realisation in 2014:

Use of nuclear energy and radiation implementing activities in the Republic of Slovenia take into account emergency preparedness and response. The Interministerial Commission for coordinating the implementation of the national plan meets regularly and is responsible for directing and coordinating preparedness at the national level. Emergency preparedness and response are regularly tested by exercises.

7 SUPERVISION OF RADIATION AND NUCLEAR SAFETY

7.1 Education, Research, Development

In 2014, no major changes in education, research and development on nuclear and radiation safety took place. The findings outlined in the Annual Report 2013 are still accurate. The State thus adopted no new strategic document that specifically covers and defines the objectives and guidelines in the implementation of the educational policy, research and development of nuclear safety or that such would be covered by any wider strategic objectives and definitions; unfortunately, the current strategic documents described in detail in last year's report do not devote any specific attention to research and development relating to nuclear safety.

In February, the SNSA organised an all-day working meeting on the challenges of nuclear safety. The meeting was at the Training Centre for Nuclear Technology of the Jozef Stefan Institute in Brinje near Ljubljana, attended by about 60 experts from the majority of Slovenian organisations dealing with nuclear safety. At the meeting colleagues from the Jozef Stefan Institute, the Institute for Metal Constructions, the Faculty of Electrical Engineering, the Institute of Occupational Health and the Institute of Civil Engineering presented their research projects relating to nuclear energy. The SNSA presented its strategy regarding the research and development needed to maintain sufficient capacity for the provision of nuclear and radiation safety in Slovenia. The focal point of the meeting was to open a debate on how to ensure stable financing of research and development in the nuclear sector, thereby preventing an outflow of experts in other areas and abroad. Participants agreed that it would be sensible to warn society at large of the importance of this challenge and risk, if in the future nothing would change.

In paragraph 7.1, the Resolution provides for the minimum level of full-time researchers, which should be achieved by providing dedicated funding. No such financing mechanisms are in place and, therefore certain specified areas of research are dying.

7.1.1 Achieving the Goals of the Resolution on Nuclear and Radiation Safety

The objectives in education, research and development that should be achieved in the period 2013–2023, as foreseen in the Resolution, are:

Goal 9

The system of authorised experts enables the optimum expertise in the decision-making of regulatory bodies on radiation and nuclear safety, the producer or applicant bearing the costs of the preparation of an expert opinion.

Pursuing the goal in 2014

Unfortunately there were no possibilities for financing development-oriented tasks, and the situation in this area in 2014 has not changed for the better. The mandatory introduction of procurement in the energy sector also included the NPP, which orders expert opinions. When ordering such, the Krško NPP has to select from among 21 authorised experts, of which 14 are from Slovenia, and the one offering the lowest price. Direct difficulties due to the possible decline in their professionalism is not yet observed, but in such circumstances it is only a matter of time. The challenge therefore remains and is becoming more acute.

The system as established by ZVISJV regarding the expert opinions of authorised experts in nuclear and radiation safety when deciding on the applications of clients in administrative proceedings (and in the preparation of reports under each NPP outage) works relatively well as the Act gives sufficient support to the SNSA in decision-making on nuclear and radiation safety. In 2014, the SNSA extended the mandate to carry out the work of an authorised expert in radiation and nuclear safety.

In 2014, all together twenty-one legal entities and natural persons were authorised for such work. In the report for 2013 the reasons for the shrinking interest in becoming an authorised expert were summarised, such as a lack of motivation, the relatively high financial investment required, and fierce competition. This general assessment has not changed, and also applies to the situation in 2014. The SNSA also in 2014 did not have the funds to allocate for financing development-oriented tasks so it could not carry out this action. Last year's prediction that the situation with respect to coverage of different areas of nuclear and radiation safety with authorised experts from Slovenia will deteriorate has not been fulfilled, but the situation is not better.

Goal 11

Slovenian educational institutions offer study programmes whose graduates can by gaining appropriate additional training can get important positions in organizations where they can ensure nuclear safety.

Realisation in 2014

The objective in this area can only be achieved systematically in a few years, while primarily wider social conditions (the attractiveness of such educational programmes for prospective career options, re-development of a nuclear programme in the country, including a clear decision on the extension of the lifetime of the Krško NPP and/or construction of the second unit of the NPP) must be met; furthermore a high motivation must exist among decision-makers in the area of the strategic development and study programs, and in the educational institutions that will recognise these educational programmes as real and potentially interesting opportunities.

At the Faculty of Mathematics and Physics of the University of Ljubljana, the Physics Department conducted the second cycle of the Nuclear Engineering master’s degree programme; in the 2014/15 school year five students were enrolled in this programme. They joined ten other students who enrolled in the programme in the past two years. In 2014 the first graduate was awarded a Master's Degree in Nuclear Engineering, and this person is now a researcher and doctoral student in nuclear engineering at the Jozef Stefan Institute.

In 2014, the master's degree study programme was renovated and an application for re-accreditation has been tabled. The new programme focuses on in-depth cooperation with the Faculty of Mathematics and Physics as the home institution of the study programme and the Faculty of Electrical Engineering (4 teachers, 3 courses) and the Faculty of Mechanical Engineering (2 teachers, 2 courses). Both faculties offer additional optional courses for the programme.
In the doctoral programme “Mathematics and Physics” within the module Nuclear Engineering there are 12 students, most of them employed at the Jozef Stefan Institute.

The Faculty of Civil Engineering of the University of Maribor implements a study programme entitled “Nuclear Energy and Technology” (three-year doctoral studies), while at the Faculty of Energy, which is also part of the University of Maribor, a study programme entitled “Energy” is conducted at all three Bologna stages, which also includes courses in the nuclear field. At the first (university) stage, one compulsory course on “Nuclear Energy Systems” is compulsory, while three other courses from the nuclear field are optional. Also at the second (master's) stage, there is one compulsory subject in the nuclear field and five optional courses.

The current situation in Slovenia regarding the scope of study and the number of students is intended to meet the needs of the profession. It should be noted that each year a few engineers with other technical and natural science backgrounds come to work in the area of nuclear technology and that they gain a nuclear education after recruitment.

On the other hand, the role of operators of nuclear installations is mainly in the dissemination of information and basic knowledge on nuclear and radiation safety among school students and adults. Through the preparation of informative materials and activities they mainly support programmes in general and professional education and contribute to the promotion of interest in such studies in conjunction with nuclear and radiation safety.

Goal 12

In the Republic of Slovenia, stable conditions for the financing and implementation of research and educational activities in the field of nuclear and radiation safety are established by which a "critical mass" of experts that can competently cover all key aspects of the safe use of nuclear energy and ionising radiation sources is ensured.

Realization in 2014

The situation in this area, in particular, the problems due to a lack of funding for focused or harmonised and especially long-term activities, was described in detail in the report for 2013. Although this goal also represents a long-term policy whereby it is necessary to foster the synergistic effects of the efforts of various interested stakeholders, the situation in 2014 did not change significantly. Unfortunately, the resources of the Agency for Research and Development for basic and applied research declined by more than 30% between 2012 and 2015, which could in a relatively short period of time (a year or two) undermine the existing basic research on nuclear and radiation safety. As in previous years, also in 2014 there were no funds for financing applied research and development in this field; and as in previous years, the movement of researchers from the area of nuclear and radiation safety to "more modern" science, especially research on nuclear fusion, has continued and accelerated, as there is more research money available.

The project of constructing the LILW repository in Slovenia is one of the few funding opportunities for applied research relating to radiation safety in which domestic experts can participate.

Maintaining and strengthening research related to nuclear safety remain two key long-term tasks.

Allocated budget appropriations in the previous year did not allow the SNSA to carry out at least part of its Strategy for Research and Development that was adopted in 2013.

7.2 Legislation

The most important piece of legislation in the field of nuclear and radiation safety in the Republic of Slovenia is the Ionising Radiation Protection and Nuclear Safety Act. The Act was adopted in 2002 (ZVISJV, Official Gazette RS, No. 67/02). It was amended for the first time in 2003 (Official Gazette RS, No. 24/03 – ZVISJV-A) and for the second time in 2004 (Official Gazette RS, No. 46/04 – ZVISJV-B). In 2011, the Act was amended for the third time (Official Gazette RS, No. 60/11 – ZVISJV-C).

Based on the ZVISJV, 28 implementing regulations were adopted by the end of 2013, namely seven governmental decrees, ten rules issued by the Minister of the Environment, nine rules issued by the Minister of Health, and two rules issued by the Minister of the Interior.

In 2014, three implementing regulations in the field of nuclear and radiation safety were adopted, namely:

- The Decree on the Criteria for Determining the Compensation Rate due to the Restricted Use of Areas and Intervention Measures in Nuclear Facility Areas (Official Gazette RS, No. 92/14). On the day this Decree enters into force the Decree on the Criteria for Determining the Amount of Compensation for Limited Use of Space Within the Area of a Nuclear Facility (Official Gazette of RS, No. 134/03 and 100/08) shall cease to apply.
- The Decree Amending the Decree on Areas of Restricted Use due to Nuclear Facilities and on the Conditions for Construction in These Areas (Official Gazette of RS, No. 92/14).
- The Rules Amending the Rules on the Transboundary Shipment of Nuclear and Radioactive Substances (Official Gazette of RS, No. 41/14).

Detailed information regarding executive acts and acts under preparation can be found at the SNSA website:
http://www.ursjv.gov.si/si/zakonodaja_in_dokumenti/si/zakonodaja_in_dokumenti/.

Due to the resignation of the Government in May 2014, the process of amending the Ionising Radiation Protection and Nuclear Safety Act (ZVISJV-D) initiated in 2013 was frozen until November of the same year. After the formation of a new government, the SNSA process was resumed. At the beginning of November 2014, amendments to the Act were sent through the new inter-ministerial coordination to all Ministries, to the Information Commissioner and to the Government Office for Legislation.Unfortunately, such coordination had not been completed by the end of 2014.

In the year 2014, preparations for the entry into force of the Protocol to the Convention on Third Party Liability in the Field of Nuclear Energy (the Paris Convention) and the Protocol to the Convention of 31 January 1963 Supplementary to the Paris Convention (the Brussels Supplementary Convention), both published in Official Gazette of RS, MP, No. 4/10 and the start of full application of the Act on Liability for Nuclear Damage (ZZOJed-1, Official Gazette of RS, No. 77/10) intensified. Thus, on the initiative of the Slovenian Nuclear Safety Administration, representatives of the Ministry of Finance, the Krško NPP, the Nuclear Pool GIZ, the Ministry of Infrastructure and Spatial Planning, and the Ministry of Foreign Affairs started to work in an informal working group to exchange views on the outstanding problems and to find possible solutions.

In response to the nuclear accident at the Fukushima NPP in Japan and to the outcomes of stress tests in 2014, Council Directive 2009/71 / Euratom establishing a Community framework for nuclear safety of nuclear installations was amended (Council Directive 2014/87 / Euratom of 8 July 2014); Member States must transpose those amendments into their legislation by August 2017.

The Official Journal of the EU published on 17 January 2014 a revised Directive EURATOM on the basic safety standards for protection against the dangers arising from ionising radiation (Council Directive EU 2013/59 / EURATOM), also known as the EU BSS (Basic Safety Standards). The EU BSS have been in preparation for almost ten years and the Member States must transpose them into their legislation by February 2018.

In September 2014, the group of European Nuclear Regulators – WENRA – updated their SRL (Safety Reference Levels), which represents harmonised European requirements on nuclear safety. Key changes in the new WENRA SRL result from the experience gained from the Fukushima accident, which occurred in March 2011. Member States should introduce these changes into their legislation by the end of 2017.

7.2.1 Achieving the Goals of the Resolution on Nuclear and Radiation Safety

As regards the legislative and institutional framework, the resolution raises two goals.

Goal 7

The Republic of Slovenia maintains its legislation in the field of nuclear safety and radiation protection in accordance with international best practices. The legislation provides for the priority of nuclear and radiation safety while enabling the main purpose of the use of nuclear energy and ionising radiation sources.

Realisation in 2014

With regard to nuclear and radiation safety, the EU acquis (directives) is promptly transfered into the legal system of the Republic of Slovenia and current and domestic regulations are harmonised with accepted WENRA standards; Slovenia also promptly fulfils the commitments adopted by all relevant international treaties to which Slovenia is party. This is recognised by the informal and formal responses Slovenia receives in this area from comparable regulatory bodies around the world, and by reviews received within regular reporting (based on the commitments made in international treaties and/or membership in various organisations and associations); unquestionably, this is also confirmed by the report of the International Atomic Energy Agency, i.e. the IRRS mission's Follow-up Report, which in 2014 assessed progress in the legislative, administrative and organisational fields of nuclear safety in Slovenia and compared it with established international standards (in particular, of the IAEA) and the best international practices as well as with the achievements reached with respect to the findings and recommendations of the basic IRRS Mission that visited Slovenia in 2011.

Also in 2014, the work in this area (primarily preparation of the draft of amendments to the Ionising Radiation Protection and Nuclear Safety Act and drafting amendments to certain regulations) depends largely on the efforts towards harmonisation of domestic legislation with international developments and best practices, and especially with established international commitments and standards.

Goal 8

The Republic of Slovenia shall maintain appropriate separation and independence of the the regulatory authorities responsible for the supervision of nuclear and radiation safety from those entities whose primary mission is to promote the use of nuclear energy or ionising radiation sources. The supervisory authorities shall have adequate financial resources and appropriate personnel to perform their duties.

Realisation in 2014

The organisation of administrative bodies in the field of nuclear and radiation safety in Slovenia is adequate, and in 2014 there was no need for any substantive changes. Formally, however, due to changes in the organisation of the Government of the Republic of Slovenia, the SNSA "moved" from the Ministry of Agriculture and the Environment back to the Ministry of the Environment and Spatial Planning. In 2014, the management of the SNSA decided to abandon the original intention of including in amendments also povisions that would allow transformation of the SNSA into a public agency for nuclear and radiation safety and to merge it at the same time with the Slovenian Radiation Protection Administration (SRPA). The general atmosphere in the country is still very unfavorable to the creation of new independent public agencies; such a decision is easier to defend because the generally established international standard of "adequate separation and independence of the administrative authorities responsible for the supervision of nuclear and radiation safety of those entities whose primary mission is to promote the use of nuclear energy or sources of ionising radiation" is undeniably ensured already in the existing legislation and by the administrative organisation of the field.

7.3 The Expert Council for Radiation and Nuclear Safety

The Expert Council for Radiation and Nuclear Safety provides expert advice to the Ministry of the Environment and Spatial Planning and to the Slovenian Nuclear Safety Administration in the field of radiation and nuclear safety, physical protection of nuclear materials and facilities, safeguards, radioactivity in the environment, radiation protection of the environment, intervention measures and mitigation of the consequences of emergencies and use of radiation sources other than those used in health and veterinary care.

The Expert Council for Radiation and Nuclear Safety convened a regular session and four correspondence sessions in 2014. In addition to the regular reporting of the SNSA Director to the Council on the status of nuclear and radiation safety, the Council considered the following subject areas: revision of the WENRA Reference Levels for nuclear reactors/nuclear power plants and the practical implications thereof on the Slovenian territory, the analysis of workers in the company QTECHNA, a report on the implementation of the EU Directive on nuclear safety and the practical guidance PS 1.05 Using Reference Documents in Administrative Procedures.

At the correspondence sessions, the Expert Council approved amendments to the Ionising Radiation Protection and Nuclear Safety Act (ZVISJV), the Practical Guideline PS 1.05 Using Reference Documents in Administrative Procedures and a report on nuclear safety entitled "Slovenian 1st Report on Nuclear Safety as referred to Council Directive 2009/71/Euratom establishing a Community framework for the nuclear safety of nuclear installations", changes in the JV12 Rules amending the Regulation on the Transboundary Shipment of Nuclear and Radioactive Substances, the Report by the Joint Convention on the Management of Radioactive Waste and Spent Fuel Management and the report on the Review Meeting of the Convention on Nuclear Safety.

7.4 The Slovenian Nuclear Safety Administration

Based on the Decree on Administrative Bodies within Ministries, the Slovenian Nuclear Safety Administration (SNSA) performs specialised technical and developmental administrative tasks, as well as tasks concerning inspection in the areas of radiation and nuclear safety; activities involving radiation and the use of radiation sources, except in medicine and veterinary medicine; protection of the environment against ionising radiation; the physical protection of nuclear materials and facilities; the non-proliferation of nuclear materials and safeguards; radiation monitoring; and liability for nuclear damage.

Notwithstanding the reorganisation of the government at the end of 2014, by which the SNSA again became an integral part of the newly created Ministry of the Environment and Spatial Planning, the scope of its activities has not changed. In 2014, the SNSA had 41 civil servants. The number of employees did not change during the year. Due to the limitations regarding employment, there have not been any new positions at the SNSA since 2011; in the same period, none of the employees has left the SNSA. In the last decade, the average age of employees at the SNSA increased by seven years! On the one hand, this is good, since employees are experienced and so it is easier for them to do their job. However, the associated risks are growing. Sooner or later the most experienced will leave their positions due to retirement and a vacuum will therefore be unavoidable. A healthy personnel policy should encourage long-term planning of staff development, scholarships for future colleagues, career advancement, focused training and other established methods to ensure personnel competency. All this has ceased due to austerity measures.

Due to budget cuts and the resulting staffing and financial limitations in the operations of the SNSA, in the long term the risk of a direct violation of the provisions of Slovenian legislation increases. The increased risk could lead to:

- increased likelihood of a nuclear or radiological accident due to a lack of expertise of the SNSA staff and the inability to perform an adequate number of inspections;
- inability to participate in the development of international safety standards and in their transfer into daily practice in Slovenia due to financial restrictions;
- inability to maintain and develop the legislative framework in the field of nuclear safety;
- loss of the ability to detect increased radioactivity in the environment and to intervene in the event of such event;
- impaired ability to act in the event of a nuclear or radiological emergency;
- inability to report to the National Assembly, the EU and in accordance with international conventions;
- violations of international agreements and a loss of reputation of Slovenia;
- inefficient operation of the SNSA, which would impose an unnecessary burden on its clients.

As all of the above circumstances were already mentioned in the 2013 report and since the situation in the financial and human resources area has not improved in 2014 but rather remained unchanged or has even worsened, the risk can be explained as medium.

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

The Expert Commission for the Verification of Professional Competences and the Fulfilment of other Requirements in Respect of Workers Performing Duties and Tasks in Nuclear and Radiation Facilities

In 2014, the Expert Commission for the Verification of Professional Competences and Fulfilment of other Requirements in Respect of Workers Performing Duties and Tasks in Nuclear and Radiation Facilities (hereinafter: the Commission) carried out exams for Senior Reactor Operators, Reactor Operators and Shift Engineers of the Krško NPP. The Commission also organised exams for the licensing of Reactor Operators of the TRIGA reactor and for the Storage Facility Manager of the Central Radioactive Waste Storage Facility.

Eight candidates acquired a Reactor Operator license for the Krško NPP for the first time. Two candidates acquired a Senior Reactor Operator license for the first time and one candidate acquired a Shift Engineer license for the first time. Extensions of licenses were granted to nine senior reactor operators and five reactor operators.

In 2014, one candidate acquired an extension of the Research Reactor Operator license for the TRIGA reactor. One candidate also acquired an extension of the license to work as the Storage Facility Manager of the Central Radioactive Waste Storage Facility.

The SNSA granted the appropriate licenses to all the mentioned candidates.

7.5 The Slovenian Radiation Protection Administration

The Slovenian Radiation Protection Administration (SRPA), an agency within the Ministry of Health, performs specialised technical, administrative and developmental tasks as well as inspection tasks related to carrying out activities involving radiation and the use of radiation sources in medicine and veterinary medicine; protection of public health against the harmful effects of ionising radiation; systematic surveying of exposure at workplaces and in the living environment due to the exposure of humans to natural ionising radiation sources; monitoring of radioactive contamination of foodstuffs and drinking water; control, reduction and prevention of health problems resulting from non-ionising radiation; and auditing and approval of radiation protection experts.

As a special operational unit within the SRPA, the Inspectorate for Radiation Protection is responsible for monitoring sources of ionising radiation used in medicine and veterinary medicine and for the implementation of legislation on the protection of people against ionising radiation. In 2014, the SRPA had five employees.

The activities of the Administration were focused on performing duties in the field of radiation protection and on strengthening the system for health safety against the harmful impacts of radiation in the Republic of Slovenia. Within this framework, the activities of the SRPA comprised issuing permits and certificates as prescribed by the Act; issuing approval to radiation protection experts; performing inspections; providing information and increasing public awareness about procedures regarding health protection against the harmful effects of radiation; and co-operation with international institutions involved in radiation protection.

The SRPA supervised radiation practices in medicine and veterinary medicine and the use of radiation sources in these activities, the protection of exposed workers in nuclear and radiation facilities, and radon exposure. Altogether, 116 permits to carry out a radiation practice, 203 permits to use radiation sources and 1 permit to import radioactive sources were granted. Additionally, 135 programmes of radiological procedures, 191 evaluations of the protection of exposed workers, 3 certificates of eligibility for foreign contractors involving radiation, 49 statements of consignees of radioactive materials and 35 certificates of received individual doses were confirmed. In 2014, the SRPA granted 2 approvals for the status of radiation protection expert to natural persons, 1 approval to an organisation that carries out radiation practices and 3 approvals to natural persons for the status of medical physics experts.

In 2014, the Inspectorate carried out 165 inspections. Of these, 7 were in-depth inspections of exposure to radon; the SRPA issued 4 decisions requiring a reduction in exposure. The Inspectorate carried out 165 inspections. Of these, 15 were in-depth inspections in medicine and veterinary medicine. 7 decisions requiring the correction of established deficiencies, and 4 decisions requiring the sealing of X-ray devices were issued. Six requests to submit evidence regarding corrected authorised deficiencies, 25 requests to submit evidence regarding the termination of the use of an X-ray device and 111 requests regarding harmonisation with the existing legislation were issued. The SRPA took action in one case, when the operational monthly personal dose of 1.6 mSv was exceeded.

Thus far, the SRPA has operated with a small number of employees and modest financial resources. Despite this, a high level of radiation protection was ensured in its areas of competence. The SRPA does not have any internal financial or staff reserves and any further reduction of resources would mean that the SRPA will not be able to carry out its legally binding obligations and that the level of radiation safety would decrease.

7.6 Approved experts

Approved Experts in Radiation and Nuclear Safety

The operators of radiation or nuclear facilities must obtain the expert opinion of approved experts with regard to specific interventions in their facilities. In 2014, there were no major changes in the operation of such experts in comparison to previous years. Their staff maintained their level of competence and the equipment used was well maintained and updated. The organisations established quality management programmes certified to be in compliance with the ISO 9001:2008 standard. The approved experts provided professional support to the Krško NPP by preparing independent reviews. An important part of their work focused on the independent review and assessment of plant modifications.

Research and development activities are an important part of the work of approved experts. Certain organisations successfully participated in international research projects.

In 2014, the Commission for the Verification of Compliance with the Requirements of Approved Experts considered three applications, two for the extension of an approval and one for the modification of an approval. The SNSA extended the approvals of two existing experts and modified the approval of one organisation.

In 2014, 20 legal entities and 1 natural person were approved by the SNSA to perform the tasks of an Approved Expert in Radiation and Nuclear Safety.

The SNSA website (http://www.ursjv.gov.si/si/info/za_stranke/pooblasceni_izvedenci_za_sevalno_in_jedrsko_varnost/) provides information on approved experts in various fields of radiation and nuclear safety.

Approved Radiation Protection Experts

Approved radiation protection experts co-operate with employers in drawing up evaluations of the protection of exposed workers against radiation; give advice on the working conditions of exposed workers, on the extent of the implementation of radiation protection measures in supervised and controlled areas, on the examination of the effectiveness thereof, on the regular calibration of measuring equipment, and on the control of the usefulness of protective equipment; and carry out training of exposed workers in radiation protection. Approved radiation protection experts regularly monitor the levels of ionising radiation, the contamination of the working environment, and the working conditions in supervised and controlled areas. Approval can be granted to individuals to provide expert opinions and present topics relating to training on radiation protection, as well as to legal entities to give expert opinions, perform control measurements and technical checks of radiation sources and protective equipment, and to carry out training regarding radiation protection for occupationally exposed workers. Individuals can obtain an approval if they have appropriate formal education, work experience and expert skills. Legal entities can obtain an approval if they employ appropriate experts and have at their disposal appropriate measuring methods accredited according to the SIST EN ISO/IEC 17025 standard. Authorisations are limited to specific expert areas.

In 2014, the SRPA issued two approvals as radiation protection experts to natural persons. Approvals were granted on the basis of the opinion of a special commission that assesses whether candidates fulfil the requirements. In 2014, the SRPA did not issue any approvals of radiation protection experts to legal entities.

Approved Dosimetric Services

Approved dosimetric services perform tasks related to the monitoring of individual exposure to ionising radiation. An approval can only be granted to legal entities that employ appropriate experts and have at their disposal appropriate measuring methods meeting the SIST EN ISO/IEC 17025 standard.

In 2014, the Krško NPP obtained authorisation to perform personal dosimetry due to exposure to neutron fields in the NPP on the basis of measurements in accordance with the albedo measurement system optically stimulated luminescence and to provide expert opinions based on these measurements.

The granting of all approvals was based on the opinion of a special commission that assessed whether candidates fulfilled the requirements.

Approved Medical Physics Experts

Approved medical physics experts give advice on the optimisation, measurement and evaluation of the irradiation of patients, the development, planning and use of radiological procedures and equipment, and ensuring and verifying the quality of radiological procedures in medicine. Only natural persons can become approved medical physics experts.

In 2014, the SRPA authorised three medical physics experts. The granting of such approval was based on the opinion of a special commission that assessed whether the candidates fulfilled the requirements.

Approved medical practitioners

Approved medical practitioners carry out medical monitoring of exposed workers. An approval is issued by the Minister of Health on the recommendation of the SRPA and the Expanded Professional Collegium of Occupational Medicine.

In 2014, the SRPA prepared two opinions with regard to the fulfilment of the requirements for carrying out medical monitoring of exposed workers.

7.7 The Nuclear Insurance and Reinsurance Pool

The Nuclear Insurance and Reinsurance Pool (hereinafter: the Nuclear Pool GIZ) protects and reinsures against nuclear threats and acts as an economic interest grouping.

The Nuclear Insurance and Reinsurance Pool has been operating since 1994, when eight members (insurance and reinsurance companies with registered offices in Slovenia) signed a contract to establish the Nuclear Insurance and Reinsurance Pool.

In 2014, the members of the pool were: the insurance company Triglav, d.o.o.; the reinsurance company Sava, d.o.o.; Adriatic Slovenica, d.o.o.; the reinsurance company Triglav Re, d.o.o.; the insurance company Maribor, d.o.o.; the insurance company Tilia, d.o.o.; and the insurance company Merkur, d.o.o.

The Nuclear Insurance and Reinsurance Pool insures domestic nuclear facilities and reinsures foreign nuclear devices within the capacities and interests provided by the Nuclear Insurance and Reinsurance Pool members on a yearly basis.

The third-party liability of nuclear operators with headquarters in the Republic of Slovenia is insured in accordance with the Act on Liability for Nuclear Damage, which entered into force on 4 April 2011. Under this policy, the Nuclear Insurance and Reinsurance Pool covers risks as prescribed by law, thereby ensuring payments to victims in the event of a nuclear accident. Costs, interests and expenses that the insured is obliged to pay to the claimant in respect of a nuclear incident are also covered. The insurance policy covers legal liability arising from the insured's operations when damage is caused by accidents at nuclear installations during the period of insurance coverage. In 2014, the Nuclear Pool GIZ participated in the implementation of the Protocol to the Paris Convention on Liability for Nuclear Damage, to which Slovenia is a party. This Protocol will bring significantly higher limits to liability and a wider range of risks for which the operator of a nuclear installation is liable and must be insured.

The Nuclear Insurance and Reinsurance Pool participates in third-party liability insurance risk up to its capacity level, while the rest of the risk is reinsured by foreign pools.

8 NON-PROLIFERATION AND NUCLEAR SECURITY

8.1 The Treaty on the Non-Proliferation of Nuclear Weapons

The international community has devoted salient attention to nuclear non-proliferation. The situation in Iran shows that its declared civil nuclear programme has not always been transparently presented.

The 8th Review Conference on the Treaty on the Non-Proliferation of Nuclear Weapons took place in spring 2010. Between 28 April and 9 May 2014, the third (and last in the 5-year period) Preparatory Meeting was held in New York (NPT PrepCom). At all the Preparatory Meetings a great deal of time is allotted to nuclear disarmament and negative security assurances, regional issues, peaceful use of nuclear energy, as well as the Rules of Procedures and the process of nominating the representatives of countries/regions to the various working committees for the 9th Review Conference, to be held in spring 2015.

Slovenia fully meets its obligations under the adopted international agreements and treaties. Together with other countries, it endeavours to prevent the further proliferation of nuclear weapons.

8.2 The Comprehensive Nuclear Test Ban Treaty

The Comprehensive Nuclear Test-Ban Treaty (CTBT) is one of the international instruments aimed at combating the proliferation of nuclear weapons. Slovenia signed the treaty on 24 September 1996 and ratified it on 31 August 1999. Currently, there are 183 states that have signed the treaty, 163 of them have also ratified it. The CTBT will enter into force when it is ratified by the remaining 8 out of the 44 countries listed in Annex II of the Treaty (Egypt, India, Iran, Israel, China, Pakistan, North Korea and the USA).

The 7th ministerial session of the CTBT took place on 24 September 2014. Its main purpose was to encourage the countries that have not signed Annex II of the treaty. Slovenia supports activities that lead to the final enforcement of the Treaty.

8.3 Nuclear Safeguards in Slovenia

At the international level, nuclear safeguards are regulated by the Treaty on the Non-Proliferation of Nuclear Weapons and the Treaty Establishing the European Atomic Energy Community. Slovenia's legal framework had to be adapted in the process of accession to the EU. Slovenia completely fulfils its obligations regarding nuclear safeguards.

In Slovenia, all nuclear material, namely the fresh and spent fuel at the Krško NPP, the Jožef Stefan Institute, the Central Storage for Radioactive Waste in Brinje, and at the other holders of small quantities of nuclear material, is under the supervision of international inspection.

All holders of nuclear material report directly to the European Commission about the quantities and status of their nuclear material, in accordance with Commission Regulation (EURATOM) No. 302/2005 on the application of EURATOM safeguards. Copies of reports are sent to the SNSA, which maintains a registry of nuclear material.

There were ten IAEA/EURATOM inspections in 2014, whereas SNSA staff took part in eight out of ten inspections.

8.4 Export Control of Dual-use Goods

The SNSA together with the Ministry of Foreign Affairs follow the activities of the Nuclear Suppliers Group (NSG) and the Zangger Committee. The mission of both associations is to prevent the export of dual-use goods, i.e. goods that might be used for manufacturing nuclear weapons, to those countries that wish to acquire such weapons. The annual Plenary Week of the NSG was held between 23 and 27 June 2014 in Buenos Aires, Argentina.

On the basis of the Act on Export Controls of Dual-Use Goods, a special Commission for the Export Control of Dual-Use Goods ("KNIBDR") has been funtioning at the Ministry of Economic Development and Technology. Dual-use goods are goods that can be used not only for civil but also for military purposes (including nuclear weapons and other weapons of mass destruction). The Commission is made up of representatives of the Ministry of Economic Development and Technology, the Ministry of Foreign Affairs, the Ministry of Defence, the Ministry of the Interior, the Police, the Financial Administration, the the Slovenian Intelligence and Security Agency, the Chemicals Office, and the SNSA. An exporter of dual-use goods must obtain a permit from the Ministry of Economic Development and Technology, which is issued on the basis of the Commission's opinion. In 2014, the Commission had 7 regular and 29 correspondence sessions. The role of the SNSA in this commission is primarily related to the export of goods that might be used in the production of nuclear weapons or nuclear dual-use items. In December 2014, the SNSA also took part in an outreach for industry/exporters; the seminar, which encompassed the area of trade in dual-use items, was sponsored by the Ministry of Economic Development and Technology and the Financial Administration.

8.5 Physical Protection of Nuclear Material and Facilities

The operators of nuclear facilities and carriers of nuclear material implemented physical protection measures in accordance with their plans on physical protection, which were approved by the Ministry of the Interior (MI). Within the changes and amendments to the main Nuclear Act (ZVISJV), several changes and amendments of the chapter dealing with physical protection were prepared. They touched upon, in particular, background checking and security vetting. In the process of its harmonisation, the Government Office for the Protection of Classified Information was involved, as well as the Government Office for Legislation and the Information Commissioner.

In March 2014, an unannounced practical field exercise, dubbed "Nevtron 2014", was carried out. It aimed at reviewing a full-scope test of the efficiency of security staff at the Krško NPP as well as the Police at the local and regional level in the event of a direct threat to the nuclear facility.

In April 2014, the MI – in cooperation with the SNSA – held a short seminar and a lecture on nuclear and radioactive material and the physical protection of nuclear facilities (i.e. nuclear security in practice). The audience consisted of all direct stakeholders and services that bear responsibility in the area of the physical protection of nuclear facilities and radioactive material, or their activities are connected to this field. The participants were representatives of the MI, the SNSA, the Inspectorate for Interior Affairs, the Police, the MI – Police and Security Directorate, and the Administration for Civil Protection and Disaster Relief.

The role of the Commission on the Physical Protection of Nuclear Facilities and Nuclear and Radioactive Material is to monitor and harmonise different tasks in the sphere of physical protection. The Commission provides its opinions on the threat assessment of nuclear facilities and nuclear and radioactive material, monitors and coordinates the implementation of measures for the physical protection of nuclear facilities and nuclear and radioactive material, makes suggestions to improve these measures, and makes proposals in the preparation of legislation in the area of the physical protection of nuclear facilities and nuclear and radioactive material. In

2014, three regular sessions of the Commission were held; the Commission adopted a proposal regarding the threat assessment for Slovenian nuclear facilities, for the transport of fresh nuclear fuel for the Krško NPP, and considered other issues in the sphere of physical protection.

In November 2014, physical protection measures were in place during the transport of nuclear material for the Krško NPP, with no incidents.

In 2014, regular training programmes were in place for the security staff that protects nuclear facilities or the transport of nuclear fuel. The personell, carrying out the transport of nuclear fuel in November were adequately trained in advance. They had to pass both written and oral tests in accordance with the Order on establishing a programme of basic training and periodic retraining of security personnel performing physical protection of nuclear facilities, nuclear or radioactive material and transport of nuclear material (Official Gazette RS, No. 12/2013). Concerning the above-mentioned training and the test, a three-member commission was established and the training was held on the premises of the Jožef Stefan Institute.

The Agency for Radwaste Management (ARAO) revised its physical protection plan for the Central Storage for Low and Intermediate Level Radioactive Waste at the end of 2014. At the beginning of 2015, the MI – based upon the prior consent of the SNSA – issued its decision on the confirmation of the above-mentioned plan.

8.6 Illicit trafficking of nuclear and radioactive materials

By the end of 2014 the SNSA had issued 22 approvals for measuring the radioactivity in scrap metal shipments. 44,451 measurements of shipments were carried out in 2014. Elevated doses were measured in four cases.

A duty officer at the SNSA was available to provide assistance and consultation to other state offices and scrap metal recyclers. Seven calls to the duty officer were registered in 2014.

The SNSA regularly receives and to a certain extent analyses the information on incidents and trafficking cases in foreign countries. The SNSA disseminates it appropriately to other Slovenian stakeholders whose scope of responsibilities also includes (combating) illicit trafficking of nuclear and other radioactive material. In 2014, Slovenia (the SNSA) reported five times to the IAEA "Incident and Trafficking Database" (ITDB): five ^{85}Kr sources were discovered in Dob pri Domžalah, followed by thorium nitrate found in Ruše, a lightning rod with $^{152/154}$Eu in Slovenja vas near Ptuj, uranyl nitrate in Domžale, and zinc uranyl acetate at one of Ljubljana's faculties.

At the end of September 2014, representatives from the SNSA, the Customs Administration, the Market Inspectorate and the Ministry of the Interior met and reviewed the current situation in the area of the illicit trafficking of nuclear and other radioactive material. At the beginning of 2014, an overview addressing three major nodal points and their detection and response capabilities was completed. The overview was carried out for the Port of Koper, the main airport (Ljubljana-Brnik) and the post office (Ljubljana).

8.7 Achieving the Goals under the Resolution on Nuclear and Radiation Safety

As can be seen from the previous chapters, Slovenia has completely achieved the set goal:

Goal 6

As Slovenia does not have any intentions regarding the non-peaceful use of nuclear energy, it is firmly bound by the NPT and fully respects its obligations; Slovenia is entirely open for international inspection control of nuclear material on its territory ("safeguards").

Realisation in 2014

Slovenia co-operates with international organisations dealing with nuclear non-proliferation and nuclear security – primarily based upon its abilities – but significantly less than in the previous decade. Slovenia fulfils its obligations vis-à-vis the application of safeguards, follows international inspections, fulfils its obligations with regard to reporting to international databases and international organisations, and follows the area of control of dual-use goods, nuclear security and terrorism. Slovenia endeavours to make a contribution as regards the global efforts regarding nuclear non-proliferation and nuclear security, based upon its human and financial resources and priorities.

9 INTERNATIONAL COOPERATION

9.1 Co-operation with the European Union

In 2014, all the EU Member States were obliged to report to the European Commission on the implementation of the provisions of the Nuclear Safety Directive (2009/71/Euratom). The first Slovenian report was prepared. The report describes for each article of the Directive how the respective provisions were met by the licensees as well as by the regulatory body.

Working Party on Atomic Questions (ATO)

During the Greek Presidency of the EU a directive proposal amending Directive 2009/71/Euratom establishing a Community framework for nuclear safety of nuclear facilities was finalised, and after the Council's approval, the amended Directive was published on 8 July 2014. The main features of the amended Directive are ensuring greater independence of regulatory bodies and the requirement that new nuclear power plants should be built so that a significant release of radioactive substances will not be possible. The Directive introduces a system of peer reviews of selected topics on nuclear safety, specifies periodic safety reviews and introduces the concept of defence in depth. It provides for emergency preparedness of nuclear installations and off-site organisations. In addition, it increases transparency and improves education and training. It thus provides a stronger framework for nuclear safety in the EU.

ATO's other issues related to the drafting of the regulation on the control of contaminated food and feedstuffs, which has not been completed yet. Discussions addressed the approval of negotiating positions at the conclusion of an agreement between the Euratom and the Republic of Korea, and on concluding an agreement between the Euratom and Canada. As usual, the ATO supported the renewal of the Euratom – KEDO Agreement. The Italian Presidency made much effort to strengthen nuclear safeguards by delivering a paper on the Italian experiences. The Italian presentation discussed the safety and security of the transport of nuclear substances and taking action in the event of any sabotage. The aim of the presentation was to encourage the collection of the best practices of the Member States in this field.

The High-level Group on Nuclear Safety and Waste Management (ENSREG)

The High-level Group on Nuclear Safety and Waste Management (ENSREG) is an independent expert body established in 2007 by a decision of the European Commission. It consists of prominent representatives of the administrative authorities responsible for nuclear safety, radiation protection and the safety of radioactive waste from all 27 Member States of the European Union. Representatives of the European Commission collaborate in the group on an equal basis.

In 2014, ENSREG approved a workshop programme on compliance with the post-Fukushima action plans. The agreement with the International Atomic Energy Agency on the implementation of international reviews of regulatory infrastructure was also updated. The group also helped implement the EU instrument on assistance to third countries in the field of nuclear safety.

Consultative Committees under the Euratom Treaty

Within the framework of the Euratom Treaty, which is part of the Community acquis, at present several technical and consultative committees are active. The SNSA complies with its obligations in three committees: the Committee under Article 31 of the Treaty, the Committee under Article 35 and the Committee under Article 37.

The Committee under Article 31 makes recommendations to the European Commission related to radiation protection and public health. In 2014, the Committee, among other items, discussed the transposition of the new European Directive on ionizing radiation protection (the so-called EU BSS) into the national legislation of the Member States.

According to the Euratom Treaty, the EU Member States are required to establish a system of radiation monitoring in the environment and to regularly report to the European Commission on the results under Article 35. The Commission has the right to verify whether such a system is in place and in line with the established requirements (Article 36). In 2014, Slovenian representatives did not attend the meeting under this Article.

The Consultative Committee under Article 37 mainly works on a correspondence basis and when the European Commission's opinion is needed on major reconstruction works or the construction of new nuclear facilities.

9.1.1 Co-operation in EU Projects

ESOREX

For several years, the SRPA has been involved in the project "The European Study of Occupational Radiation Exposure – (ESOREX)". The ESOREX project is dedicated to the collection, processing and comparison of occupational doses data at the international level. Within the project framework, countries share experience on organising individual monitoring and managing the national data registry. The project is supported by the European Commission, but it is not limited to only EU Member States. In 2013, ESOREX started to prepare an internet platform for the exchange of information, which will be maintained by the Member States after the end of the project. The preparation of the platform is directed by the ESOREX Steering Group, consisting of representatives of the five Member States (including a representative of Slovenia), a representative of the European Commission and a representative of UNSCEAR. In 2014, The ESOREX Steering Group met in May 2014, while in September 2014 a workshop was organised, where a platform for the exchange of information was presented.

ENATRAP III

In 2014, the SRPA became part of the project "European Network on Education and Training and Radiological Protection – ENETRAP III", which is intended to coordinate training in radiation protection at the EU level and the mutual recognition of qualifications of skilled workers and experts. Slovenia joined the project as a test country with regard to the mutual recognition of experts in radiation protection.

Other Projects

At the request of the Croatian regulatory body, in 2014 the SRPA organised a two-day training course in the field of radiation protection in medicine. Training was organised for three inspectors of the Croatian Radiation and Nuclear Safety Administration.

Assistance in Drafting Radiation and Nuclear Safety Laws and Regulations in West Balkan Countries

At the beginning of 2014, the International Atomic Energy Agency launched a project, for which the European Commission provided the funds, to assist in the harmonisation of legislation with the EU acquis in the countries of the Western Balkans. A consortium led by the Austrian company ENCO was awarded the project, in which the SNSA also participated. It was a six-month project and assisted in developing draft regulations for Croatia, Bosnia and Herzegovina, Serbia, Montenegro, Macedonia and Albania.

9.2 The International Atomic Energy Agency

In 2014, Slovenia successfully cooperated with the International Atomic Energy Agency (IAEA). A Slovenian delegation also attended the regular annual session of the General Conference in 2014. The most important Slovenian activities are as follows:

- Slovenia received 31 individual applications for the training of foreign experts in Slovenia in 2014 and one group application for the training of 11 candidates under the Eastern European Research Reactors Initiative. 20 training requests were implemented, two training applications were withdrawn by the IAEA, three training application requests were declined by the Slovenian institutions, while six individual applications for training will be implemented in 2015.
- The Jožef Stefan Institute, Department of Nuclear Medicine, the Institute of Biomedical Informatics of the University of Ljubljana, the Institute of Civil Engineering and the Institute of Oncology Ljubljana actively participated in coordinated research projects. They were involved in seventeen research projects, which had already been launched in the previous years. Five coordinated research projects were successfully completed in 2014.
- The project activities planned under the SNSA project "Strengthening Regulatory Capabilities of the Nuclear Safety Administration" commenced at the beginning of the year, while the activities under the ARAO's project "Supporting Radioactive Waste and Spent Fuel Management for the Implementing Organisation" were postponed for a few months. The assignments of the national project of the Jožef Stefan Institutes's project entitled "Feasibility Study and Installation of a Thermal Neutron-Driven 14 MeV Neutron Converter in the TRIGA Research Reactor" were also underway. In the middle of 2014, the national project of the Department for Nuclear Medicine entitled "Supporting the Development of Ga-68 Labelled Bio Molecules for PET Imaging of Neuroendocrine Tumours" was completed.
- In 2014, Slovenia organised a regional training course of the IAEA.
- Participation in workshops, training courses and technical meetings organised by the IAEA is one of the most important possibilities for expert training of Slovenian specialists. In most cases, the IAEA is willing to cover the participants' attendance costs.
- The participation of Slovenian specialists and their involvement as experts in various IAEA committees, missions and workshops abroad is important as well.

In 2014, the interregional project "Strengthening the control of radioactive waste from cradle to grave in the Mediterranean Region" continued at an advanced pace. Representatives of the ARAO and the SNSA actively collaborated in the project, which comprises all the Mediterranean countries.

Last year Slovenian representatives successfully and actively cooperated in many regional projects, especially in the following ones, "Strengthening Member State Technical Capabilities in Medical Radiation Protection", "Strengthening Medical Physics in Radiation Medicine" and "Controlling Fruit Flies in the Balkans and the Eastern Mediterranean".

At the end of 2014, the Republic of Slovenia's outstanding membership fees amounted to EUR 360,510 due to inability to pay this amount. Funds in the 2015 state budget allocated for payment of IAEA membership fees amount to only EUR 130,982 , while the outstanding fees owed to the IAEA for 2015 amount to EUR 374,940. Therefore, in 2015 the amount of obligations owed towards the IAEA's regular budget will increase to EUR 604,467 assuming there is no change or additional payment into the SNSA's budget. The SNSA has observed that the trend of arrears has been increasing and approaching twice the amount of the annual obligations to the IAEA. In the new two-year period 2016–2018, it is planned that Slovenia becomes a Member of the IAEA Board of Governors, so it would be reasonable to reverse this trend in arrears as soon as possible.

IRRS Follow-up Mission

Between 9 and 16 September 2014, the IRRS Follow-up Mission (Integrated Regulatory Review Service) came to Slovenia to review the implementation of the recommendations and suggestions given by the IRRS mission in 2011. The IRRS Follow-up Mission commended the work and efforts of the SNSA and other state bodies in the period between the two missions, as substantial progress was achieved. The vast majority of suggestions and recommendations were taken into account. Nevertheless, the recommendation to accelerate the construction of the repository for low and intermediate radioactive waste remained open. The mission also found that recurrent financial and personnel constraints may have short and long-term effects on the performance of the regulatory tasks of the SNSA. It also encouraged the implementation of the strategy of research and development of nuclear and radiation safety prepared by the SNSA, but financial resources are not available for this purpose.

9.3 Nuclear Energy Agency (NEA) of the Organisation for Economic Cooperation and Development

Since 2011, Slovenia has been a full member of the Nuclear Energy Agency (NEA) of the Organisation for Economic Cooperation and Development (OECD). The mission of the NEA is to assist its member countries in maintaining and further developing the scientific, technological, and legal bases required for the safe, environmentally friendly and economical use of nuclear energy for peaceful purposes. The Agency also closely collaborates with the International Atomic Energy Agency in Vienna and the European Commission in Brussels.

In 2014, Slovenia actively participated in five standing committees, namely the Radioactive Waste Management Committee, the Committee for Radiation Protection and Public Health, the Committee on the Safety of Nuclear Installations, the Committee on Nuclear Regulatory Activities, and the Nuclear Law Committee. The representatives of the Committee for Technological and Economic Studies on Nuclear Energy Development and the Fuel Cycle and Nuclear Science Committee did not attend last year's meetings. Slovenian representatives also participate in working groups of the standing committees. In 2014, Mr. William Magwood from the USA was appointed the NEA’s new Director General, replacing Mr. Luis Echavarri of Spain, the long-time Director General, following his retirement.

Slovenian institutions (the NPP, the SNSA and the SRPA) continue to participate in the International System of Occupational Exposure – ISOE. ISOE is an information system on occupational exposure to ionising radiation in nuclear power plants, supported by the OECD/NEA and the IAEA. The Information System is maintained by technical centres with the support and cooperation of both organisations mentioned, nuclear power plants and regulatory bodies.

A lack of funding also limited the participation of Slovenian members in the NEA standing committees in 2014. This means a lower flow of information on the latest expertise from abroad, as some members only participate as corresponding members. Slovenia is in an unusual position, as after having become a regular member of the OECD/NEA, the Slovenian representatives’ attendance at meetings of working committees and groups is much more infrequent than it used to be when it still had the status of an observer country.

9.4 Co-operation with Other Associations

The Western European Nuclear Regulators Association (WENRA)

WENRA (The Western European Nuclear Regulators Association) is an association consisting of representatives of nuclear regulatory authorities from European countries with nuclear power plants. The main objectives of WENRA are to develop a common approach to nuclear safety and to exchange experiences in the field of nuclear safety.

In 2014, WENRA continued with the update of safety reference levels for existing nuclear power plants, taking into account the experiences gained from the Fukushima accident. A new draft of safety reference levels for radioactive waste storage was prepared and in December they were published in the final report. Emergency response was also discussed and the guidelines for the coordination of emergency actions among neighbouring countries were confirmed.

The European Nuclear Security Regulators Association (ENSRA)

The European Nuclear Security Regulators Association (ENSRA) is an association consisting of representatives of nuclear regulatory authorities that cover nuclear security. It was established in 2004. Slovenia joined the ENSRA in 2008. The main objectives of ENSRA are to exchange information on nuclear security, current security issues and events on the development of comprehensive understanding of the fundamental principles of physical protection, and to promote common security principles in Europe.

ENSRA's plenary meeting was held in October in Belgium, where the presidency of the association was assumed by Hungary on 1 January 2015. In 2014, ENSRA mainly dealt with the exchange of information on important security challenges (e.g. raids of activists on nuclear installations) as well as the adoption and exchange of declarations on operation procedures (the new Terms of Reference).

The International Nuclear Law Association (INLA)

The International Nuclear Law Association (INLA) is an international association of legal and other experts in the field of the peaceful use of nuclear energy. The objectives of the INLA are to support and promote knowledge and development of legal issues and research related to this field, the exchange of information among its members and cooperation with similar associations and institutions. The INLA has approximately 500 members from more than 50 countries and international organisations.

In October 2014, INLA held its Congress, which is normally organised every two years. The conference was divided into ten sections that discussed issues regarding the regulation of using radiation sources, safety and licensing, the management of radioactive waste, radiation protection, global trends in the construction of new nuclear power plants, nuclear projects in less developed countries, transportation, physical security and non-proliferation and liability for nuclear damage.

CAMP (NRC)

CAMP is an international programme for the maintenance and use of software for safety analysis of nuclear power plants. The Jožef Stefan Institute, Krško NPP and the SNSA are involved in the programme under agreement with the US NRC (the US Nuclear Safety Regulator). Membership and programme coordination costs are fully covered by the Krško NPP. The Slovenian National Coordinator of the CAMP programme is the Jožef Stefan Institute, which regularly monitors and reports on the activities of CAMP and actively cooperates and contributes to the development and use of computer programmes.

Association of the Heads of European Radiological Protection Competent Authorities

A representative of the SRPA is a member of the Association of the Heads of European Radiological Protection Competent Authorities – HERCA. In 2014, the Association addressed radiation protection measures and their harmonisation and unification in the event of an emergency. Furthermore, HERCA and WENRA succeeded in harmonising their views and strengthened cooperation with international organisations in the field of radiation protection and radiological equipment manufacturers.

The European ALARA Network

As one of 20 European countries, Slovenia participates in the European ALARA Network (EAN). The EAN is dedicated to optimising radiation protection and sharing good ALARA practices in industry, research and medicine. In the framework of the EAN, international workshops on specific fields are organised. In addition, the EAN issues a newsletter on practical implementation of the ALARA principle, examples of good practices and other news on radiation protection. The EAN has an active role in studies conducted by the European Commission and other international organisations in the field of radiation protection. The network is also involved in other aspects of implementing the ALARA principle in practice. There are several sub-networks in the framework of the EAN. The SRPA is active in the ERPAN (the European Radiation Protection Authorities Network), which is dedicated to the exchange of operational information on surveillance and measures in radiation protection.

9.5 Agreement on the Co-ownership and Management of the Krško Nuclear Power Plant

A special Intergovernmental Commission shall be a key body regulating relations between the parties to the Agreement between the Government of the Republic of Slovenia and the Government of the Republic of Croatia on regulating the status and other legal relations connected to investments in the Nuclear Power Plant, and its exploitation and decommissioning (Official Gazette RS 23/03 – International Treaties; hereinafter referred to as the Agreement). The members of the Slovenian and Croatian sides have been newly appointed a few times since 2012, but the Commission has not met since 2010. Due to the change in leadership of the Slovenian ministry responsible for energy, the procedure to appoint new members of the Slovenian delegation to this Commission was initiated in December 2014.[2]

9.6 Co-operation in the Framework of International Agreements

Bilateral Co-operation

On the basis of bilateral agreements between these four countries, the regular annual meeting of the Czech Republic, Hungary, Slovakia and Slovenia, i.e. the so-called Quadrilateral Meeting, took place in April in Balatonfüred, Hungary.

After many years, the delegations of the Slovenian Nuclear Safety Administration and the Croatian Office for Radiation and Nuclear Safety met in Zagreb in April 2014. The meeting underlined cooperation and harmonisation in the area of emergency preparedness and response. Both sides are well informed about the developments in the respective countries.

[2] The Government appointed the Slovenian members of the special Intergovernmental Commission on 22 January 2015.

In October 2014, the representatives of Austria and Slovenia convened at their annual meeting in Reichenau an der Rax in Austria. Both sides informed each other of major developments regarding legislation, administrative work, radiation monitoring, emergency preparedness and waste management. Slovenian answers to questions about the Krško Nuclear Power Plant posed by the Austrian side prior to the meeting were also addressed. Slovenia was the only country to have submitted answers, though Austria sent their queries to all neighbouring countries with nuclear power plants.

The Sixth Review Meeting of the Contracting Parties to the Convention on Nuclear Safety

In March 2014 in Vienna the IAEA, convened the 6th Review Meeting of the Contracting Parties to the Convention on Nuclear Safety, which was attended by 69 out of 76 contracting parties. The Slovenian national report emphasised the Slovenian post-Fukushima action plan, as well as the Krško NPP safety upgrade programme. The report described the main events at the Krško NPP, e.g. the reactor trip due to OPΔT false signals, caused by the induced voltage in the reactor protection system and fuel leakage. Furthermore, the document mentioned the lack of financial and human resources at the SNSA being a result of the economic crisis, the IRRS mission conducted in 2011, changes in legislation that incorporate the recommendations of the IAEA and the WENRA and the completion of the second Periodic Safety Review.

Switzerland proposed a new article to the Convention requiring that the Contracting Parties have such a design and construction of nuclear installations that would prevent any nuclear accident with significant radioactive release. As a consensus on the article was not reached, it was decided to organise a diplomatic conference in 2015 where the amendment will be discussed and decided upon.

9.7 Achieving the goals of the Resolution on Nuclear and Radiation Safety

As can be seen from the above chapters, Slovenia efficiently and rationally strives to achieve the goals set out in the Resolution. The document also reports on problems due to the lack of funding (the accumulation of arrears towards the IAEA, the inability to attend the meetings).

Goal 2

In principle, the Republic of Slovenia joins international conventions, agreements, contracts or other methods of cooperation allowing a rapid and equitable exchange of information and mutual assistance in ensuring nuclear and radiation safety and reducing risks to humans and the environment both in the territory of the Republic of Slovenia as well as elsewhere.

Realisation in 2014

The Slovenian authorities and other organisations in the field of nuclear and radiation safety and physical protection are involved in international associations based on their needs and the benefits that they can gain from such membership. This collaboration has to contribute to the maintenance of nuclear and radiation safety in Slovenia on a comparable international level.

International cooperation should be encouraged and maintained in all areas of nuclear and radiation safety, including science and education.

The Republic of Slovenia, the Slovenian authorities and other organisations in the field of nuclear and radiation conclude bilateral agreements on cooperation in the field of nuclear and radiation safety if this facilitates the achievement of planned goals. Such agreements are especially important when they provide Slovenia with early information in the event of a radiological emergency in the territory of another country.

Goal 3

The Republic of Slovenia will continue to actively participate in all activities within the EU where its presence is mandatory and where Slovenia can meet its specific long-term interests.

Realisation in 2014

The Republic of Slovenia will continue to have an active role in all activities within the EU where its presence is mandatory, i.e. in reviewing proposals, in the adoption and implementation of the EU acquis, and in the areas where Slovenia can meet its specific long-term interests.

Goal 4

The Republic of Slovenia is and remains an active member of the IAEA. As a member of this Agency, it contributes a mandatory membership fee. In accordance with its capabilities, it also provides human and financial resources, in particular in the areas where its direct or indirect interests can be served.

Realisation in 2014

In the area of technical cooperation, Slovenia supports projects that have great potential, in particular in countries in geographical proximity, in countries with similar programmes or technology, and particularly in areas where Slovenian experts are able to provide their assistance.

The Republic of Slovenia will receive technical assistance especially in the areas where no domestic capabilities are available to achieve the given nuclear and radiation safety goals.

The Republic of Slovenia will continue to support and motivate its experts for professional work in third countries within the framework of the IAEA and invite international expert advisory groups as part of periodic advisory missions to facilities and institutions to independently verify the country's capabilities. Above all, it will invite expert groups that Slovenia is committed to inviting.

Goal 5

The Republic of Slovenia remains an active member of the OECD Nuclear Energy Agency (NEA). For its collaboration, Slovenia contributes the agreed amount of the membership fee. In line with its human and financial resources, Slovenia participates in the work of NEA committees, the NEA Data Bank and those subcommittees and working groups that are important for ensuring a high level of nuclear and radiation safety.

10 USE OF NUCLEAR ENERGY IN THE WORLD

At the end of 2014, there were 443 nuclear reactors for electricity production operating in 31 countries. In 2013, ten new nuclear power plants were put into operation, of which one was in Russia, one in Argentina, one in Republic of Korea and seven in China. One nuclear power plant in the USA ceased operation. In Japan, all nuclear power plants remain shut down due to the accident at Fukushima in 2011. The construction of five new nuclear power plants started in 2014, of which one was in the United Arab Emirates, two in Belarus and two in Taiwan.

In Europe, there are nuclear power plants under construction in Finland, Slovakia, France, Russia, Ukraine and Belarus. New plants are planned for Poland, Hungary, the Czech Republic, Finland, Romunia, Russia, Armenia, Bulgaria, France, Lithuania, Turkey and Ukraine. Detailed data on the number of reactors by country and their installed power is presented in Table 9.

Table 9: The number of reactors by country and their installed power

Country	Operational		Under construction	
	No.	Power [MW]	No.	Power [MW]
Belarus			2	2,218
Belgium	7	5,927		
Bulgaria	2	1,926		
Czech Republic	6	3,904		
Finland	4	2,752	1	1,600
France	58	63,130	1	1,630
Hungary	4	1,889		
Germany	9	12,074		
Netherlands	1	482		
Romania	2	1,300		
Russia	34	24,654	9	7,371
Slovakia	4	1,814	2	880
Slovenia	1	688		
Spain	7	7,121		
Sweden	10	9,651		
Switzerland	5	3,333		
Ukraine	15	13,107	2	1,900
United Kingdom	16	9,373		
Europe total:	**185**	**162,437**	**17**	**15,599**
Argentina	3	1,627	1	25
Brazil	2	1,884	1	1,245
Canada	19	13,500		
Mexico	2	1,330		
USA	99	98,639	5	5,633
Americas total:	**125**	**116,437**	**7**	**6,903**
Armenia	1	375		
India	21	5,308	6	3,907
Iran	1	915		
Japan	48	42,388	2	2,650
China	27	23,025	23	22,738
Korea, Republic of	24	21,667	4	5,420
Pakistan	3	690	2	630
Taiwan	6	5,028		
United Arab Emirates			3	4,035
Asia and Middle East total:	**131**	**99,396**	**40**	**39,380**
South Africa:	**2**	**1,860**		
World total	**443**	**380,673**	**64**	**61,882**

11 RADIATION PROTECTION AND NUCLEAR SAFETY WORLDWIDE

The International Nuclear and Radiological Event Scale (INES) is used worldwide as a tool for consistent reporting to the public on the safety significance of nuclear and radiological events. International reporting on events is performed for more significant events rated at Level 2 or higher and for events that have attracted the interest of the international public. The INES reports are published on the web-based communication system NEWS: http://www-news.iaea.org and the INES reports of events in Slovenia are published on the SNSA website in the section INES events.

Significant events rated according to the INES scale

In 2014, 26 event reports were published via the NEWS system. The reports were divided into the following groups: 2 events in NPPs, 6 events concerning releases of radioactive water from the Fukushima Daiichi NPP, 1 event in a radioactive waste storage, 8 events concerning use of radioactive sources, 4 events concerning finding radioactive sources, and 4 events concerning the radioactive exposure of workers in medicine. One report described inappropriate protection of workers with an irradiation device. The events with overexposure of workers were rated as level 3; in two cases this occurred during performance of radiography and in one case it was during repair of a medical X-ray device. There were 9 level 2 event reports published, 7 reports on level 1 events and 1 report on a level 0 event. For 6 events in the Fukushima Daiichi NPP the INES rating was not determined.

A level 3 event occurred in the handling of a radiographic camera in a chemical plant in Peru. Because of failure of equipment containing a 1.22 GBq ^{192}Ir source, three operators were exposed. One of them received a less than 500 mSv whole-body dose and the dose to his left hip was estimated to be more than 25 Sv, where also deterministic effects (skin redness) were observed. Two other workers were exposed and received whole-body doses of 15.85 and 17 mSv, respectively. The main cause of the event was non-compliance with protection procedures. The regulatory body suspended the company's license for performance of radiography for 6 months.

A level 3 rating was also issued for an event in Australia. After completing a logging operation, the logging tools were lifted from the rig to the surface, where the tools contained ^{137}Cs and ^{241}Am-Be sources. The ^{137}Cs source with activity of 54 GBq had fallen out from the shielding without the engineer noticing it. This resulted in exposure of an operator that worked near the unshielded source. Another worker saw the source lying on the floor; he picked it up and handed it to a third operator. The first worker received a dose of 4-13 Sv to his leg, 510 mSv to his hand and a whole-body dose of 2.7 mSv. Deterministic effects of radiation were observed on the left leg of this worker. The second worker received a dose of 570 mSv to his hand and a whole-body dose of 0.79 mSv, while the third worker received a dose of 53 mSv to his hand.

The third event rated as level 3 occurred in a hospital in Switzerland. While repairing an X-ray device a service technician accidentally activated the device and was exposed to radiation for about 5 minutes. He had forgotten to wear his dosimeter that day. Deterministic effects of radiation were observed on his neck and face. The local skin dose was estimated to be around 5 Gy.

An event that attracted international public interest in a NPP was the failure of electrical equipment in a turbine hall that caused the disconnection of the plant from the power grid. The event did not affect the plant safety and was rated as level 0 according to the INES scale.

Most events were connected to the use of radiation sources. Six events rated level 2 were due to the overexposure of workers and were caused by improper operation of radiographic devices or inappropriate actions of workers while repairing faulty devices, by non-compliance with procedures, and by failure to use personal protective equipment or personal dosimeters.

Four INES reports described events with lost, stolen of found radiation sources. All of the events were rated as level 1 according to the INES scale.

During an armed robbery of a storage facility various electronic equipment was stolen, as well as two sources of Am-Be with activities of 185 GBq each. The National Police located the sources, which had not been removed from the shielded container and therefore did not endanger the public.

In a plant in bankruptcy it was discovered that a ^{60}Co source of category 4 was missing. The source was stored in a shielded container. The local scrap metal facilities were searched but the lost or stolen source has not yet been found.

INES Events in Slovenia

In Slovenia, there were no events in 2014 that needed to be reported according to the INES criteria. However, a final report on an INES event from 2013 (Exposure of workers performing industrial radiography) was prepared in accordance with the findings on the event circumstances and the report was published on the SNSA web site.

Other Internationally Interesting Events in 2014

The IAEA website reported on two events that were not rated according to the INES criteria.

Robbers stole a pick-up truck with an ^{192}Ir source with activity of 1.23 TBq (category 4). The vehicle was later found but the source was not there. The container with the radiation source was found following a report from a member of public and it was delivered to the regulatory body and placed in storage.

The second event was caused by a cleaner at an oil refinery, who found an ^{192}Ir source in the form of a metal chain that had fallen out of a pipe. He stored the source in a pocket and was therefore exposed for more than 3 hours to the source. During this period he received a dose of 1.31 Gy. The deterministic effects of the irradiation were observed as erythema and skin ulceration.

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