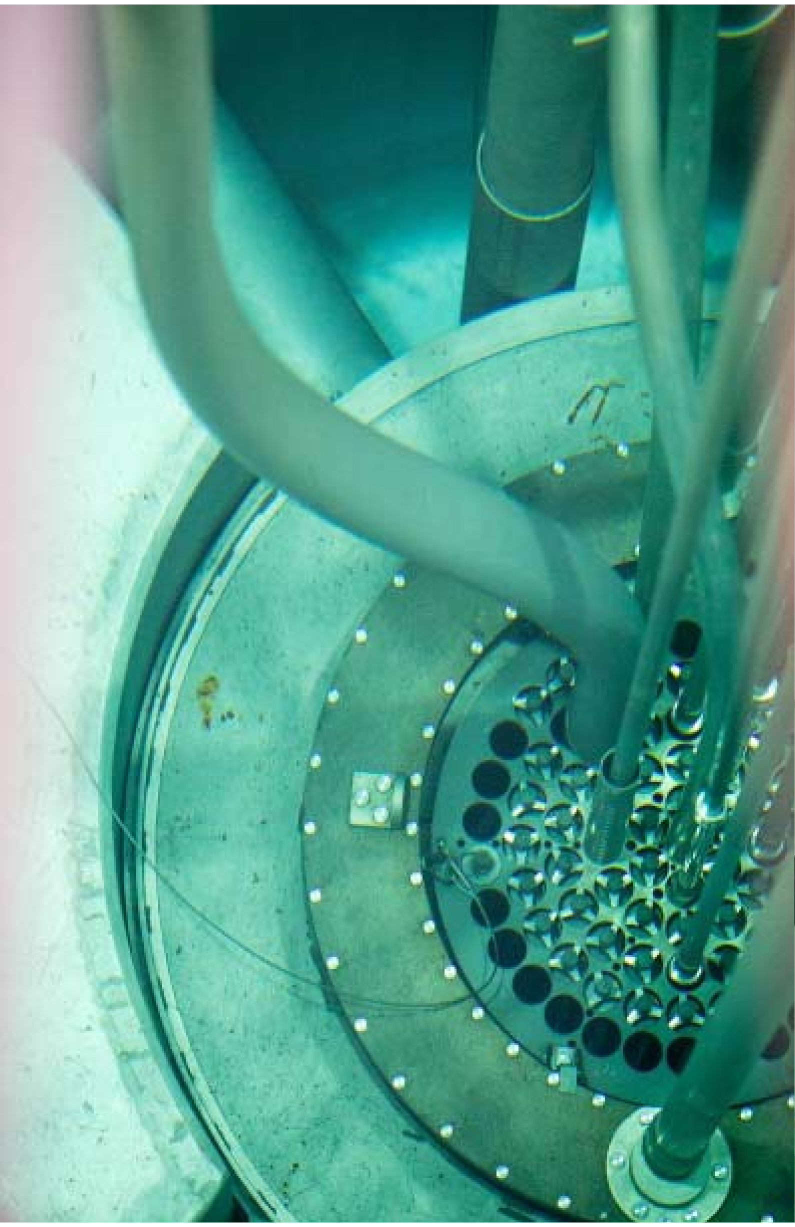
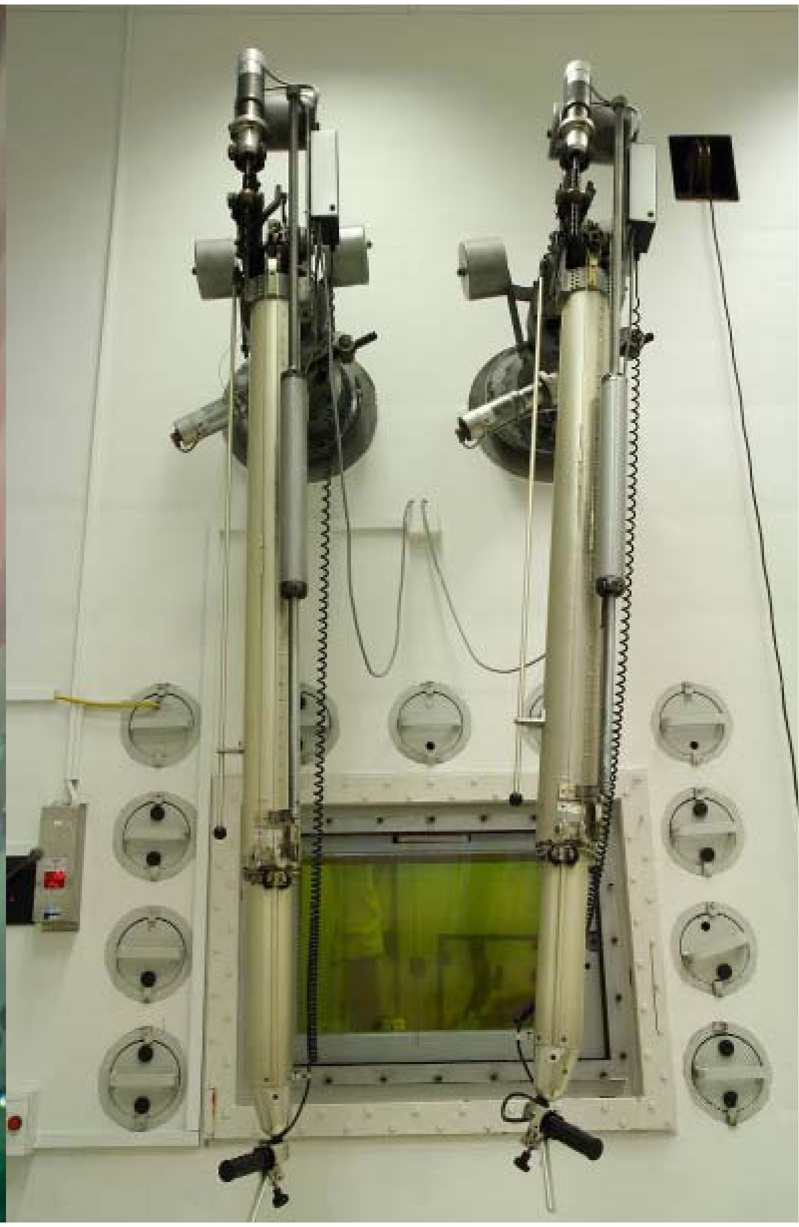
REPUBLIC OF SLOVENIA
MINISTRY OF THE ENVIRONMENT AND SPATIAL PLANNING
SLOVENIAN NUCLEAR SAFETY ADMINISTRATION

Fifth Slovenian Report under the

Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management





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Cover photo: TRIGA MARK II Research Reactor

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All Slovenian Reports under the Joint Convention and other information can be found on the home page of the Slovenian Nuclear Safety Administration at www.ursjv.gov.si

PREFACE

The National Report on Fulfilment of the Obligations of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management is prepared in fulfilment of Slovenia's obligation as a Contracting Party to this Convention.

This report was prepared by the Slovenian Nuclear Safety Administration. Contributions to the report were made by the company NEK d.o.o., the Jožef Stefan Institute, the Agency for Radwaste Management, the company Žirovski vrh Mine d.o.o., the Ministry of Infrastructure and Spatial Planning, the Isotope Laboratory of the Institute of Oncology, the Department for Nuclear Medicine of the Ljubljana University Medical Centre and the Slovenian Radiation Protection Administration. It constitutes an updated document with basically the same structure as previous national reports under the Convention. Issues raised at the fourth review meeting and future plans are addressed in Section K of the report.

The report was approved by the Expert Council for Radiation and Nuclear Safety and adopted by the Government of the Republic of Slovenia.

The report was prepared in the first half of 2014, when the Slovenian Nuclear Safety Administration (SNSA) was the body within the Ministry of Agriculture and the Environment. Since new government has been elected in September 2014, the SNSA is since then the body within newly established Ministry of the Environment and Spatial Planning.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

ADR	European Agreement Concerning the International Carriage of Dangerous Goods by Road
ALARA	As Low As Reasonably Achievable
ARAO	Agency for Radwaste Management
CFR	Code of Federal Regulations
CRDM	Control Rod Driving Mechanisms
DRPI	Digital Rod Position Indication
EU	European Union
ERDO-WG	European Repository Development Organisation - Working Group
FA	Fuel assemblies
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
IGD-TP	Implementing Geological Disposal of Radioactive Waste Technology Platform
IJS	Jožef Stefan Institute
LILW	Low and Intermediate Level Waste
NPP	Nuclear Power Plant
OECD/NEA	Organisation for Economic Co-operation and Development/ Nuclear Energy Agency
OSART	Operational Safety Review Team
PHARE	Central and Eastern European Countries Assistance for Economic Restructuring
PWR	Pressurised Water Reactor
RS	Republic of Slovenia
SFRY	Socialistic Federative Republic of Yugoslavia
SNSA	Slovenian Nuclear Safety Administration
SRPA	Slovenian Radiation Protection Administration
TENORM	Technologically Enhanced Naturally Occurring Radioactive Material
TLD	Thermoluminiscent Dosimeter
TRIGA	Training Research Isotope General Atomic operated by IJS
USA	United States of America
US NRC	United States Nuclear Regulatory Commission
WANO	World Association of Nuclear Operators

EXECUTIVE SUMMARY

Slovenian Nuclear Programme

The Republic of Slovenia has a small nuclear programme (Figure 1): one operating nuclear power plant, one research reactor and one central storage facility for radioactive waste from small producers. In addition there is also a uranium mine at Žirovski vrh, though this is now closed. The geographical locations of the nuclear and radiation facilities are given in the figure below. The Republic of Slovenia has no facility for final disposal of radioactive waste or spent nuclear fuel.

Figure 1: **The nuclear programme in the Republic of Slovenia**

The Krško Nuclear Power Plant (Krško NPP) is one of the main pillars of the Slovenian power system. It is situated on the left bank of the River Sava in the south-eastern part of Slovenia. It is a Westinghouse two-loop Pressurised Light Water Reactor with nominal output power 727/696 MWe (gross electrical power/net electrical power). It is designed to operate until the end of 2023. In 2012 the Slovenian Nuclear Safety Administration issued a decision approving modifications which will enable long-term operation of the Krško NPP. The operation of the NPP could be extended from 2023 to 2043, pending the successful conclusion of Periodic Safety Reviews in 2023 and 2033. The plant is owned by state-owned Slovenian and Croatian electrical power companies (GEN energija d.o.o. and Hrvatska Elektroprivreda d.d. respectively).

The plant is operated by the public enterprise Krško NPP d.o.o. The Krško NPP is the major producer of radioactive waste in the Republic of Slovenia. As part of the technological process of electricity production, all operational radioactive waste and spent nuclear fuel are stored within the plant area. Solid radioactive waste is treated and then packed into steel drums, which are then stored in the solid radwaste storage facility. Spent nuclear fuel is stored under water in the spent fuel pool.

The Jožef Stefan Institute Reactor Infrastructure Centre (IJS Reactor Infrastructure Centre) is a part of the Jožef Stefan Institute (IJS). It is located in Brinje, about 15 km north-east of Ljubljana. The main purpose of the centre is operation of the TRIGA Mark II research reactor for the needs of IJS and other research groups. The TRIGA Mark II research reactor is a General Atomics open-pool type research reactor with a thermal power of 250 kW. It was initially licensed in 1966 and was re-licensed for steady state and pulse operation after renovation and reconstruction in 1991. The facility is used in research projects and for education. Fuel elements are kept in the reactor building of the IJS Reactor Infrastructure Centre. In addition to spent fuel, the reactor produces a small amount of low- and intermediate- level waste (LILW). The part of the IJS Reactor Infrastructure Centre is a hot laboratory, which is among other licensed also for the treatment of radioactive waste from small producers.

The research reactor is operated by the Jožef Stefan Institute, a public research institution that is financed from the national budget by the Ministry for Education, Science and Sport.

The Žirovski vrh Uranium Mine was in operation in the period from 1984 to 1990. Its lifetime production was 610,000 tons of ore, from which 452.5 tons of U_3O_8 was produced. The Žirovski vrh Uranium Mine ended regular operations in 1990. The decision to close it was influenced by economic reasons, since its uranium production was no longer economically competitive. In 1992, the Republic of Slovenia, as the owner of the Žirovski vrh Uranium Mine, established a company called Žirovski vrh Mine d.o.o. to perform the permanent closure of the mine (Permanent Cessation of Exploitation of the Uranium Ore and Prevention of Consequences of the Mining in the Uranium Mine at Žirovski vrh Act). The financial resources for decommissioning and restoration were provided from the national budget.

All entrances to the underground mine are now closed. The uranium ore mill has been decommissioned and the resulting wastes have been disposed of at the Jazbec mining waste disposal site. To this site all mining waste from numerous other mining waste piles has been moved and disposed of. The total amount of disposed material on this site is 1,910,425 tons, with a total activity of 21.7 TBq. At the Boršt uranium mill tailings disposal site, 610,000 tons of hydrometallurgical waste, 111,000 tons of mine waste and 9,450 tons of material collected during decontamination of the mill tailings in the Boršt site vicinity have been disposed of, with a total activity of 48.8 TBq. Closure works at the Jazbec disposal site have been completed and the administrative procedure is in its final stage. The closure of the Boršt disposal facility has been delayed due to the activation of a landslide.

The Central Storage Facility for Radioactive Waste in Brinje is intended for storage of low- and intermediate- level radioactive waste arising from medical, industrial and research applications. The construction of the facility started in 1984 and it was put into operation in 1986. In 1999, the responsibility for managing and operation of the storage was transferred from the IJS to the Agency for Radwaste Management (ARAO). Following refurbishment and two and a half years of trial operation, a new operating licence was issued in early 2008.

The Agency for Radwaste Management is a public utility for implementation of radioactive waste management as a public service. It was established by the Slovenian Government and is responsible for radioactive waste management, including management of institutional radioactive waste, post-closure monitoring and maintenance of disposal sites of uranium mining and milling waste, and disposal of radioactive waste from the Krško NPP. It is financed from the national budget and fees paid by waste producers when the liabilities of further waste management are transferred from them to ARAO. Activities regarding the siting and construction of an LILW repository are financed from the Fund for the Decommissioning of the Krško NPP.

Governmental Policy

The governmental policy in the area of safety of spent fuel management and safety of radioactive waste management is governed by the national nuclear legislation and international agreements. Based on the legislation, a number of measures have been implemented to protect the environment and the public from the harmful impact of radioactive waste and spent fuel. The most important measures are:

- Establishment and functioning of the regulatory body, the Slovenian Nuclear Safety Administration (SNSA), which is the competent authority in the area of nuclear and radiation safety and radioactive waste management. It was established in 1987. Previously, the functions of the regulatory body were performed by the Committee of Energy and Industry.
- Establishment of ARAO as a public utility for radioactive waste management by Slovenian Government (1991).
- Establishment of Žirovski vrh Mine d.o.o., a public enterprise for the decommissioning of the uranium production site (1992).
- Establishment of the Fund for the Decommissioning of the Krško NPP (1995).

In addition, the Government has prepared several documents pertinent to the policy in the area of radioactive waste management. The most important are as follows.

The Resolution on the National Energy Programme adopted by the Slovenian Parliament in 2004. In this document the following policy was adopted:

- The share of nuclear energy shall be preserved at the current level.
- The Krško NPP shall operate at least until 2023.
- In order to secure safe and reliable operation of the Krško NPP, adequate measures are implemented.

- A decision on operating life extension of the Krško NPP shall be adopted in 2011 on the basis of an evaluation programme which shall start in 2008.

The revised National Energy Programme (NEP) or National Energy Concept is still in preparation and in the phase of general public consultation. The draft National Energy Program foresees the use of nuclear energy as a contributor to the transition to reliable low carbon power supply sources.

The Agreement between the Government of the Republic of Slovenia and the Government of the Republic of Croatia on the Regulation of the Status and Other Legal Relations Regarding the Investment, Exploitation and Decommissioning of the Krško NPP (hereinafter the Agreement). In the Agreement the following policy is adopted:

- Decommissioning of the Krško Nuclear Power Plant and management of its radioactive waste and spent fuel are the joint responsibility of the contracting parties, and they should ensure efficient common solutions from both the economic and environmental protection points of view.
- If the contracting parties do not reach agreement on a common solution for radioactive waste and spent fuel management during the regular lifetime of the Krško NPP, they undertake that within two years of that time they must finish removal of operational radioactive waste and spent fuel from the location of the Krško NPP (one half by each party) and will individually bear the costs of their management (including subsequent division and removal of radioactive waste from decommissioning).
- The contracting parties shall, in equal shares, assure funds for the preparation of the decommissioning programme and its execution and funds for the preparation of the programme for the disposal of radioactive waste and spent fuel. If the contracting parties agree on a joint solution for the disposal of radioactive waste and spent fuel they shall finance it in equal shares or shall finance their shares of the activities.
- The Republic of Slovenia and the Republic of Croatia shall jointly prepare and approve a new plan for the decommissioning of the Krško NPP and disposal of LILW and high-level waste (hereinafter the Decommissioning Plan).
- The Republic of Slovenia and the Republic of Croatia shall establish funds for the management and collection of financial resources for decommissioning and radioactive waste disposal costs.

The current contribution to the Slovenian fund for financing one half of the decommissioning and spent fuel and radioactive waste disposal is 0.30 Euro cents per kWhe of the Slovenian share of energy produced by the Krško NPP.

The revision of the Programme for Decommissioning of the Krško NPP and Disposal of LILW and High-Level Waste is not yet finished. The Intergovernmental Commission did not meet in 2011 through 2013. Consequently, the new version of the Decommissioning Programme was not adopted. Furthermore there is still no agreement on a common LILW disposal solution and spent fuel management solution between Slovenia and Croatia based on the dual ownership and the shared responsibility for radioactive waste management from the Krško NPP.

The Resolution on the 2006–2015 National Programme for Managing Radioactive Waste and Spent Nuclear Fuel was adopted by the Slovenian Parliament in February 2006. According to the programme, the Krško NPP, the major radioactive waste generator, shall continue to operate until 2023, with an option of life extension. After the termination of Krško NPP's operation, the spent fuel will be transferred to dry storage for a period of about 35 years, when the spent fuel repository should be operable. The LILW waste repository shall be built in Slovenia. The design of the repository should be modular, with sufficient capacity to accommodate all future LILW waste arising in Slovenia. The spent fuel from the Triga Mark II research reactor will be returned to the country of origin. The institutional waste stored at the Central Storage Facility for Radioactive Waste in Brinje which meets the waste acceptance criteria (WAC) shall be disposed of in the LILW repository. The remaining waste from the Central Storage Facility for Radioactive Waste in Brinje shall be stored at the facilities of the repository if agreement on this issue is reached with the local community.

The Resolution on Nuclear and Radiation Safety in the Republic of Slovenia (for the period 2013 – 2023) was adopted in the Parliament in June 2013. The Resolution is a programmatic, high-level national policy document which contains a descriptive part divided into chapters; for each chapter the objectives which must be delivered during the period of validity of the Resolution are set. The Resolution therefore comprises the national policy, strategy and plan. The chapters are as follows:

- fundamental safety principles;
- description of nuclear and radiological activities in Slovenia;
- description of the international cooperation in the field of nuclear and radiation safety;
- description of the existing legislation (including binding international legal instruments, e.g. conventions);
- description of the institutional framework;
- competence of professional support (research, education and training).

Siting and design of the LILW repository

Within the framework of siting of the LILW repository, the activities were carried out at two sites: Vrbina (Krško municipality) and Vrbina Šentlenart (Brežice municipality). The latter was proposed only at the beginning of 2007. Within the process of preparation of the Spatial Plan of National Importance for the Vrbina site, the SNSA issued guidelines determining the content and scope of the Special Safety Analysis of the LILW repository. Considerable effort and attention are devoted to communication with stakeholders, including local communities and non-governmental organisations.

The municipality council of Krško gave its consent to the proposal of the national spatial plan in July 2009. A great step forward was the adopting of the Decree on a Detailed Plan of National Importance for an LILW repository in Vrbina in the municipality of Krško, at the end of 2009. With its publication in the Official Gazette of the Republic of Slovenia (No. 114/09) on 31 December 2009, the procedure for the siting of the repository was completed. Unfortunately, further procedures for the preparation and approval of the environmental impact assessment, detailed field investigations, finalization of the design, construction and putting into operation were significantly delayed due to different administrative reasons. There were complications related to the method of financing of the project and the legal arrangements among investor and implementing organisations, which were slowly resolved only towards the end of 2013. The investment programme for the project, which is a prerequisite for most of other steps, was signed by the Minister of infrastructure and spatial planning only in summer 2014. It is now targeted that the repository could start receiving first waste in 2020. The original target for start of operation was 2013. This delay increases the challenges for the Krško NPP which has to cope with its limited capacities of the radwaste storage.

The following internet sites are available for additional information:

- Slovenian Nuclear Safety Administration: http://www.ursjv.gov.si/
- Krško NPP: http://www.nek.si/
- Jožef Stefan Institute Reactor Infrastructure Centre: http://www.rcp.ijs.si/
- Jožef Stefan Institute: http://www.ijs.si/
- Agency for Radwaste Management: http://www.arao.si/
- GEN energija d.o.o.: http://www.gen-energija.si/
- Žirovski vrh Mine d.o.o.: http://www.rudnik-zv.si/
- Fund for Financing the Decommissioning of the Krško Nuclear Power Plant and for the Disposal of Radioactive Waste from the Krško Nuclear Power Plant: http://www.sklad-nek.si/

SECTION A: INTRODUCTION

On 29 September 1997, the Republic of Slovenia signed the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (hereinafter the Convention). The Convention was ratified in the Parliament in February 1999. It entered into force for the Republic of Slovenia in June 2001.

In this fifth report, the fulfilment of the obligations in the period 2011–2013 is evaluated. The report presents the achievements in and contributions to enhancing the safe handling and disposal of spent fuel and radioactive waste.

This report is prepared to meet the obligation for reporting under Article 32 of the Convention. It is structured in accordance with IAEA guidelines INFCIRC/604/Rev.2. In order to provide for fluent reading, certain information is provided in the form of attachments and referred to in the text. The information provided in the report presents the status at the end of 2013.

In the following sections the fulfilment of each of Articles 3 to 32 of the Convention is evaluated separately. It can be concluded that Slovenian regulations and practices are in compliance with the obligations of the Convention.

SECTION B: POLICIES AND PRACTICES

Article 32, Paragraph 1: Reporting

In accordance with the provisions of Article 30, each Contracting Party shall submit a national report to each review meeting of Contracting Parties. This report shall address the measures taken to implement each of the obligations of the Convention. For each Contracting Party the report shall also address its:

(i) spent fuel management policy;

(ii) spent fuel management practices;

(iii) radioactive waste management policy;

(iv) radioactive waste management practices;

(v) criteria used to define and categorise radioactive waste.

(i) Spent Fuel Management Policy

In 1996, the Slovenian Government adopted the Strategy for Long-Term Spent Fuel Management, which was later superseded by the Resolution on the 2006–2015 National Programme for Managing Radioactive Waste and Spent Nuclear Fuel, adopted by the Slovenian Parliament in February 2006. The National Programme from 2006 duly implements the relevant provisions of the Agreement with Croatia.

On the basis of the Agreement, the Republic of Slovenia and the Republic of Croatia jointly prepared and approved a Programme for Decommissioning of the Krško NPP and Disposal of LILW and High-Level Waste (hereinafter the Decommissioning Programme) in 2004. In accordance with requirements from the Agreement, a new revision of the document should be adopted every five years.

In its long-term strategy for spent fuel management The Decommissioning Programme from 2004 foresees spent fuel storage in dry casks. Spent fuel will be moved from pool to dry storage between 2024 and 2030 and will be stored in casks until 2065, when a deep geological repository is assured. The operational phase of the spent fuel repository will end in 2070 and the repository should be closed in 2075. In the event of an export option, the removal of spent fuel from dry storage is planned for between 2066 and 2070.

According to the Decommissioning Programme, for all domestic scenarios disposal in deep geological formations is considered as safe long-term solution for spent fuel and high-level waste. In preparing the evaluation, the Swedish concept was used as a guideline.

The basic characteristics of the concept are:

- Direct disposal of spent fuel in appropriate canisters, with capacity for 1,600 fuel elements or 620 metric tons of metallic uranium and a small additional volume of high-level waste (~16 m^3).
- The following phases are studied and evaluated: research and development, including site selection and characterisation, design and construction, operation, and closure.

As an alternative to disposal in a deep geological formation either in Slovenia or in Croatia, the option of export and disposal of spent nuclear fuel in a third country was also considered.

Within final disposal options, the ARAO participates at the EU level in two programmes which address the possibility of building a multinational/regional repository for spent fuel and high-level waste (ERDO-WG and IGD-TP).

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

The Resolution on the 2006–2015 National Programme for Managing Radioactive Waste and Spent Nuclear Fuel will be changed to take into account the results of stress tests and all the various solutions, which should include the options of long-term storage (100 years) and different options for fuel reprocessing and final disposal in a geological repository (national, regional and multinational). It will be also harmonized with the feasibility study for LILW repository.

(ii) Spent Fuel Management Practices

The Republic of Slovenia has no facilities for off-site management of spent fuel. The spent fuel that is generated by the Krško NPP and the IJS Reactor Infrastructure Centre (TRIGA Mark II research reactor) is managed in wet storage facilities that are an integrated part of these nuclear facilities.

Krško NPP

Spent fuel is stored in the spent fuel pool inside the Fuel Handling Building of the Krško NPP. In 2003, a project of increasing the storing capacity of the spent fuel pool (reracking) was completed. After the reracking, 1,694 storage locations were available for spent fuel. Following the accident at Fukushima in 2011, more restrictive requirements were implemented for safe storage of nuclear fuel in the spent fuel pool under potential beyond design bases accidents. Due to these requirements the storage capacity of the spent fuel pool was estimated to be sufficient for operation until 2018. By the end of 2013, 1,096 locations were occupied with nuclear fuel.

Following the reracking, the spent fuel racks are now of two types. The old racks are designed without neutron poison control. These racks provide 621 cells (6 × 72, plus 3 × 63 cells), and constitute a storage capacity for spent fuel plus one full core for emergency unload. The new racks are designed with neutron poison control and comprise nine modules providing 1,073 usable cells.

The spent fuel racks are designed to withstand shipping, handling, normal operating loads (impact and dead loads of fuel assemblies), and Safe Shut-down Earthquake and Operating Base Earthquake seismic loads meeting Seismic Category I and American Institute of Steel Construction requirements.

Technical characteristics of the spent fuel pool

The spent fuel pool structure is made of reinforced concrete. The walls and floor of the pool are covered with a stainless steel liner. Underneath the liner plates there is a system of embedded leak collection channels. A spent fuel pool leak detection system is provided to monitor the integrity of the liner of the spent fuel pool, the fuel transfer canal and the cask loading area.

Removable gates are provided in the spent fuel pool to allow submerged transfer of fuel assemblies between the spent fuel pool and the transfer canal or the cask loading area. When the gates are in place, the canal and the cask loading area may be drained.

The spent fuel pool cooling and cleanup system is designed to remove the decay heat generated by the spent fuel assemblies stored in the spent fuel pool and to maintain the cooling water at the desired temperature, level, clarity and chemical specifications. The cooling system consists of two redundant pumps and three heat exchangers with associated piping, valves and instrumentation. The third heat exchanger was installed in April 2002 in the framework of spent fuel pool reracking.

The water purification system with spent fuel pool demineraliser and filter is designed to provide adequate purification in order to permit unrestricted access of the plant personnel to the spent fuel storage area and to maintain optical clarity of the spent fuel cooling water. Water surface clarity is maintained by the operation of the spent fuel skimmer system.

System piping is arranged in such a way that failure of any pipeline cannot drain the spent fuel pool below the water level required for radiation shielding. A depth of approximately 3.05 m of water over the top of the stored spent fuel assemblies is required to limit direct radiation to 0.025 mSv/h.

Whenever a fuel assembly with defective cladding is removed from the reactor core, a small quantity of fission products may enter the spent fuel cooling water. The provided purification loop removes fission products and other contaminants from the water. By maintaining radioactivity concentrations in the spent fuel cooling water at 18.4×10^4 Bq/cm^3 (β and γ radiation) or less, the dose at the water surface is 0.025 mSv/h or less, thus allowing unrestricted access for the plant personnel.

Criticality analysis for spent fuel pit racks was performed as a design basis criterion. For the old racks calculations were performed for an infinite array of cells with a spacing of 296.42 mm by 304.80 mm to verify that the configuration is critically safe. For the new racks criticality safety is assured by geometrically safe configuration, the use of a borated stainless steel absorber sheet and a procedure to verify that the reactivity equivalence curve is met.

Fuel management Strategy

All the spent fuel is stored in the spent fuel pool. To minimise the amount of spent fuel and reduce fuel costs, the Krško NPP is extending the burnup of fuel elements. The average spent fuel burnup in the spent fuel pool is 39.1 GWD/MTU, while the last three spent fuel regions had an average burnup of 52.0 GWD/MTU. The Low Leakage Loading Pattern was introduced in the design several years ago. Using this type of design achieved an additional reduction of spent fuel production.

IJS Reactor Infrastructure Centre

The two spent fuel pools are part of the TRIGA Mark II research reactor. The first spent fuel pool was constructed with the reactor in 1966 and is no longer in use. The second one was constructed in 1992. Its capacity is 195 spent fuel elements and it is located in the basement of the reactor building. It is accessible by crane through the cover in the reactor hall floor. The pool is 3.5 m deep and is lined with stainless steel sheets. It is equipped with an on-line water radioactivity monitor.

Both pools have been empty since 1999, when all spent fuel elements (a total of 219) were shipped to the USA. The new pool is maintained as operational and prepared for immediate use if necessary.

In 2007, 10 fresh fuel elements were transferred to the French company AREVA and shipped to France. The total number of the remaining fuel elements (irradiated and fresh) at the reactor is 84.

A detailed criticality analysis of the spent fuel racks design was performed. Heat removal is not applicable for the TRIGA Mark II research reactor fuel. A safety analysis of accidents involving spent fuel during normal operation and fuel handling was performed and is included in the Safety Analysis Report.

(iii) Radioactive Waste Management Policy

The Resolution on the 2006–2015 National Programme for Managing Radioactive Waste and Spent Nuclear Fuel (the Programme), is one of the key documents in the field of radioactive waste management and is prepared in accordance with the Ionising Radiation Protection and Nuclear Safety Act (the 2002 Act). In the Programme, LILW management is treated as an integral process, covering all stages from waste generation to waste disposal. Various current and near-future radioactive waste streams are taken into account, considering both present and planned waste management practices. Besides radioactive waste from the Krško NPP, other small producers (from medicine, industry and research) and other activities involving radioactive waste (the uranium mine under decommissioning, TENORM, decommissioning of reactors, etc.) are also described. The Programme includes an analysis of measures for the minimisation of radioactive waste production and its treatment and conditioning before disposal. The siting and the construction of a repository for short-lived LILW is one of the principal goals of LILW management in Slovenia. The limited storage capacities at nuclear facilities call for decisions to be taken and practical solutions to be found.

A significant step forward in solving this problem was made by the selection and approval of the site for LILW disposal in 2009. The Vrbina site in the municipality of Krško has been adopted by the Government decree on the national spatial plan.

Responsibility in the area of LILW management is clearly defined. Three independent parties – the producers of radioactive waste, the SNSA as the regulatory body and the ARAO as implementer of the public service for radioactive waste management – are involved in the process of radioactive waste management. The operators of nuclear and other radiation facilities are responsible for radioactive waste management at their facilities. The ARAO has responsibility for collecting, transporting, treating, storing and disposing of institutional LILW. The ARAO also has responsibility for disposal of all radioactive waste coming from electricity production and long-term monitoring and maintenance of disposal facilities for waste from uranium mining and milling. All activities are made transparent to the public through annual reports, via the Internet and from outreach activities. Special attention is devoted to communication with and the participation in decision-making of the public in the local municipalities with nuclear facilities and in the area selected for the LILW repository site and non-governmental organisations.

(iv) Radioactive Waste Management Practices

Within the scope of the Convention, the Central Storage Facility for Radioactive Waste in Brinje, the Boršt mill tailings site and the Jazbec mine waste pile at the Žirovski vrh Uranium Mine are the only radioactive waste management facilities in the Republic of Slovenia. The LILW that is generated by the operation of the Krško NPP is managed and stored at the Krško NPP site, while the waste produced by the operation of small producers (the IJS Reactor Infrastructure Centre and in industry, research and medicine) is managed in the Central Storage Facility for Radioactive Waste in Brinje.

Central Storage Facility for Radioactive Waste in Brinje

Institutional radioactive waste is stored in the Central Storage Facility, situated in Brinje near Ljubljana. The facility is operated by the ARAO.

The ARAO holds a licence to carry out a radiation practice. The licence to carry out the radiation practice includes the following activities:

- Collection of radioactive waste at waste producers' premises;
- Collection of radioactive waste on-site in the event of accidents;
- Collection of radioactive waste in cases where the waste producer is unknown;
- Dismantling of sealed sources at producers' premises (less complex sources);
- The use of radioactive sources for calibration and testing of measuring devices;
- The treatment and conditioning of radioactive waste in a hot cell facility for the purposes of storage; and
- The transport of radioactive materials and transportation of nuclear materials as a part of public service.

The ARAO has a Radioactive Waste Management Programme. The programme is an operational document for radwaste management valid for two years. It contains information on the organisation of activities and methods of carrying out activities, recording and reporting, definitions of responsible services and persons, information on documents forming the basis for carrying out activities, information on packaging, information on radioactive waste, management procedures and methods, measures to minimize radioactive waste generation, clearance and capacities in place, and consideration of interdependencies between all stages of management and alignment of the management procedures with operative programmes under the national programme of radioactive waste management.

The waste inventory in the Central Storage Facility for Radioactive Waste has been characterised, treated and conditioned. The ARAO has been performing treatment and conditioning of radioactive waste as a regular activity at a nearby processing facility (a hot cell facility) since 2012. ARAO staff carry out waste sorting, characterisation and compressing, dismantling of unused ionising smoke detectors, and solidification of liquid radioactive waste. It is planned to implement dismantling of other sealed sources in the next two years.

During the development of the WAC for storing the institutional radioactive waste in the Central Storage Facility, the ARAO considered the generic WAC for the planned LILW repository, the IAEA TECDOCs, Safety Standards, Safety Standards Series, Slovenian legislation and operators' practices. The WAC for the storage facility will be revised when the WAC for the repository is approved.

A series of new documents related to the facility and revisions of existing documents has been produced in last three years, including nuclear and radiation safety training programme for staff, a facility decommissioning plan, a radioactive waste management programme, a physical protection plan, documents on working procedures and manuals. Changes in the legislation in the field of physical protection of nuclear facilities came into force in 2013. The revision of some physical protection measures was planned in 2014 and the first part of the changes was already implemented in 2013. In 2013, the ARAO started with a new revision of the safety case for the storage facility. This is planned to be finished in 2014. The new revision is required because of changes in the facility and new IAEA GSG - 3 requirements.

Žirovski vrh Uranium Mine

There are two permanent disposal sites for mining and milling waste: the Jazbec mine waste pile and the Boršt mill tailings site. All temporary mine waste disposal piles in the area were relocated to the Jazbec mine waste pile.

The general goal of the site remediation project was to minimise, to the lowest reasonable level, radiological and chemical long-term impacts on the environment. The major objective was decontamination of the sites, buildings, structures and equipment, so that the facilities and the land can be reused or opened for the public.

In the course of remediation of the mine, parts of the galleries have been backfilled with mine waste. All entrances into the mine have been sealed. Institutional control of mine water discharges is assured.

The ore processing area and buildings have been decontaminated or demolished. Following site remediation, the ore processing area has been in free public use. Contaminated waste materials (scrap metal, plastics and building debris) were disposed of either into the mine or onto the Jazbec mine waste pile. No regular monitoring is needed at the mill site.

At the Jazbec mine waste pile, there are 1,862,425 tons of mine waste, uranium ore, contaminated soil and building debris with average concentration 69 g U_3O_8/t and 48,000 tons of red mud from raffinate neutralisation, with a specific activity 65 kBq ^{230}Th/kg. The area of Jazbec is 67,325 m^2. To divert background and underground water into the culvert, polyethylene, steel and concrete pipelines have been built. Through the remedial action the deposited mining debris and the Jazbec mine waste pile were isolated from rainfall waters with a multilayer cover to prevent or reduce contaminants dissolution and radon exhalation. The underground culvert was repaired to assure long-term stability, and intake of the surface hinterland water into the culvert was prevented. All other mine waste, contaminated soil and rubble from mine objects was removed and disposed of at the site by 2006. Remedial actions were completed in 2008. The radon exhalation rate from the waste pile surface was 1 Bq/m^{2}s before the remediation, while following the completed remediation the exhalation is $<$ 0.05 Bq/m^{2}s. Institutional monitoring of seepage water, ground water level, air and object surface and stability control will be needed in the future.

The Boršt mill tailings site is situated on a hillside, 535–565 m above sea level. During the short operational life of the site approximately 610,000 tons of mill tailings and 73,000 tons of mine waste were deposited there. In 2004, an additional 38,000 tons of mine waste was transported to Boršt. During 2008 and 2009, 9,450 tons of contaminated materials from decontamination of auxiliary objects were deposited at Boršt. The total mass of deposited materials is 730,450 tons. The area of Boršt is 42,000 m^2. The mill tailing materials are sands and slimes under 28 mesh (0.5 mm). The average activity of ^{226}Ra is 8,600 Bq/kg.

Realisation of Boršt remediation is complicated due to reactivation of a landslide of the base of the tailings site. The current rate of movement is approximately 3 cm per year. An expert group concluded that the probability of collapse of the slope is negligible, but proposed investigation of the landslide by way of drill holes. It is planned that additional measures will be implemented to stabilise the base rock sliding under the Boršt mill tailings pile.

The current arrangement of the mill tailings assures protection against background waters, prevention of the spread of soluble components into underground and surface waters, reduction of radon exhalation and prevention of erosion by rainfall. The multilayer cover of total thickness 2.05 m is composed of a drainage layer (mine waste and crushed stone), compacted clay (the sealing layer), local material (the protecting layer) and grassed topsoil. Remediation of the Boršt mill tailings started in 2007 and was completed in 2010. The radon exhalation rate from the mill tailings surface before the arrangement was 1 – 5 Bq/m^2s, and after final arrangement is less than 0.1 Bq/m^2s. Institutional monitoring of seepage water, ground water, ground water level, air, surface integrity and stability will be needed in the future.

All other surfaces in the mining area affected by uranium production have been decontaminated and will be returned to unconditional land use.

Krško NPP

The Krško NPP has its own Radioactive Waste Management Programme, supplemented by a technical report. The Programme is revised and updated at least every two years. The Krško NPP considers this document a valuable source of input for future decision-making and long-term planning in the area of operational radioactive waste management. Waste generation rates are predicted, based on the present situation and future options. The available storage capacity for radioactive waste at the Krško NPP is assessed by extrapolation. In addition, a Radioactive Waste Committee was formed at the Krško NPP as an interdisciplinary team through which communication and transparency in the area of radioactive waste management have been enhanced. Due to slow progress in the siting and construction of the repository for LILW, the storage capacities at the NPP are almost exhausted. The NPP is planning to assure additional storage capacity in the waste preconditioning area of the storage building. The entrance area of the storage building will be adjusted for preconditioning of waste.

Radioactive waste treatment and conditioning

During the operation of the Krško NPP, various radioactive substances in liquid, gaseous and solid form are generated. Radioactive substances are collected, segregated and processed to obtain a final form for storing in the plant's radioactive waste storage locations. Depending on the processing method, radioactive substances are collected and segregated. These radioactive substances are processed in a system for radioactive waste treatment. The system is constructed for collecting, processing, storing and packaging of waste in a suitable form to minimise releases into the environment. Three fundamental systems are used for radioactive waste management, i.e. systems for liquid, solid and gaseous radioactive waste.

The plant is provided with a **Gaseous Waste Processing System** consisting of two parallel closed loops with compressors and catalytic hydrogen recombiners and of six decay tanks for compressed fission gases. Four of the tanks are used during normal plant operation, while the remaining two are used during the reactor shut-down. The capacity of the tanks is adequate for more than one month's gaseous waste hold-up. Within this period, the majority of the short-lived fission gases decay, while the remaining gases are released into the atmosphere under favourable meteorological conditions. Automatic radiation monitors in the ventilation duct prevent uncontrolled release when radioactive gas concentration exceeds the permissible level.

Liquid radioactive waste, arising from all sources during the operation of the Krško NPP, is processed by the **Liquid Waste Processing System** consisting of tanks, pumps, filters, evaporators and two demineralisers. The system is designed to collect, segregate, process, recycle and discharge liquid radioactive waste. The system design considers the potential exposure of personnel and assures that the quantity of radioactivity released into the environment is as low as reasonably achievable.

All solid radioactive waste generated during plant operation, maintenance activities and servicing is collected in the Solid Radioactive Storage Facility. Used spent resins, evaporator concentrates (boric acid), used filters and other contaminated solid waste such as paper, towels, working clothes, laboratory equipment and various tools, form most of the solid waste. Compressible solid waste is compressed and encapsulated in standard-size 208 l drums, while dried evaporator concentrate and sludges and dried spent resin are stored in stainless steel drums. These drums are presently stored in the Solid Radwaste Storage Facility within the plant area.

Radioactive waste volume reduction programme

Numerous programme improvements, design changes and work practice improvements have been pursued at the Krško NPP to decrease the generation rate of radioactive waste of various types. With the introduction of the 18-month fuel cycle, the generation of radioactive waste was additionally reduced.

Segregation techniques are used for collecting non-contaminated materials separately, which allows waste streams to be processed separately. Metal materials exceeding exemption/clearance levels, are stored onsite before melting. To reduce the volume of solid radioactive waste to be stored, supercompaction campaigns are carried out.

The original Westinghouse procedure for evaporator bottoms and spent resin treatment was replaced with a system of treatment of these types of waste called the In-drum Drying System. The drying process converts the accumulated wet spent resins into a dry, free-flowing bead resin condition. The dried primary resins are filled directly into 200 l stainless steel heavy drums with biological shields (150 l of usable volume). Dried secondary spent resins are filled into 200 l stainless steel drums without biological shields. The drying and volume reduction process for evaporator bottoms and sludges converts the concentrate into dry solid waste products with low residual moisture and no free water. The Krško NPP is using an external service for the incineration of combustible waste and melting of radioactive metallic waste material.

The risks associated with radioactive waste management are kept reasonably low. Different types of waste are segregated in an early collecting phase and stored separately to avoid chemical interactions. Tube-type containers are used as an overpack for the storage of standard 200 l drums and products for supercompaction in the plant radioactive waste storage facility. Any new type of radioactive waste resulting from a new technology being used is evaluated and incorporated into the Safety Analysis Report.

Safety Review

According to the findings of the first Periodic Safety Review (2003), the Krško NPP radioactive waste storage operation is appropriate. In the original project, the radioactive waste storage was designed as five-year interim storage. Since then, though, some design changes have been conducted to increase storage capacity, including improved packaging, and consequently the storage period has been extended. Due to the prolonged storage, a plant packaging inspection programme has been established to monitor container integrity.

The 2nd Krško NPP Periodic Safety Review phase was completed on 15 December 2013. The programme of radioactive waste management has been reviewed, including the evaluation of the design basis for the durability and integrity of waste packages. Periodic safety review has shown that the durability and integrity of radioactive waste packages are within acceptable levels.

Small Producers of Radioactive Waste in the Republic of Slovenia

Management of institutional radioactive waste (from medical and industrial applications and research activities) was delegated as a public service to the public utility, i.e. to the waste management agency ARAO. This includes the collection of waste at the producers' premises, transport of waste, treatment and conditioning, storage and disposal of waste. The ARAO is also responsible for the management of radioactive waste in the event of industrial accidents and of historical waste.

- **Jožef Stefan Institute Reactor Infrastructure Centre**

During the lifetime of the TRIGA Mark II research reactor, only a small amount of solid radioactive waste has been produced (approximately 50 litres per year). This waste consists mainly of contaminated material and equipment (paper, plastics, glassware, etc.) and contaminated mechanical and chemical filters (e.g. ion exchange resins). Spent resins are collected in drums. The activity content is estimated to be less than 1 GBq/m^3. The waste is transferred to the Central Storage Facility for Radioactive Waste in Brinje.

The reactor does not directly produce any radioactive liquid waste. However, during the chemical treatment of irradiated samples in adjacent research laboratories, some radioactive liquids are produced. This liquid waste is collected and further conditioned. Waste water containing radionuclides is collected in a special 20 m^3 decay tank. After measuring the isotope concentration and activity, the liquids are released to the River Sava when they reach the prescribed limits.

No gaseous radioactive waste that needs further treatment and storing is produced. Radioactive gases produced due to normal reactor operation (mainly argon) are released through controlled atmospheric release venting.

- **Radioactive Waste Management in Industry and Research**

Radioactive sources are widely used in industry and research. There are a number of industrial applications, for example in industrial radiography, thickness, level and density gauges, moisture detectors, eliminators of static electricity, and lightning conductors, etc. In the Republic of Slovenia, 82 industrial and research organisations were using 770 sealed sources as of the end of 2013. Spent and disused radioactive sources were either returned to the suppliers or shipped to the Central Storage Facility for Radioactive Waste in Brinje.

Requirements for the use and storage of disused radioactive sources and waste are set out in the 2002 Act (Articles 9–16). For the conduct of radiation practices it is necessary to obtain a licence. An applicant shall submit a plan for the use and storage of the radiation source as well as a plan for the handling of radioactive waste resulting from the radiation practice.

During the decontamination and decommissioning of buildings at the Reactor Infrastructure Centre of the Jožef Stefan Institute used for the processing of uranium ore, which took place from 2005 until 2007, as many as 31 drums of waste contaminated with naturally occurring radioactive material (NORM) were produced. Part of this material (12 drums) was transferred to the Central Storage Facility in February 2010. In accordance with the SNSA's decision, the Institute sent part of the material, i.e. 12 drums of contaminated construction material and soil, which were conditionally cleared, to a municipal landfill in June 2011. Since it is not allowed to dispose of metal items or wood at any municipal landfill, the remaining 7 drums are still temporarily stored at the location of the Reactor Centre in Brinje.

- **Radioactive Waste Management in Medicine**

In the Republic of Slovenia unsealed radioactive sources (radiopharmaceuticals) for diagnosis and therapy are used in seven clinics or hospitals. The main users are the Institute of Oncology and the Ljubljana University Medical Centre's Department for Nuclear Medicine. There is no production of radiopharmaceuticals in the Republic of Slovenia.

The Institute of Oncology imported (among other sources) 0.61 TBq of ^{131}I and the Ljubljana University Medical Centre's Department for Nuclear Medicine imported 0.37 TBq of ^{131}I in 2013. All other users together imported 0.1 TBq of ^{131}I in the same year. The Institute of Oncology uses decay storage tanks in order to control releases of radioactive effluents. The Ljubljana University Medical Centre's Department for Nuclear Medicine releases the effluents directly into sewerage systems. Patients from other hospitals are not hospitalised. It is estimated that less than 0.3 TBq of ^{131}I is released annually into the environment.

The short-lived radioactive waste (residues contaminated with ^{131}I, ^{123}I, ^{125}I, ^{99m}Tc, ^{99}Mo, ^{201}Tl, ^{177}Lu, ^{90}Y, ^{111}In or ^{67}Ga) which is produced during medical practice is stored locally at the users' locations. After decay, the material is transferred to the municipal disposal sites. In 2010, the Ljubljana municipal waste disposal site was equipped with a portal radiation monitor, which raised the alarm on several occasions. It was determined that certain short-lived radioisotopes from medical practices had not decayed below clearance levels before being transferred to the disposal site. Corrective measures and procedures were later agreed on and implemented.

Other small amounts of solid radioactive waste, mainly containing ^{57}Co, ^{137}Cs and ^{106}Ru (in total less than 1 GBq) are temporarily stored at local sites and periodically transported to the Central Storage Facility for radioactive waste in Brinje.

(v) Criteria used to define and categorise radioactive waste

The Regulation on Radioactive Waste Management and Classification of Radioactive Wastes takes into account, with some modifications, the radioactive waste categorisation system recommended in the "EC Recommendation on a Classification System for Solid Radioactive Waste" (OJ L 265, 13 October 1999, p. 37).

The provisions of this regulation apply to substances in gaseous, liquid or solid form; they apply to objects or equipment containing radioactive substances or being so contaminated that they exceed clearance levels, if generated as waste from radiation practices or from intervention measures, if their holder intends or has to discard them since their further use is not foreseen, or if the holder does not have a licence for their use in accordance with the regulations on protection against ionising radiation.

With regard to their aggregation state, radioactive waste is divided into solid, liquid and gaseous waste.

With regard to the level and type of radioactivity, the solid radioactive wastes are categorised as follows:

1. transitional radioactive waste;
2. very low-level radioactive waste, for which the competent regulatory body for nuclear and radiation safety may approve conditional clearance;
3. low- and intermediate-level radioactive waste (LILW), with insignificant heat generation, which is classified into two groups:
   - 3.1 short-lived LILW, containing radionuclides with a half-life shorter than 30 years and specific activity of alpha emitters equal to or lower than 4,000 Bq/g for an individual package, but on average not higher than 400 Bq/g in the overall amount of LILW;
   - 3.2 long-lived LILW, where the specific activity of alpha emitters exceeds the limitations for short-lived LILW;
4. high-level radioactive waste, which contains radionuclides whose decay generates such an amount of heat that this has to be considered in its management;
5. radioactive waste containing naturally occurring radionuclides that are produced in the processing of nuclear mineral materials or other industrial processes and are not sealed sources of radiation in accordance with the regulations on the use of radioactive sources and radiation practices.

The Decree on Activities Involving Radiation defines the conditional and unconditional clearance of radioactive material as follows: "The competent ministry may approve the clearance of radioactive substances or radiation sources, provided that there is no possibility that after such clearance the radioactive substance or radiation source causes a collective dose higher than 1 manSv per year, nor that the effective dose received by any member of the public exceeds 10 μSv per year".

The regulatory control of radioactive substances can be terminated without a prior decision of the competent ministry if the specific activity of radionuclides in substances does not exceed the values set in Table 3 of the Decree on Activities Involving Radiation (clearance levels).

SECTION C: SCOPE OF APPLICATION

Article 3: Scope of Application

1. *This Convention shall apply to the safety of spent fuel management when the spent fuel results from the operation of civilian nuclear reactors. Spent fuel held at reprocessing facilities as part of a reprocessing activity is not covered in the scope of this Convention unless the Contracting Party declares reprocessing to be part of spent fuel management.*
2. *This Convention shall also apply to the safety of radioactive waste management when the radioactive waste results from civilian applications. However, this Convention shall not apply to waste that contains only naturally occurring radioactive materials and that does not originate from the nuclear fuel cycle, unless it constitutes a disused sealed source or it is declared as radioactive waste for the purposes of this Convention by the Contracting Party.*
3. *This Convention shall not apply to the safety of management of spent fuel or radioactive waste within military or defence programmes, unless declared as spent fuel or radioactive waste for the purposes of this Convention by the Contracting Party. However, this Convention shall apply to the safety of management of spent fuel and radioactive waste from military or defence programmes if and when such materials are transferred permanently to and managed within exclusively civilian programmes.*
4. *This Convention shall also apply to discharges as provided for in Articles 4, 7, 11, 14, 24 and 26.*

The Convention applies to the safety of spent fuel management in the Krško NPP and in the IJS Reactor Infrastructure Centre. No spent fuel reprocessing is foreseen.

It also applies to the safety of the operational waste from the Krško NPP, of the mining, milling and decommissioning waste from the Žirovski vrh Uranium Mine and of the waste from small non-power applications which are stored in the Central Storage Facility for Radioactive Waste in Brinje.

The 2002 Act does not stipulate any special legal provision for the spent fuel or radioactive waste that results from military or defence programmes. Therefore the same legal provisions are applicable to such waste. However, it should be noted that there is practically no radioactive waste from the defence programme of the Republic of Slovenia.

SECTION D: INVENTORIES AND LISTS

Article 32, Paragraph 2: Reporting

This report shall also include:

(i) a list of the spent fuel management facilities subject to this Convention, their location, main purpose and essential features;

(ii) an inventory of spent fuel that is subject to this Convention and that is being held in storage and of that which has been disposed of. This inventory shall contain a description of the material and, if available, give information on its mass and its total activity;

(iii) a list of the radioactive waste management facilities subject to this Convention, their location, main purpose and essential features;

(iv) an inventory of radioactive waste that is subject to this Convention that:

(a) is being held in storage at radioactive waste management and nuclear fuel cycle facilities;

(b) has been disposed of; or

(c) has resulted from past practices.

This inventory shall contain a description of the material and other appropriate information available, such as volume or mass, activity and specific radionuclides;

(v) a list of nuclear facilities in the process of being decommissioned and the status of decommissioning activities at those facilities.

(i) List of Spent Fuel Management Facilities

The Republic of Slovenia has no off-site spent fuel management facilities. The spent fuel that is generated by the operation of the Krško NPP and the IJS Reactor Infrastructure Centre (TRIGA Mark II research reactor) is managed in storage facilities which are integral parts of these nuclear facilities.

(ii) Inventory of Spent Fuel

Krško NPP

The Fuel Handling Building is a part of the Krško NPP. It is operated under the plant's licence and is therefore not considered an independent nuclear facility. The Fuel Handling Building consists of a spent fuel pool and the fuel handling system.

There were 859 spent nuclear fuel units in the spent fuel pool at the end of 2013. The fuel batches of the spent fuel assemblies with corresponding region numbers are listed in Section L, Annex d. These fuel assemblies will probably never return to the core unless emergency core loading has to be performed.

There are seven types of fuel stored in the Krško NPP's spent fuel pool:

- All Westinghouse standard type fuel assemblies, including Siemens KWU fuel, are considered spent. Fuel batches No. 1 to No. 8B are standard fuel type.
- Vantage 5 fuel type, including fuel batches No. 15 and No. 15B, is spent.
- There are two leaking Vantage 5 fuel assemblies with very low burnup. These two assemblies, along with several other leaking fuel assemblies, can potentially be repaired and reused in future cycles. Therefore they are excluded from the spent fuel.
- Fuel assemblies (FAs) potentially susceptible to Top Nozzle Separation (FAs, with 304L sleeves that are welded to the top nozzle) – fuel batches No. 9 to 18 (altogether the susceptible fuel batches are from No. 1 to 18).
- Fuel assemblies from fuel batches No. 19, 20, 21, 22A, 22B, 23B, 24B, 25B and 26B with either:

- average burnup higher than 50 GWD/MTU or
- declared as spent nuclear fuel under a previous declaration.

- The Fuel Rod Storage Basket (FRSB), containing single fuel rods from repaired fuel assemblies, and
- The Strainer Basket for Fuel Rods (SBFR), containing fuel rod segments, is also considered as spent fuel.

IJS Reactor Infrastructure Centre

There are two interim storage pools which are part of the IJS Reactor Infrastructure Centre. The old storage pool is not in use. The newer storage pool is maintained in operational condition and prepared for immediate use if necessary. Both pools have been empty since 1999, when all spent fuel elements (a total of 219) were shipped to the USA for final disposal.

(iii) List of the Radioactive Waste Management Facilities

The Central Storage Facility for Radioactive Waste in Brinje, the Boršt mill tailings site and the Jazbec mine waste pile at the Žirovski vrh Uranium Mine are the only radioactive waste management facilities in the Republic of Slovenia pursuant to the Convention. The operational waste from the Krško NPP is managed and stored in storages under an operating licence for the Krško NPP.

Central Storage Facility for Radioactive Waste in Brinje

The storage facility is a near-surface concrete building with its roof covered with layer of soil. The building is subdivided by concrete walls into nine storage sections and an entrance area. The ground plan of the facility is 10.6 m × 25.7 m and its height is 3.6 m. A small area is intended as a checkpoint between the radiological controlled and supervised area, the area for loading and unloading waste and for internal transport. The storage section at the back of the building is deeper relative to the level of the other sections.

The facility is equipped with a ventilation system for reducing radon concentration and air contamination in the storage facility. To obtain relatively low and constant humidity, it is equipped with an air drying system. The water and sewage collecting system is designed as a closed system to retain all liquids from the storage facility in the sump. Liquids are discharged after measurements of radioactive contamination show that this is below the regulatory limit. The electricity supply system is used for lighting the storage facility and for ventilation. The storage facility is physically and technically protected against fire, acts of violence, burglary, sabotage and so forth.

Jazbec Mine Waste Pile at the Žirovski vrh Uranium Mine

The Jazbec mine waste pile is located on the north-eastern slope of the hill Žirovski vrh at an altitude above 427 metres. The pile area was reshaped and was covered with a final 1.95-m-thick layer. A detailed inventory of the Jazbec mine waste pile is provided in Table 10. The design of remediation and the safety analysis report on final remediation of the Jazbec mine waste pile were realised in 2004. The remediation was completed in 2008. Since September 2013 the Jazbec mine waste pile has been a national infrastructure facility.

Boršt Mill Tailings Site at the Žirovski vrh Uranium Mine

The Boršt mill tailings site is located on the north-western slope of the Boršt hill at an altitude above 535 metres. The waste inventory is provided in Table 11. During the operation and construction of the Boršt mill tailings site, some mine waste was used to consolidate the surfaces used for mill tailings transportation. In the remediation process the slopes were minimised and a rock support scarp was constructed at the head of the mill tailing. The surfaces were covered by a 0.5 m-thick-layer of mining waste overlaid by various soil layers with total thickness of 2.05 m, thus with a total of 2.55 m.

In 1991, a few months after a heavy rainfall, a landslide beneath the deposited mill tailings was activated. About 4.5×10^6 m^3 of the hillside became unstable and sliding started at a rate of about 0.5 to 1.0 mm per day. The main reason for the landslide was probably the extremely high groundwater level. In 1994 and 1995 a drainage tunnel of nearly 600 metres in length was constructed together with vertical drainage wells. Consequently the slide stopped in 1995.

The design of remediation and the safety analysis report on final remediation were approved in 2005. The remediation was completed in 2010. In 2008, during intensive work on the implementation of the final arrangement of the mill tailings, the landslide was reactivated. An expert team was set up to assess the situation and to propose mitigation measures. The team concluded that the probability of a sudden collapse of the landslide was negligible, but proposed investigation of the incoming water using drill holes. The final decision on how the repository will be closed has not yet been adopted. It is planned that additional measures will be implemented to stabilise the base rock under the Boršt mill tailings pile. Decision will be made on the basis of studies which will show what kind of radiological risk exists.

Krško NPP

The Krško NPP includes the following buildings for radioactive waste management:

The Auxiliary Building, where the systems for solid, liquid and gaseous waste processing are located. The building is located adjacent to the Fuel Handling Building and the Reactor Building within the Radiologically Controlled Area. Appropriate monitoring and radiological control is provided during all stages of radioactive waste processing. The main activities related to waste management in this building are pre-treatment (waste collection, segregation, chemical adjustment, decontamination), treatment (radionuclide removal, volume reduction) and conditioning (drying, immobilisation, packaging). The conditioned waste is transported to the Solid Radwaste Storage Facility by forklift or an electric-powered cart (using a special shield when necessary).

The Solid Radwaste Storage Facility, an interim storage, originally built as a 5-year storage. Its operating licence was extended in 1988 due to the lack of an LILW repository. It is a reinforced concrete structure, seismically designed, located adjacent to the Auxiliary Building. The total area is 1,470 m^2; following an area optimisation project, applying a special steel structure to support the storage of waste on the second level, the useful volume was increased to allow waste storage for a longer period of time. The storage time in the Solid Radwaste Storage Facility is variable and is dependent on waste generation rates and waste management plans. The inner area is divided into 6 fields by 60-cm-thick interior concrete walls; the exterior walls and the ceiling are 100 cm thick, providing appropriate insulation and radiological shielding. The facility has provisions for storing different types of solid radioactive waste separately and retrieving them for further processing (supercompaction, incineration, melting and clearance after decay of the radionuclide) or disposal at a later time. The Storage Facility is equipped with a ventilation system, smoke detectors and a local radiation monitor.

The Decontamination Building, an interim storage, built for decay storage of two old steam generators and radioactive waste produced through the replacement of steam generators and other larger components. It is a seismically designed reinforced concrete structure consisting of the following three areas: the decontamination area, a "mock-up" area and an area for storage of old steam generators. The building meets the requirements for a LILW storage. The outer wall and the roof slab design were governed by radiological shielding requirements.

(iv) Inventory of Radioactive Waste

Central Storage Facility for Radioactive Waste in Brinje

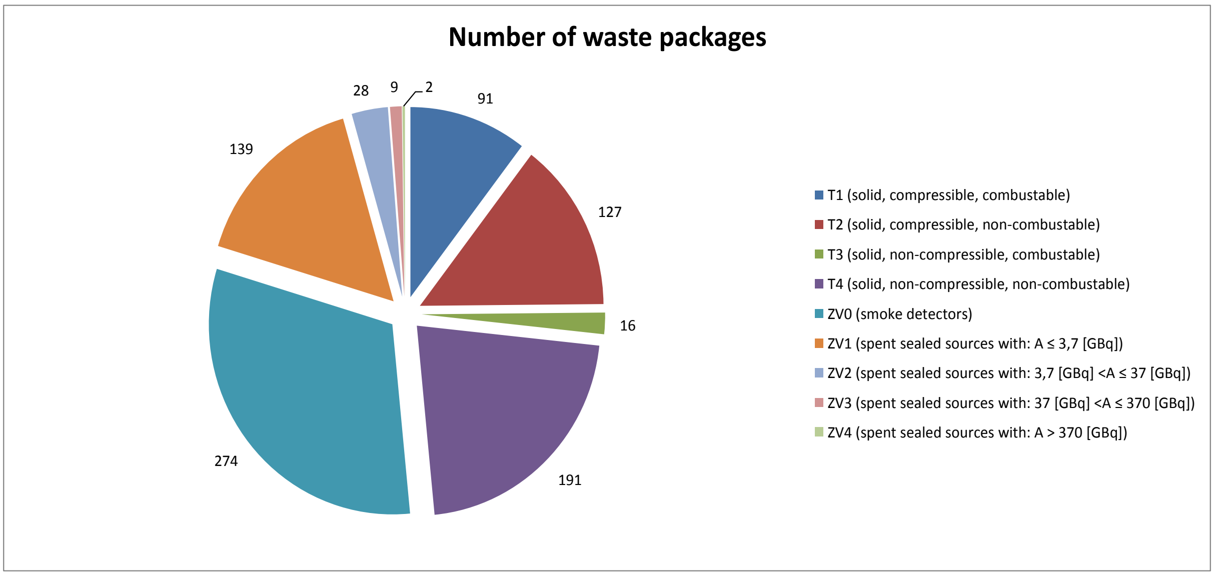
At the end of 2013, 92.4 m^3 of radioactive waste was kept in the storage facility, with a total mass of 50 tons. The storage is already filled to around 80% of its capacity, and consequently the operator is taking steps towards volume reduction. The total volume of waste was reduced in the last years following several campaigns of waste repacking and exemption of emptied and cleared containers. Annually approximately 50 consignments of waste from small producers are received.

The waste forms are:

- solid, compressible, combustible (T1),
- solid, compressible, non-combustible (T2),
- solid, non-compressible, combustible (T3),
- solid, non-compressible, non-combustible (T4),
- smoke detectors (ZV0),
- spent sealed sources with A < 3,7 GBq (ZV1),
- spent sealed sources with 3,7 GBq < A < 37 GBq (ZV2),
- spent sealed sources with 37 GBq < A < 370 GBq (ZV3),
- spent sealed sources with A > 370 GBq (ZV4) and
- mixed waste (M).

Waste is packed in drums, in the original containers for spent sealed sources, in plastic or metal boxes, and in plastic bags.

Figure 2: **Number of waste package types in the Central Storage Facility for Radioactive Waste in Brinje at the end of 2013**



The drums contain mostly contaminated materials such as paper, glass and plastic materials with induced radioactivity caused by neutron exposure in the research reactor. Disused sealed sources are stored in the original shielding containers or are repacked in lead containers placed in the standard drums fitted with concrete shielding.

From 2012 on, the ARAO has been carrying out dismantling of ionising smoke detectors as a regular activity. The reduction factor of this treatment is significant, and despite of the constant arrival of new waste collected at waste producers, the volume of stored radioactive waste in the storage facility has been very slightly increasing.

In 2013, the ARAO collected 202 litres of liquid waste from medical use (the research institute). Prior to their acceptance at the storage facility, this liquid waste was solidified.

The total activity of the waste at the end of 2013 was 3.2 TBq. In the last three years the Central Storage Facility for Radioactive Waste has received approximately 2.5 m^3 of solid radioactive waste annually. The list of radioactive wastes is given in Section L, Annex (e), Table 9.

Jazbec mine waste pile and Boršt mill tailings site

Basic data on mine waste and other debris at the Jazbec and Boršt sites are summarised in Section L, Annex (e), Tables 10 and 11, presenting the situation at the end of 2013.

Krško NPP

See Section L, Annex (e), Tables 6, 7 and 8.

(v) Nuclear Facilities in the Process of Being Decommissioned

There are no nuclear facilities currently being decommissioned. The Žirovski vrh uranium mine, which is a radiation facility in accordance with the definition in the 2002 Act, is the only facility which is in the process of being decommissioned in the Republic of Slovenia.

SECTION E: LEGISLATIVE AND REGULATORY SYSTEM

Article 18: Implementing Measures

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

The legislative, regulatory and administrative measures, and other steps necessary for implementing the obligations of the Republic of Slovenia under the Convention, are discussed in this report.

Article 19: Legislative and Regulatory Framework

1. *Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of spent fuel and radioactive waste management.*
2. *This legislative and regulatory framework shall provide for:*
   - *(i) the establishment of applicable national safety requirements and regulations for radiation safety;*
   - *(ii) a system of licensing of spent fuel and radioactive waste management activities;*
   - *(iii) a system of prohibition of the operation of a spent fuel or radioactive waste management facility without a license;*
   - *(iv) a system of appropriate institutional control, regulatory inspection and documentation and reporting;*
   - *(v) the enforcement of applicable regulations and of the terms of the licenses;*
   - *(vi) a clear allocation of responsibilities of the bodies involved in the different steps of spent fuel and of radioactive waste management.*
3. *When considering whether to regulate radioactive materials as radioactive waste, Contracting Parties shall take due account of the objectives of this Convention.*

1. Legislative and Regulatory Framework

The main law of the Republic of Slovenia in this area is the Ionising Radiation Protection and Nuclear Safety Act (the 2002 Act) which also regulates radioactive waste and spent fuel management. The Act was amended in 2003, 2004 and 2011.

The 2011 amendments were published in the Official Gazette of the Republic of Slovenia, No. 60/2011, on 29 July 2011 and entered into force on 13 August 2011. Most of the provisions of the amendments represent minor editorial corrections. Among the more important substantive developments, the introduction of a requirement of Council Directive 2009/71/Euratom (establishing a Community framework for the nuclear safety of nuclear installations) on competent authorities, self-assessment regarding their own organisation and consistency of national legislation with internationally established standards in the fields covered by the Act and the regulations issued pursuant thereto, and other regulations in the field of peaceful uses of nuclear energy should be mentioned; furthermore, a commitment to the international peer review process of individual areas of radiation protection and nuclear safety is incorporated into the Act. A restriction of the right to strike of certain categories of workers in radiation and/or nuclear facilities (those with duties important to safety) in order to protect the public interest has also been introduced into the Act. The provisions on physical protection have also largely been completed as a result of international commitments and because of the EU directives, where in addition to nuclear material, to some extent even radioactive substances have to be protected. Regarding licences to carry out radiation practices and licences for the use of sources of radiation, some unnecessary duplication of certain requirements were found and removed from the Act. In areas where the Act refers to other laws, such references were updated (i.e. the law on environmental protection, the law on construction, the law on spatial planning, the law on the recognition of professional qualifications and the law on minor offences). Since the Act no longer uses the term "competent ministry", but rather designates in each case the actual competent authority, it is now easier to understand and is not misleading with regard to the competences of various ministries and other government authorities. The amendments also regulate the overtime work, which can be ordered for the staff of competent authorities and the "permanent availability" of inspectors and professional officers, who can act quickly and take appropriate actions in cases of loss or finding an unknown source of radiation, in cases of emergency. The 2011 amendments have not brought any significant changes in the area of radioactive waste and spent fuel management.

The next amendment of the 2002 Act is foreseen for mid 2014. The 2014 amendments will also bring some minor changes in the area of radioactive waste and spent fuel management. The proposed amendments contain provisions on governing the implementation of different public services (management of radioactive waste, disposal of radioactive waste, long-term monitoring and maintenance of repositories of mining and hydro-metallurgical tailings). The proposed amendments clearly define the obligations of the Agency for Radwaste Management, that carries out all the above activities, as well as its rights in the proceedings in which is undoubtedly expressed her legal interest (e.g. closure of the repository, where it will later perform a public service for long-term monitoring and maintenance).

On 6 March 2006, the Minister of the Environment and Spatial Planning adopted the Rules on Radioactive Waste and Spent Fuel Management.

On 1 February 2006, the Parliament of the Republic of Slovenia passed the Resolution on the 2006–2015 National Programme for Managing Radioactive Waste and Spent Nuclear Fuel (Official Gazette of the Republic of Slovenia, No. 15/2006). This Programme is a part of the National Environment Protection Programme and sets goals and tasks in the field of radioactive waste and spent nuclear fuel management.

The resolution sets out general timelines and financing for activities related to radioactive waste and spent fuel management for all radiation and nuclear facilities. It foresees the construction of a repository for LILW with the capacity to satisfy the needs of the Slovenian part of LILW generated in the operation and decommissioning of the Krško NPP and for the disposal of waste from all other Slovenian waste generators. In parallel the resolution requests provision of technical possibility for the construction of a full-capacity repository for all waste from the Krško NPP, if appropriate agreement with the Republic of Croatia on a joint solution of this issue is agreed upon.

On 2 July 2013 the Parliament of the Republic of Slovenia passed the Resolution on Nuclear and Radiation Safety in the Republic of Slovenia (for the period 2013–2023) as a concrete and immediate response to one of the recommendations of the 2011 Integrated Regulatory Review Service (IRRS) mission to Slovenia. The Resolution represents a high-level national policy paper. The SNSA has to report to the Parliament on the implementation of the provisions of the Resolution once a year; such a report is an integral part of the SNSA's annual Report on Radiation and Nuclear Safety, which is adopted by the Government and later on by the Parliament of the Republic of Slovenia. In such a report the success of achieving the objectives of the Resolution has to be pointed out.

A comprehensive overview of the legislative and regulatory framework which governs nuclear and radiological safety is attached to this report (Section L, Annex (f)). The list consists of the national legal framework and the international instruments (multilateral and bilateral treaties, conventions, agreements and arrangements) to which the Republic of Slovenia is a party.

(2i) National Safety Requirements and Regulations for Radiation Safety

In addition to the main principles (among others "justification", "optimisation", "ALARA" and "prime responsibility for safety"), the 2002 Act also includes, with respect to radiation protection areas, provisions on:

- reporting an intention to carry out radiation practices or to use a radiation source,
- licensing of radiation practices or use of a radiation source,
- general principles on protection of people against ionising radiation,
- classification of facilities (nuclear, radiation and less important radiation facilities),
- licensing procedures with respect to siting, construction, trial operation, operation and decommissioning of nuclear, radiation and less important radiation facilities,
- radioactive contamination and intervention measures,
- radioactive waste and spent fuel management,

- import, export and transit of nuclear and radioactive materials, radioactive waste and spent fuel,
- physical protection of nuclear materials and facilities,
- non-proliferation and safeguards,
- administrative tasks and inspection, and
- penalties.

Based on the 2002 Act seven decrees have been adopted by the Government and 21 rules have been adopted by the competent ministers. A number of second level acts will be amended following the amendments of the 2002 Act. In the period since the fourth report under the Convention the Rules amending the Rules on Operational Safety of Radiation and Nuclear Facilities have been adopted. Rules on providing qualification for workers in radiation and nuclear facilities were adopted in 2011, replacing the previous rules in this area from 2005.

In the area of physical protection two legal documents were adopted in 2013; these replaced the previous legal framework in this area from 2005:

- Rules on physical protection of nuclear facilities, nuclear and radioactive materials, and transport of nuclear substances, and
- The Order on establishing a programme of basic training programme and periodic retraining of security personnel performing physical protection of nuclear facilities, nuclear or radioactive materials and transport of nuclear substances.

The Slovenian legislation is based on broadly accepted international standards. Furthermore all the European Union directives from the field of radiation and nuclear safety have been completely transposed into Slovenian legislation. The Slovenian legislation meets all provisions of IAEA Safety Standards in respect of the obligations arising from the Joint Convention.

Within the legislative and regulatory framework which covers spent fuel and radioactive waste management, the following decrees and acts should be mentioned:

- The Decree on Establishment of a Public Agency for Radwaste Management,
- The Decree on the Method and Subject of and Conditions for Performing a Public Service of Radioactive Waste Management,
- The Act Governing the Fund for Financing Decommissioning of the Krško Nuclear Power Plant and Disposal of Radioactive Waste from the Krško NPP, and
- Permanent Cessation of Exploitation of the Uranium Ore and Prevention of Consequences of the Mining in the Uranium Mine at Žirovski vrh Act.

(2ii) Licensing System

A system of licensing of spent fuel and radioactive waste management is provided for in the 2002 Act, while the Rules on Radiation and Nuclear Safety Factors (JV5) lay down details on the documentation which must be submitted in a particular phase of licensing. The prescribed licensing process is of a general nature, so is applicable to whole spectra of nuclear and radiation facilities.

The basic classification of facilities is provided by the Act itself, where in definition No. 22 of Article 3 it provides that a nuclear facility is "a facility for the processing or enrichment of nuclear materials or the production of nuclear fuels, a nuclear reactor in critical or sub-critical assembly, a research reactor, a nuclear power plant and heating plant, a facility for storing, processing and disposal of nuclear fuel or high radioactive waste, or a facility for storing, processing or disposal of low- and intermediate-level radioactive waste". Therefore the entire spectrum of licensing requirements (for siting, construction, trial operation, operation, decommissioning and/or closure of the repository) have to be complied with by the applicant (investor or operator of the facility) in accordance with the provisions of the 2002 Act and of the Rules on Radiation and Nuclear Safety Factors.

An investor planning to construct nuclear facility shall compile and submit in the application for the facility, among other things, the following principal documents demonstrating nuclear and radiation safety:

- A special safety analysis report in the procedure of approval of the national spatial plan;
- An environment impact report in the procedure of approval of construction;

- A safety analysis report in the procedure of approval of construction.

General requirements for the design basis for a radioactive waste or spent fuel storage facility and for a radioactive waste or spent fuel repository are laid down in the Rules on Radiation and Nuclear Safety Factors.

In the licensing processes, the investor/operator shall attach to the licence application, in addition to the design documentation, a safety analysis report, the opinion of an authorised radiation and nuclear safety expert (authorised by the SNSA) and other prescribed documentation as set by the Rules on Radiation and Nuclear Safety Factors.

In the subsequent licensing processes (for approval of trial operation, operation, decommissioning or closure of the facility) the licensee has to submit the above-described application with an appropriately amended set of documents and opinions. The operating experience and feedback and any modifications of the facility have to be clearly documented and described.

General provisions and responsibilities of the holder of the radioactive waste and spent fuel (as well as of the State) are defined in Section 4.8., "Radioactive waste and spent fuel management" of the 2002 Act. The 2002 Act (Articles 93–99) contains the following provisions:

- on radioactive waste and spent fuel management;
- on the national public service for radioactive waste management;
- on the national public service for the disposal of waste from energy producing nuclear facilities;
- on surveillance of closed repositories of mining and hydro-metallurgical tailings;
- on national public utility institutions;
- on the national programme of radioactive waste and spent fuel management; and
- on national infrastructure facilities.

On the basis of the provisions of the 2002 Act, the Rules on Radioactive Waste and Spent Fuel Management were adopted. The Rules (see Annex 5 of the Report) contain, inter alia, the following provisions:

- on classification of radioactive waste with regard to the aggregation state and the level and type of radioactivity;
- on requirements for radioactive waste and spent fuel management (general requirements – radioactive waste or spent fuel management procedures, programmes and plans; special requirements – sorting, treatment and packing, labelling, keeping, storing, decay-keeping, handover and takeover, reshuffling, liquid and gaseous radioactive waste release, disposal, acceptance criteria for storage or disposal, waste from exploitation and reprocessing of raw nuclear mineral material, and very-low-level radioactive waste management); and
- on record keeping and reporting (holder's records, central records, reporting, loss and findings).

The Decree on the Method and Subject of and Conditions for Performing a Public Service of Radioactive Waste Management contains among others the following provisions:

- on the scope and type of public service;
- on general requirements of discharging the public service;
- on requirements which have to be fulfilled by the performer of the public service;
- on the rights and duties of the use of the public service;
- on financial sources and the method of establishing the price; and
- on inspection.

The public service for radioactive waste management referred to in Article 97 of the 2002 Act was established in 1991 as the ARAO (Governmental Decree on the Establishment of a Public Agency for Radwaste Management).

(2iii) System of Prohibition of the Operation of a Spent Fuel or Radioactive Waste Management Facility without a Licence

Spent fuel and radioactive waste management facilities are defined by the 2002 Act as nuclear facilities. Consequently, all relevant licences are needed, including an operating licence. Operation of such a facility without a licence is prohibited according to Article 57 of the Act.

In the penal provisions of the 2002 Act, it is foreseen that a financial penalty of between EUR 5,000 and 500,000 shall be imposed on a legal entity which violates the above prohibition; in addition a financial penalty of between EUR 1,000 and 10,000 shall be imposed on any responsible person appointed by a legal entity for the same violation. If the violation is committed by a sole trader, a financial penalty of between EUR 5,000 and 150,000 shall be imposed. If the nature of the offence is particularly serious (because of the amount of damage caused, the amount of illegally acquired pecuniary advantage or the perpetrator's intent) these penalties can be tripled.

(2iv) System of Appropriate Institutional Control, Regulatory Inspection, and Documentation and Reporting

Institutional control and regulatory inspection with respect to safety of spent fuel and radioactive waste management rests with the SNSA. Within the scope of inspection an inspector may:

- issue decisions and orders within the framework of administrative proceedings;
- order measures for radiation protection and measures for radiation and nuclear safety to assure that the licensee fulfils all legal requirements regarding safety;
- order the termination of a radiation practices or use of a radiation source where the inspector finds that a proper licence has not been issued or if there is a failure in following the prescribed methods for handling the radiation source or radioactive waste; an appeal against such a decision of an inspector shall not hinder its execution; and
- seal any radiological device which does not meet the acceptance criteria for proper operation.

The 2002 Act has only one article on inspection, since the Inspection Act prescribes the general principles of inspection, its organisation and status, the rights and duties of inspectors, inspection measures and other issues relating to inspection, which are to be followed also by nuclear and radiation safety inspectors.

(2v) The Enforcement of Applicable Regulations and of the Terms of Licences

The enforcement of applicable regulations and of the terms of licences is ensured by the application of penal provisions, inspection and provisions relating to the issuing, renewal, amendment, withdrawal and expiration of licences, as provided for in the 2002 Act.

Based on the Inspection Act as well as on the 2002 Act, a graded approach in enforcement policy is ensured. The inspector may (if in their assessment such a measure is sufficient and appropriate) only warn the licensee about the irregularities and set a date by which the corrective measures must be carried out. The inspector may also (among other measures) perform all measures in line with the Minor Offences Act or report (in the case of a criminal offence) the licensee to the public prosecutor.

The inspector may also terminate a radiation practice or the use of a radiation source if the operator is operating without the licence, but may not revoke or suspend a licence. This can be done only by the authority which has issued the licence (in most cases the SNSA), though the inspector may propose such a measure.

(2vi) Allocation of Responsibilities

As described above, the legislative framework (the 2002 Act, the Decree on the Method and Subject of and Conditions for Performing a Public Service of Radioactive Waste Management and the Rules on Radioactive Waste and Spent Fuel Management) provides a clear allocation of responsibilities of the bodies involved in the different steps of regulating spent fuel and radioactive waste management (producer, holder, mandatory state-owned public services, regulatory body) and also defines the system of recording and reporting.

Article 20: Regulatory Body

1. *Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in Article 19, and provided with adequate authority, competence and financial and human resources to fulfil its assigned responsibilities.*
2. *Each Contracting Party, in accordance with its legislative and regulatory framework, shall take the appropriate steps to ensure the effective independence of the regulatory functions from other functions where organisations are involved in both spent fuel or radioactive waste management and in their regulation.*

1. Regulatory Body – the Slovenian Nuclear Safety Administration (SNSA)

First of all, it is to be reported that following early elections for deputies to the National Assembly at the beginning of December 2011, the composition of the Slovenian Government changed with the number of ministries being cut back from the existing 15 to only 12, which in practical terms means that some previously autonomous ministries have been merged with others into new, unified ministries.

In the case of the Slovenian Nuclear Safety Administration (SNSA), which was until then a part of the Ministry of Environment and Spatial Planning (MESP), this has meant that the SNSA has been from the governmental reorganisation on an organisational unit within the newly established Ministry of Agriculture and the Environment (MAE), as the environment ministry has been merged with the Ministry of Agriculture; on the other hand, the spatial planning department of the previous MESP is now part of the newly established Ministry of Infrastructure and Spatial Planning, which is responsible for the promotion or utilisation of nuclear energy.

It should be pointed out that the legal status of the SNSA remains unchanged and that the SNSA retains (under the MAE) the same level of independence and autonomy as before (when it was under the MESP).

The SNSA, as a regulatory body in the area of nuclear and radiation safety, is a functionally autonomous body within the MAE (hereinafter the Ministry). The SNSA's responsibilities and competencies are defined in the Governmental Decree on Administrative Authorities within Ministries.

The SNSA performs specialised technical and developmental administrative tasks and tasks of inspection in the area of radiation and nuclear safety, radiation practices and use of radiation sources (except in health and veterinary care), protection of the environment against ionising radiation, physical protection of nuclear materials and nuclear facilities, non-proliferation of nuclear weapons, and safeguards of nuclear goods. Furthermore it monitors radioactivity in the environment, third party liability, and the transport, import and export of radioactive materials.

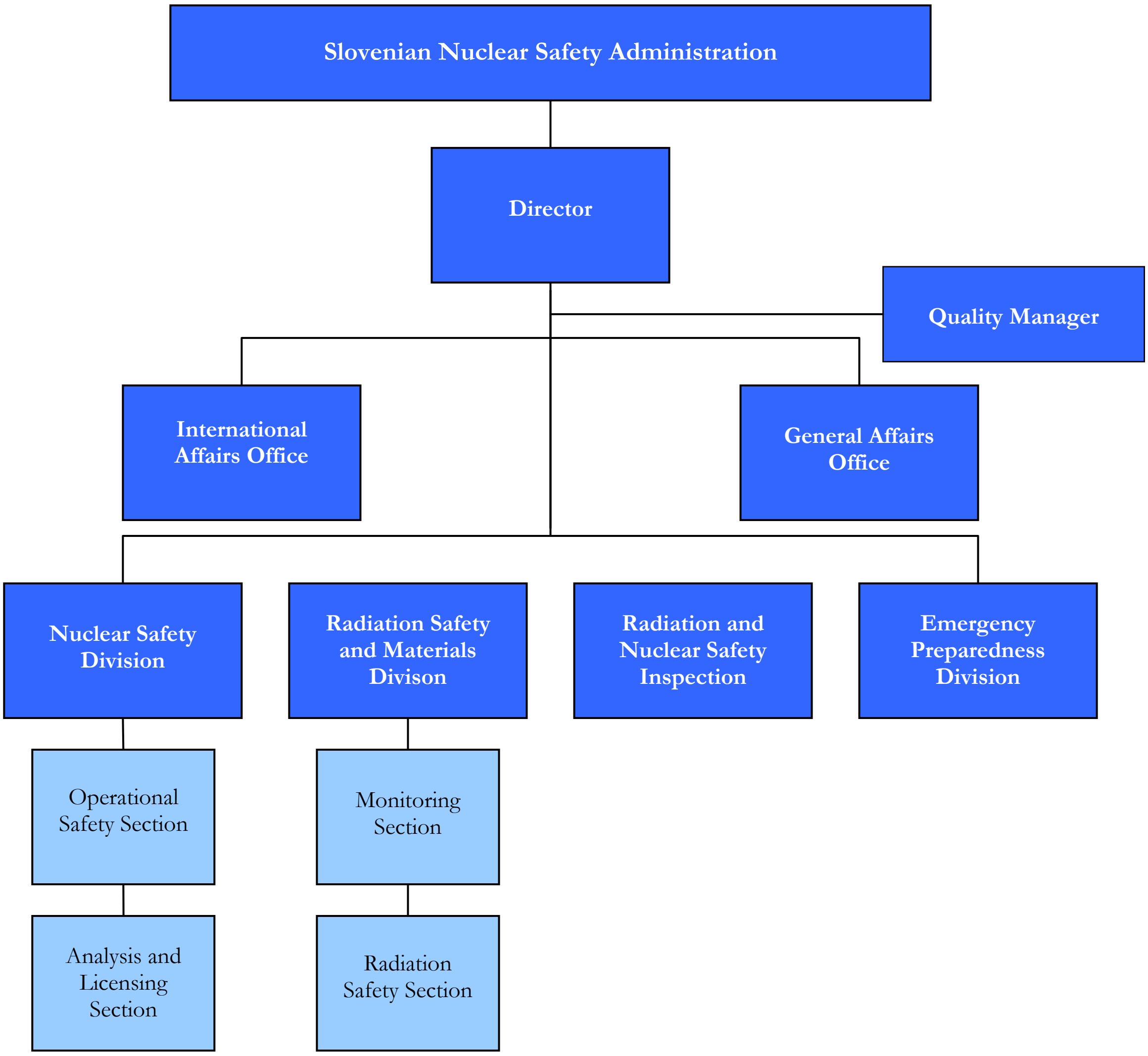
The precise competencies of the SNSA and other relevant administrations which are entrusted with implementation of the legislative framework to govern the safety of spent fuel and radioactive waste management are prescribed in particular in the 2002 Act and other legislation listed in Section L, Annex (f) of this report.

The SNSA is organised into four divisions and two offices. These are (the number in brackets denotes the number of staff in the respective division):

- The Division of Nuclear Safety (12),
- The Division of Radiation Safety and Materials (10),
- The Division of Emergency Preparedness (4),
- The Division of Inspection (5),
- The Office of International Co-operation (3),
- The Office of General Affairs (5),
- The QA Manager (1).

The SNSA's internal organisational units are shown in Figure 3.

Figure 3: **Internal organisational units of the SNSA**



The staff of the SNSA is interdisciplinary, consisting of employees with a range of educational backgrounds: physicists, mechanical, electrical and chemical engineers, mining technologists and geotechnologists, architects, metallurgists, geologists, lawyers, linguists, and administrative workers.

At the end of 2013, the SNSA had 41 employees, of whom 8 held a doctor's degree and 13 a master's degree, 19 had completed higher or university education and one had completed secondary school education.

Each position in the SNSA organisational chart has recognised necessary competences for the staff member occupying it. In this context, however it has to be mentioned quite openly that due to the very strict and restrictive governmental policy on employment in the last few years, no new staff member in the SNSA has been employed; based on this restrictive governmental policy in the previous two years, even temporary employment substituting workers who have retired or have been temporarily on maternity or sick leave was not allowed.

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

For each year, the SNSA prepares the so-called Educational and Training Plan for its employees. There are also other tools used for the career development of SNSA's staff, such as yearly interviews and on-thejob training. Furthermore, a so-called "systematic approach to training" is under preparation at the level of SNSA staff.

Also because of the above-mentioned governmental policy of not increasing the number of civil servants in administration, the SNSA has had to substantially improve its management system and has increased the effectiveness of its work.

In December 2010, the SNSA successfully passed the third regular yearly control audit of its management system (the first was conducted in 2008) based on ISO Standard 9001:2008. During the audit no incompatibilities were found and it was confirmed that the SNSA quality management system is in accordance with ISO 9001:2008. Unfortunately, due to financial restrictions and Government policies, which greatly limits the budgetary resources, in 2013 the SNSA was not able to extend the contract with the external auditor and therefore could not maintain the ISO standard; however, in its business the SNSA still preserves all the elements necessary for the implementation of the management system in accordance with this standard.

The Director of the SNSA is the head of the regulatory authority and represents the SNSA. At the governmental and parliamentary level, the SNSA is represented by the Minister of Agriculture and the Environment. The Director is responsible to the Minister for his work and for the work carried out by the SNSA. The organisation of the SNSA is prepared by the Director and approved by the Government on the motion of the Minister.

Regulatory matters relating to spent fuel and radioactive waste management are dealt with by the Division of Radiation Safety and Materials.

The budget of the SNSA is determined on the basis of the activities carried out in the previous year, taking into account new needs, which have to be well justified. The budget is the only source for financing for the SNSA's basic activities. The operators of nuclear or radiation installations and other licensees do not pay any licensing or inspection fees. The only fee which is applicable under the general Act on Administrative Fees is the so-called administrative tax for the licensing (administrative) procedure, which is of symbolic value. Such a fee is paid to the state budget and not directly to the SNSA. Furthermore, if the SNSA determines that some expertise is needed within the licensing (administrative) procedure, the applicant bears the costs under the relevant provision of the Act on General Administrative Procedure.

Although the SNSA is part of the Ministry, it still has its own share of the Ministry's budget and is independent in allocating the programmes, projects and other expenses from its budget. The state budget is prepared for a biannual cycle. The composition of the SNSA's budget for 2014 and 2015 is shown in Table 1. This budget comprises all activities within the SNSA areas of competence.

Table 1: The SNSA budget for 2014 and 2015

Structure		**2014**	**2015**
Salaries		1,381,010	1,381,010
Material Expenses		519,963	519,963
Investments		8,090	8,090
Membership fees (IAEA, OECD/NEA membership)		348,415	450,000
Prepare project		7,680	8,280
Prepare project		2,560	2,760
Outsourcing	Nuclear Safety	50,330	50,330
	Radiation Safety	100,965	100,965
Total		**2,419,013**	**2,521,398**

Other Regulatory Bodies

The 2002 Act gives the responsibility in the area of radiation practices and use of radioactive sources in health and veterinary care to the Slovenian Radiation Protection Administration (SRPA) within the Ministry of Health. In general the responsibilities are divided between the SNSA and the SRPA in the area of radiation protection, while the area of nuclear safety is the SNSA's sole responsibility. The SNSA is responsible for the monitoring of emissions into the environment, while the SRPA is responsible for the monitoring of the exposure of the population. Based on the 2002 Act, the SNSA is competent for consents for mining work, licensing for operations, the completion of decommissioning and the closure of a repository, while the SRPA performs inspection tasks in the area of radiation protection (dose limits, protection of exposed workers, etc.).

The SRPA responsibilities and competencies are (as for all other governmental bodies) also defined in the Decree on Administrative Authorities within Ministries: "The SRPA performs technical, administrative, inspection and development tasks in the area of radiation practices and use of radiation sources in health and veterinary care; health protection of people against the detrimental effects of ionising radiation; systematic inspection of working and living premises due to exposure of people to natural radiation sources; implementation of monitoring of radioactive contamination of foodstuffs and drinking water; reduction, restriction and prevention of the health-detrimental effects of non-ionising radiation; and assessment of compliance and authorisation of radiation protection experts".

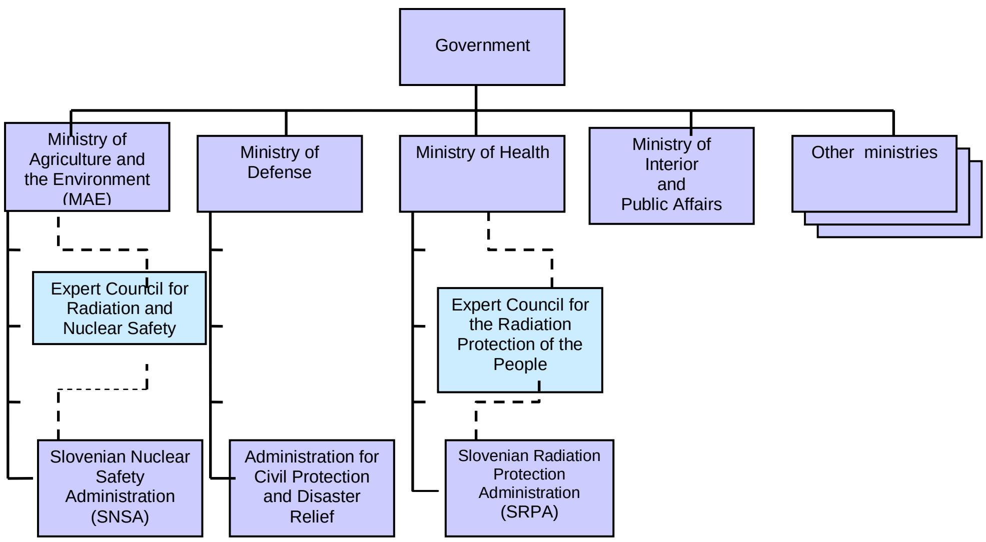
Besides the SNSA and the SRPA, some other administrations, ministries and organisations are also entrusted with the implementation of the 2002 Act, in particular:

- The Administration for Civil Protection and Disaster Relief (within the Ministry of Defence), as the operator of the National Notification Centre, is responsible for notification procedures in the event of radiological emergency;
- The Ministry of the Interior (following the above-mentioned reorganisation of the Government) has, inter-alia, competencies in the area of physical protection of nuclear materials and nuclear facilities in general, while the SNSA only approves the Safety Analysis Report, to which the plan of physical protection is attached as a separate and restricted document;
- The Environmental Agency within the Ministry of Agriculture and the Environment;
- The Spatial Planning Directorate within the Ministry of Infrastructure and Spatial Planning; and
- The Directorate for Energy (within the Ministry of Infrastructure and Spatial Planning).

Based on the 2002 Act, the Expert Council for Radiation and Nuclear Safety was appointed as an advisory body to the Ministry of Agriculture and the Environment and the SNSA, and the Expert Council for the Protection of People against Ionising Radiation, with responsibility for radiological procedures and the use of radiological sources in health and veterinary care, was appointed as an advisory body to the Ministry of Health and the SRPA.

The position of the SNSA and the SRPA in the governmental structure is shown in Figure 4.

Figure 4: **The SNSA and the SRPA within the governmental structure**



2. Effective independence

The principle of "effective independence" is not laid down explicitly in the 2002 Act. It is met by the sum of different provisions of different laws and by-laws which generally define, inter alia, the following: the position of administrative bodies such as the SNSA and the SRPA within the structure of the ministries; the structure of the state budget, the reporting scheme within the governmental framework; and the decision-making hierarchy in appeal process within administrative procedures.

The SNSA is a part of the state administration. Based on the Public Administration Act, the SNSA, in terms of its administrative decisions, is an independent body within the Ministry of Agriculture and the Environment. Administrative decisions mean all decisions taken by the SNSA within the licensing process and within the inspection control. Decisions adopted by the SNSA within its scope of competence are taken solely and exclusively by the SNSA and can not be dictated or imposed on the SNSA by the Ministry of Agriculture and the Environment, the Minister or any other body within the Ministry. In some cases the 2002 Act provides that appeal against an SNSA ruling is not possible. This does not mean, however, that the licensee has no judicial remedy at its disposal. The licensee may not use an appeal in the administrative procedure (where the decision would be taken by the Ministry of Agriculture and the Environment), but does have a constitutional right to submit its case to the court within a civil law procedure.

In accordance with the 2002 Act, besides licensing, inspection and enforcement of nuclear and radiation safety also rest with the SNSA. The inspection powers include control over implementation of provisions of the 2002 Act, regulations and decrees issued in accordance with the 2002 Act and other terms of the licences. Within the scope of inspection, an inspector may:

- issue decisions, conclusions and/or orders within the framework of administrative proceedings;
- order measures for radiation protection and measures for radiation and nuclear safety; and
- order cessation of a radiation practice or use of a radiation source when it is established that the applicable licence has not been issued or if the prescribed methods of handling a radiation source or radioactive waste have not been followed.

An appeal against a decision of an inspector does not prevent its execution.

The enforcement of applicable regulations and the terms of licences is ensured by the application of penal provisions and inspection provisions as well as provisions related to suspending the operation of a nuclear facility as provided for by the 2002 Act.

The office of the Director of the SNSA is not a political position in the Slovene legal system (unlike the case of the office of a Minister or State Secretary), but rather as the highest level in the structure of employees (i.e. civil servants) within the governmental administration. Open competition for the position of Director of the SNSA (or certain other positions in governmental bodies, for example managing directors, secretaries-general and the heads of bodies within ministries and of administrative units) is carried out through a special Competition Commission, which in each case shall be appointed by the governmental Council of Officials. The whole procedure is set out in the Civil Servants Act. Once appointed, the Director of the SNSA is directly subordinate to the Minister and reports to the Minister, but in administrative decisions, he or she is independent from the Minister or any other body within the Ministry. The Public Administration Act and the 2002 Act assure the de jure independence of the SNSA.

SECTION F: OTHER GENERAL SAFETY PROVISIONS

Article 21: Responsibility of the Licence Holder

1. *Each Contracting Party shall ensure that prime responsibility for the safety of spent fuel or radioactive waste management rests with the holder of the relevant license and shall take the appropriate steps to ensure that each such license holder meets its responsibility.*
2. *If there is no such license holder or other responsible party, the responsibility rests with the Contracting Party which has jurisdiction over the spent fuel or over the radioactive waste.*

The provisions on the prime responsibility of the licence holder for the safety of nuclear and radiation facilities and also for the safety of spent fuel management or radioactive waste management is one of the main principles of the 2002 Act.

Article 57 of the 2002 Act provides the following specific requirement: "A nuclear facility, a radiation facility or a less important radiation facility may not be constructed, tested, operated or used in any other way, or permanently ceased to be used, without a prior approval or permit pursuant to this Act. The safety of a facility, including the safety of handling radioactive substances, radioactive waste or spent fuel which is found or produced in the facility, must be ensured by the operator".

The system of licences is set up to assure that facilities are designed, constructed, commissioned and prepared for operation in accordance with the national or international codes, standards and experience.

A clear requirement for the handling of radioactive waste and spent fuel is set in Article 93 of the 2002 Act, which provides that the holder of radioactive waste and spent fuel shall ensure that the radioactive waste and spent fuel are handled in the way prescribed and that transfer of the burden of disposing of radioactive waste and spent fuel to future generations is avoided as far as is possible. The producers responsible for the occurrence of radioactive waste and spent fuel must ensure that the radioactive waste is produced in the smallest possible quantities.

The costs of radioactive waste and spent fuel management must be paid by the person responsible for its generation or by the holder of the waste if the ownership was transferred to him by the person responsible for its occurrence, or if he acquires it in any other way.

If the person responsible for the generation of radioactive waste or spent fuel is not known, the state must assume full responsibility for its management.

The holder of radioactive waste and spent fuel must forward the information on the generation thereof to the central registry of radioactive waste and spent fuel, which is maintained by the Slovenian Nuclear Safety Administration.

Article 22: Human and Financial Resources

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

(i) qualified staff are available as needed for safety-related activities during the operating lifetime of a spent fuel and a radioactive waste management facility,

(ii) adequate financial resources are available to support the safety of facilities for spent fuel and radioactive waste management during their operating lifetime and for decommissioning,

(iii) financial provision is made which will enable the appropriate institutional controls and monitoring arrangements to be continued for the period deemed necessary following the closure of a disposal facility.

The licensee has the prime responsibility for the safety of their facilities. This responsibility includes provision of adequate financial and human resources both to support the safety of facilities for spent fuel and radioactive waste management during their operating life-time and for their decommissioning.

Krško NPP

(i) Human Resources

The Krško NPP has overall responsibility for design, engineering, construction, licence application, operation, fuel management, procurement and quality assurance as well as for radioactive waste management. The Krško NPP is organised in several divisions, including the Technical Division, which is responsible for operating, maintenance and technical services; the Engineering Division, responsible for design, engineering, configuration management, licensing, procurement engineering and project management; the Quality Systems Division, which encompasses the Nuclear Oversight Section, which is responsible for independent safety assessments; the Administrative Division; and the Financial Division. In all positions, qualified personnel perform all the various activities needed for radioactive waste and spent fuel management. At the end of 2013, 636 people, both technical and non-technical staff, were employed at the Krško NPP.

Handling of radioactive waste is the responsibility of the Chemistry Department, which is a part of the Technical Division. The Chemistry Department is also responsible for decontamination activities.

The Nuclear Fuel Department, which is a part of the Engineering Division, is responsible for accountability and control of special nuclear materials and for spent fuel management. The handling of processes themselves is carried out by the Nuclear Fuel Department and the Operations Department.

Radiological control is carried out by the Radiation Protection Department, which is a part of the Technical Division.

Personnel Qualifications and Experience

All technical posts at the Krško NPP are assessed. The minimum requirements in terms of educational qualifications, number of years of experience in relevant positions and certified competence to undertake certain tasks are assured by the Krško NPP.

The qualifications consist of the basic formal education and of special knowledge. Special knowledge involves basic principles of the operation of nuclear power plants, radiological protection, industrial safety and so on. The courses and training exercises are organised by the Training Department, which also looks after the record keeping of qualifications.

Training

All personnel working at the plant receive basic introductory training. The training course is comprehensive, addressing, inter alia: organisational arrangements, area designations and arrangements for working in radiologically controlled areas, plant layout and services, industrial safety, quality assurance, and emergency response.

Training in radiological protection is given at different levels of complexity, depending on the level of responsibility of the employee. A basic training course is given to all personnel before they have to enter a radiologically controlled area, with the objective of ensuring that they have sufficient understanding of the principles of ionising radiation to enable them to work safely in the controlled area. A more advanced course is provided for the personnel permanently working in a controlled area or with systems that contain radioactive material. Personnel specialised in health physics attend the most advanced course.

Personnel dealing with radioactive waste and spent fuel are educated and trained to perform their duties. Special services in this area are also provided from abroad.

(ii) Financial Resources

The expenses for radioactive waste treatment, conditioning and storing and for spent fuel storage are part of the production costs. The financial resources for these activities are ensured during the operational period of the Krško NPP.

According to the Agreement, the owners of the Krško NPP, GEN energija d.o.o. and Hrvatska Elektroprivreda d.d., are obliged to assure the funds for the decommissioning and the final disposal of radioactive waste and spent fuel.

The Slovenian share of assets for the decommissioning of the Krško NPP and for the post-operational radioactive waste and spent fuel management are assured through the Act Governing the Fund for Financing Decommissioning of the Krško NPP and Disposal of Radioactive Waste from the Krško NPP. This Act was amended in 2003 in light of the Agreement between the Government of the Republic of Slovenia and the Government of the Republic of Croatia on the Regulation of the Status and Other Legal Relations Regarding Investment, Exploitation and Decommissioning of the Krško NPP. The Slovenian share of financial assets is collected through a levy for the kWhe delivered to the Slovenian grid since 1996. Due to a revision of the Decommissioning Programme in 2004, in 2005 the levy was increased to 0.30 euro cents per kWhe delivered to the Slovenian electrical power company GEN energija d.o.o.

The Croatian share of assets for the decommissioning of the Krško NPP and for the post-operational radioactive waste and spent fuel management is assured in accordance with the bilateral Agreement through an adequate Croatian Fund for Decommissioning and Spent Fuel Management. The Croatian Fund was established by the Act on Governing the Fund for Financing Decommissioning and Disposal of Radioactive Waste and Spent Fuel of the Krško NPP. This act was adopted by the Croatian Parliament in October 2007.

Jožef Stefan Institute Reactor Infrastructure Centre

(i) Human Resources

The TRIGA Mark II research reactor operation staff (the full-time staff consist of four reactor operators, four radiological protection technicians and the head of the radiological protection group and the part-time staff of the head of reactor operation, the head of the reactor infrastructure centre and a secretary) are responsible for spent fuel and radioactive waste handling and management. Staff are appropriately trained and equipped.

The Hot Cell Laboratory operates under the TRIGA Mark II research reactor operating licence. The staff consist of three part-time workers.

The TRIGA Mark II research reactor operation staff are responsible for and trained to perform the specific tasks in spent fuel management and radioactive waste management. The specific knowledge, training, skills and certificates required from reactor operators for these tasks are a radiological protection certificate, a crane operator certificate, a forklift driver certificate, a welder certificate and remote manipulation skills.

The personnel must also have some practical experience with spent fuel shipment projects and the treatment of spent sealed sources for storage.

(ii) Financial Resources

The financial resources for maintaining the safety of spent fuel and radioactive waste at the IJS Reactor Infrastructure Centre are provided within the budget for reactor operation. Financial provisions for decommissioning are not provided. However, as the Republic of Slovenia is the owner of the facility, it will also have the responsibility to assure financial resources for proper decommissioning and spent fuel management.

Agency for Radwaste Management

(i) Human Resources

The ARAO is a public utility service and the number of employees is defined by the Government. At present there are four organisational units and several independent services, such as the QA/QC Service and the Radiation Protection Service. The ARAO has a qualified staff of 20 persons for performing all phases of the public service of institutional radioactive waste management and a competent staff to manage the licensing phase for the LILW repository, where subcontractors are also involved to perform special tasks. Its Radiation Protection Service partly depends on outsourcing of experts, though a completely independent Radiation Protection Service is planned to be realised in the near future.

Because of governmental restrictions, the number of employees has fallen in recent years and there is almost no redundancy of expert workers. Consequently the professional positions require broad professional backgrounds and flexibility on the part of the staff, who have a diverse and adequate professional structure: 62% of employees hold graduate degrees, mostly in engineering and science, 19% hold postgraduate degrees and the remaining 19% have completed secondary school education. The ARAO has also taken on several younger professionals who were involved in specialised professional training courses and other types of learning. Professional development of employees is an important part of ARAO policy. Participation in training courses, workshops, seminars and conferences is supported in order to maintain the high quality of the team and its outputs.

(ii) Financial Resources

Financing of the ARAO is based on an annual work plan and is subject to annual contracts between the ARAO and the Government and the Fund for Decommissioning of the Krško NPP respectively. Regular work has been considerably slowed down in the last few years due to delays in contracting with the Government.

Institutional radioactive waste management is financed from the national budget and from fees paid by waste producers when the liabilities for further waste management are transferred from them to the ARAO. Fees are defined by the Government and have not changed since 2000. The ARAO is planning to propose a new price list to the Government in 2014.

LILW repository siting, licensing, construction and operation and disposal of half of the LILW from the Krško NPP are financed from the Fund for Decommissioning of the Krško NPP. This funding is also supervised by the Government. The money is collected through a levy for the kWhe delivered to the Slovenian grid and has not changed since 2005.

Žirovski vrh Uranium Mine

(i) Human Resources

At the beginning of 2002, the Žirovski vrh Uranium Mine was transformed into the public company Žirovski vrh Mine, d.o.o. At the same time a new company organisation was also established.

Žirovski vrh Mine d.o.o. has an adequate and experienced staff of seven people (four permanent staff and three other staff), mostly the monitoring staff. It is standard practice that additional expertise, elaboration of projects and major remedial activities are contracted out on a commercial basis.

(ii) Financial Resources

The financial resources for the activities of the public company Žirovski vrh Mine, d.o.o., are assured solely from the state budget.

Isotope Laboratory of the Institute of Oncology

(i) Human Resources

The staff working with radioisotopes at the Institute of Oncology have appropriate education and experience as required by the national legislation.

At the moment the staff of the Isotope Laboratory is sufficient (three medical doctors, two radiopharmacists, eight radiological engineers, one maintenance worker and two nurses). The number of staff has been relatively constant during the last five years, though it may need to be increased if new nuclear medicine techniques are introduced.

(ii) Financial Resources

The Institute of Oncology is mainly financed by the Slovenian health insurance scheme and to a lesser extent from the budget of the Ministry of Health. The Department of Radiological Safety at the Institute of Oncology will strive to ensure additional financial resources for its projects connected to radiological safety and safe storage and disposal of radioactive waste.

Ljubljana University Medical Centre - Department for Nuclear Medicine

(i) Human Resources

The Department for Nuclear Medicine consists of three sections: the Section for Thyroid Diseases, the Section for Nuclear Medicine Diagnostics and the Section for Radiopharmacy and Radiochemistry. At present 77 persons are employed at the department (14 medical doctors, 4 radiopharmacists, 1 biologist, 1 physicist, 2 electrical engineers, 9 radiological engineers and 10 senior hospital nurses, the others being technicians and administration and maintenance personnel). The staff working with radioisotopes at this department have appropriate education and experience as required by the national legislation.

(ii) Financial Resources

Functioning of the University Medical Centre's Department for Nuclear Medicine is assured by the Health Insurance and the Ministry of Health.

Article 23: Quality Assurance

Each Contracting Party shall take the necessary steps to ensure that appropriate quality assurance programmes concerning the safety of spent fuel and radioactive waste management are established and implemented.

Article 63 of the 2002 Act and its amendments and the Rules on Radiation and Nuclear Safety Factors (Official Gazette of the Republic of Slovenia, Nos. 92/2009 and 9/2010; hereinafter Rules JV5), which in 2009 substituted Regulation E1, explicitly require safety and quality management measures to be taken for all activities related to nuclear and radiation facilities, from the design stage through operation to the decommissioning stage. An investor or an operator of a radiation or nuclear facility must ensure that the facility is managed safely and in accordance with the provisions of the Act. The operator of the radiation or nuclear facility must establish, implement, evaluate and continually improve its management system and must describe the latter in documents according to the requirements determined by the minister competent for the environment.

Krško NPP

The company NEK d.o.o., as the licence holder, is responsible for the overall quality of the design, construction, operation, maintenance and modification of the plant. The quality assurance programme was already implemented in the design and construction of the plant and was in full compliance with the following: the United States Atomic Energy Commission Appendix B to 10 CFR 50 Quality Assurance Criteria for NPPs and Fuel Reprocessing Plants, the quality assurance (QA) guidance provided in the WASH 12833 Guidance on QA Requirements During the Design and Procurement Phase of Nuclear Power Plants, and the WASH 1309 Guidance on QA Requirements During the Construction Phase of Nuclear Power Plants.

Since the beginning of its operation, the overall Krško NPP Quality Assurance Programme and its applicable procedures were implemented to assure that all planned and systematic actions necessary to provide adequate confidence that all items or services will satisfy given requirements as regards quality are in place. The overall requirements for quality, as one of the major objectives for Krško NPP operation, are set forth in the updated safety analyses report, which serves as a base for the operating licence. The Krško NPP Quality Assurance Programme is implemented and maintained to comply with national legislation, best international practice and recognised industrial standards.

Krško NPP’s policy is to establish and implement an integrated management system bringing together in a coherent manner all the requirements for managing the organisation. The main aims of the system are achieving and improving safety by planned and systematic actions necessary to provide adequate confidence that all these requirements are satisfied, and ensuring that health, environmental, security, quality and economic requirements are not considered separately from safety requirements. The policy is established by the Management Board’s Statement of Policy and Authority and implemented through the Quality Assurance Programme presented in QD-1 and applicable programmes and procedures. QD-1 is developed and maintained by the Quality and Nuclear Oversight Division and approved by the Management Board.

The Krško NPP management system is a set of interrelated and interacting elements; it establishes policies and objectives and enables those objectives to be achieved in a safe, efficient and effective manner. Safety is the paramount element in the Krško NPP management system, overriding all other demands. Having an integrated management system in accordance with Slovenian regulatory requirements (Rules JV5) and IAEA GS-R-3 requirements, it is essential to maintain and continuously enhance safety. An integrated management system provides a number of benefits together with enhanced safety and business performance. During the 30 years of the Krško NPP’s operation, the quality requirements and related documents have been revised and upgraded several times. The latest revision of the QD-1 Quality Assurance Plan was issued in 2011.

One of the most obvious changes was the enlargement of the scope of QD-1 to cover interdisciplinary areas defined in Plant Management Programme MD-1: "Commitments and Goals of the Krško NPP", such as safety culture, self-assessment, human performance and industrial safety. The table defining relationships between certain standards was also updated to provide a matrix for better correlation between the requirements of various standards (10 CFR 50 App. B, IAEA GS-R-3, Rules JV5 and ISO9001).

The Quality Assurance Programme applies to safety related and seismic designed structures, systems and components, including their foundations and supports, and non-safety related SSC (Augmented Quality) as identified on the Q-List in the Master Equipment Component Database. Activities affecting the quality of these structures, systems and components are controlled to an extent consistent with their importance to safety. The Quality Assurance Programme is implemented by all Krško NPP departments, while programme requirements are also extended to contractors and suppliers in line with the importance of their services and scope of supply for nuclear safety.

Since the 4th Slovenian Report under the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, the internationally recognised standard for industrial safety, additional to the ISO 14001:2004 standard implemented in 2008, i.e. BS OHSAS 18001:2007, has been introduced into Krško NPP practices (in 2011).

Internal audits within Krško NPP are performed in two-year intervals in accordance with procedure ADP-1.0.006. Internal audits cover functional and cross-functional areas in accordance with IAEA, ANSI, NRC, EPRI and WANO guidelines. Audit results are reported and documented through the company's Corrective Action Programme, where audit findings are tracked until they are implemented.

Krško NPP suppliers are audited in three-year intervals in accordance with procedure ADP-1.8.001. For international suppliers, Krško NPP takes part in NUPIC audits and surveys.

In line with its policy of monitoring and constantly upgrading nuclear safety and QA requirements, Krško NPP has been following the efforts of the nuclear industry at large (the IAEA, WANO, INPO, EPRI, ASME and others) and enhancing its management system to improve safety and to excel in operation. Krško NPP will continue to develop its internal quality assurance processes and requirements in the future. The most important objective of the entire organisation – to ensure safe and efficient power plant operation – will continue to be the most important goal of the Quality Assurance Programme.

Jožef Stefan Institute Reactor Infrastructure Centre

QA at the IJS Reactor Infrastructure Centre is part of the Jožef Stefan Institute's QA Programme. The Director of the IJS and the head of the reactor operation department are responsible for its implementation. Specific internal QA and quality control documentation is applied. QA activities connected with reactor operation are subject to both internal inspections (Jožef Stefan Institute QA management and an audit team) and external inspections by the regulatory body. The QA Programme is subject to periodical reviews.

The IJS Reactor Infrastructure Centre QA is implemented and maintained to a great extent in accordance with following standards:

- SIST EN ISO 9001:2008,
- IAEA GS-R-3,

and acceptance criteria defined in:

- The programme for assessment of a request for performing work in the hot cell laboratories,
- The programme for performing work in the hot cell laboratories,
- The programme for informing public about unusual events on the reactor site,
- The programme for assessment of a request for performing work at the reactor,
- The programme for performing work at the reactor, and
- The instructions for performing work in the hot cell laboratories.

In 2013–2014 two new quality assurance documents were implemented:

- The monitoring programme of operating experience and
- The monitoring programme of operating indicators.

Agency for Radwaste Management

The ARAO has in place an integrated management system that gives the required priority to nuclear safety. The ARAO integrated management system is based on IAEA GS-R-3, ISO 9001:2008 and ISO 14001:2004 requirements. Every year internal audits and management reviews are conducted to ensure the suitability, adequacy and effectiveness of the implemented management system. External management system assessment and certification is conducted according to ISO 9001:2008 and ISO 14001:2004 every year. A recertification audit was carried out in 2013.

Through a process approach, the ARAO continuously improves the effectiveness of its integrated management system to achieve company goals and enhance nuclear safety. Based on our mission, vision and company policy, the main objectives are defined at http://www.arao.si/agencija-arao/strateski-cilji.

Žirovski vrh Uranium Mine

The basic objective of Žirovski vrh Mine d.o.o. is to perform the permanent cessation of uranium ore exploitation and to mitigate the consequences of uranium production at the Žirovski vrh uranium mine. The system of quality control and quality assurance was formally introduced in the Žirovski vrh Mine d.o.o. for the purpose of uranium mine remediation at the end of 2005 (Quality Assurance Manual – 1st edition, December 2005). The Manual was revised following personnel and organisational changes (Quality Assurance Manual – 3rd edition, June 2007).

The Quality Assurance Manual, together with the reference document, contains instructions and procedures with reference to quality control and defines efficient implementation of the responsibility for the operational quality of the company.

Internal audits of individual activities and procedures have been carried out on the basis of the annual programme. On the basis of findings of non-conformities, corrective measures have been introduced to ensure quality during the implementation of the permanent cessation of uranium ore exploitation and the prevention of consequences of mining in the Žirovski vrh uranium mine and the protection of the environment and people against the consequences of the mining operations.

Slovenian Nuclear Safety Administration

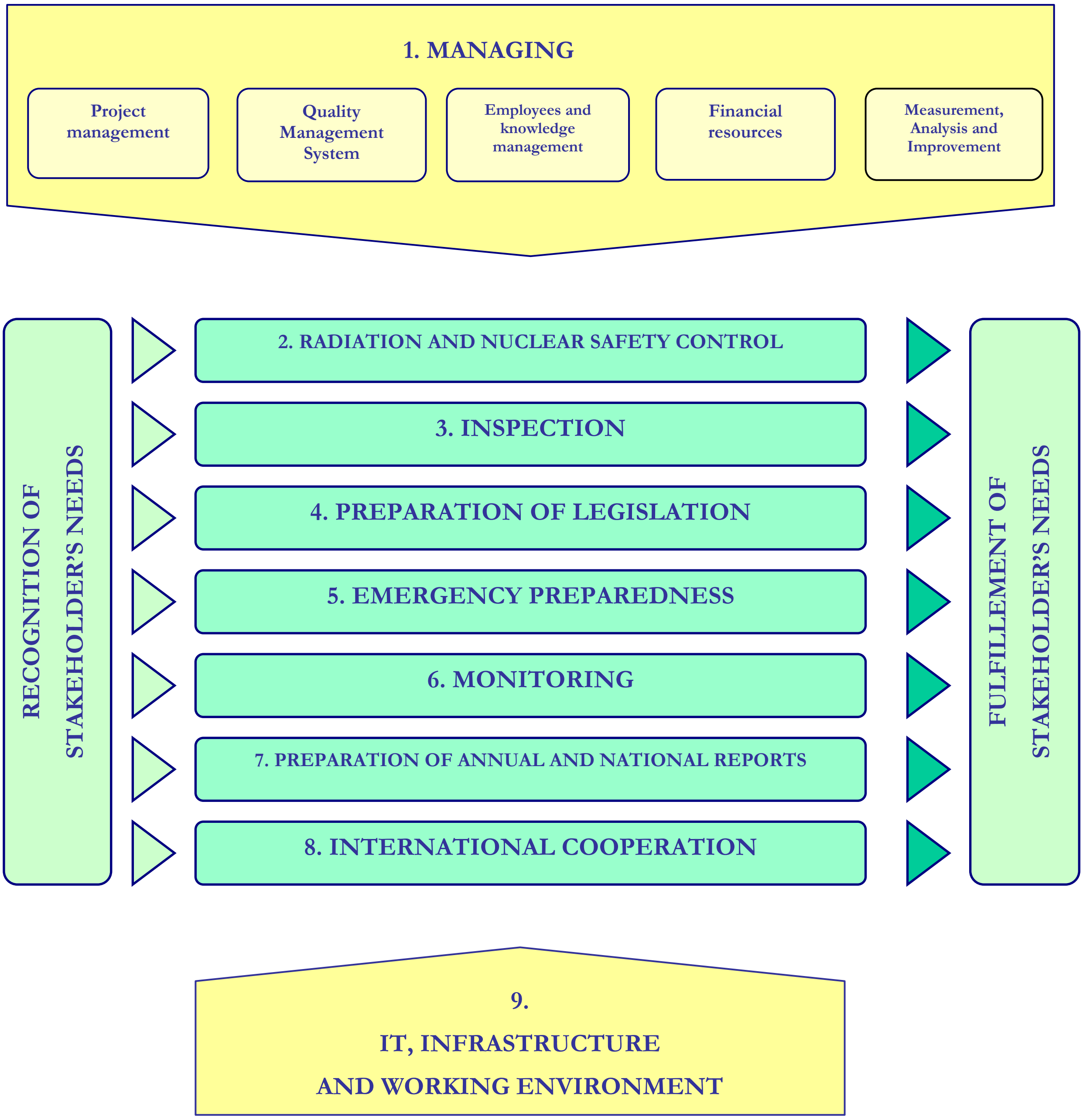
In 2001, the SNSA decided to establish and implement a documented Quality Management System based on the Government Programme on Management for Excellence in State Administration, supported by the IAEA Safety Series No. 50-C/SG-Q, "Quality Assurance for Safety in Nuclear Power Plants and other Nuclear Installations"; Code and Safety Guides Q1–Q14, IAEA, 1996; ISO 9001, "Quality Management Systems – Requirements", Third Edition, 2000; and IAEA-TECDOC-1090, "Quality Assurance within Regulatory Bodies", 1999.

In 2006, the SNSA redefined the management system, taking into consideration the requirements of the new IAEA safety standard "Management System for Facilities and Activities", 2006, and the ISO 9001: 2000 standard.

In December 2007, the certification audit took place and the SNSA successfully acquired the ISO 9001:2000 certificate for the management system. In December 2010, an external recertification audit was carried out in accordance with ISO 9001:2008. The external auditor concluded that the SNSA management system complied with this newer standard.

The aim of the management system is to ensure the implementation of the SNSA mission and achieve its vision while taking into consideration the SNSA values and optimally using available resources. The SNSA management system is based on the process approach. The processes are divided into one management process, seven core processes and one supporting process (Figure 5).

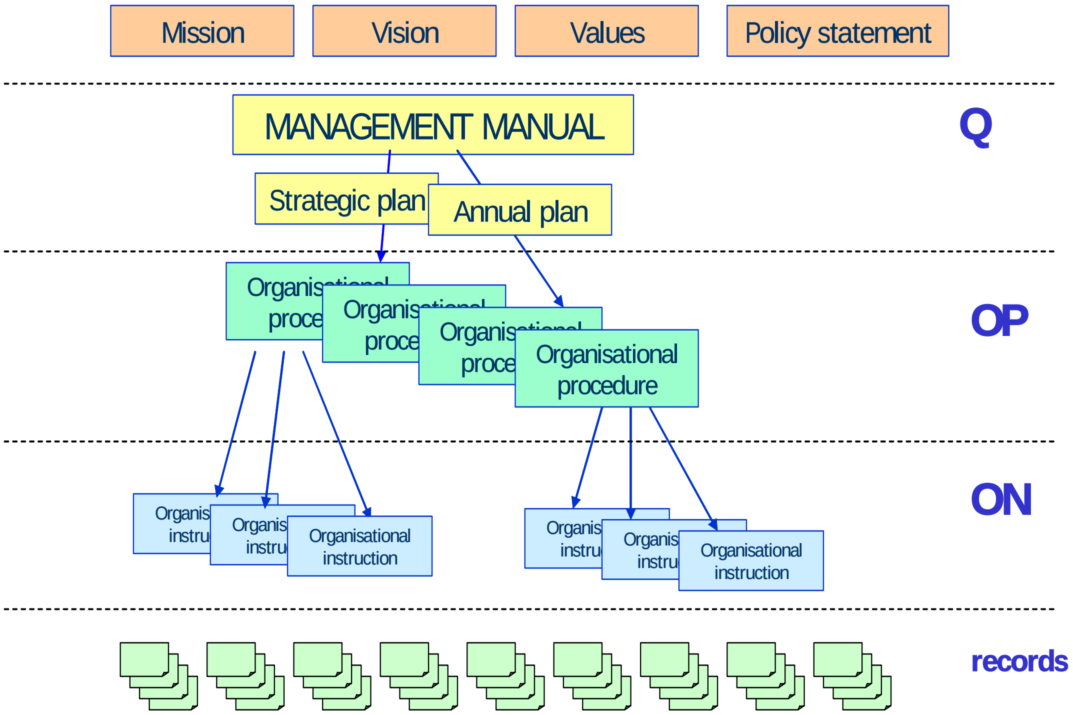
Figure 5: **The SNSA management system**



The SNSA Management System is documented at five levels of management documentation (Figure 6):

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

Figure 6: **SNSA management documentation**



During the period from 2007 to the beginning of 2014, the SNSA management has been ensuring that SNSA employees are familiar with the management system and its vision, mission and values and with management policy. Several internal audits of the SNSA management system have been performed. At the beginning of each calendar year, management reviews of the SNSA management systems are carried out to ensure its continuing suitability, effectiveness and efficiency. Based on findings, deficiencies have been remedied and several improvements to the management system have been introduced.

Due to the lack of financial resources, the SNSA had decided not to pursue a second external recertification audit, which was foreseen for December 2013, and thus lost the certificate of the management system's compliance with ISO 9001:2008. However, even though the SNSA no longer has a formal certificate of compliance of the management system with ISO 9001:2008, it will continue to carry out all activities in accordance with the requirements of this standard and the IAEA standard GS-R-3 and will ensure continuous improvement of the effectiveness and efficiency of its operations.

Article 24: Operational Radiation Protection

1. *Each Contracting Party shall take the appropriate steps to ensure that during the operating lifetime of a spent fuel or radioactive waste management facility:*
   - *(i) the radiation exposure of the workers and the public caused by the facility shall be kept as low as reasonably achievable, economic and social factors being taken into account;*
   - *(ii) no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection; and*
   - *(iii) measures are taken to prevent unplanned and uncontrolled releases of radioactive materials into the environment.*
2. *Each Contracting Party shall take appropriate steps to ensure that discharges shall be limited:*
   - *(i) to keep exposure to radiation as low as reasonably achievable, economic and social factors being taken into account; and*
   - *(ii) so that no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation which have due regard to internationally endorsed standards on radiation protection.*
3. *Each Contracting Party shall take appropriate steps to ensure that during the operating lifetime of a regulated nuclear facility, in the event that an unplanned or uncontrolled release of radioactive materials into the environment occurs, appropriate corrective measures are implemented to control the release and mitigate its effects.*

Legislation, Regulations and Requirements

Radiation protection legislation as applied to nuclear and radiation facilities, including radioactive management, is regulated by the 2002 Act. The subsidiary regulations and decrees, published in the period 2003–2007, are mostly based on Council Directive 96/29/Euratom.

The new subsidiary regulations concerning categorisation of radioactive sources and waste are the Rules on Radioactive Waste and Spent Fuel Management, the Rules on the Use of Radiation Sources and on Activities Involving Radiation, and the Decree on Checking the Radioactivity of Shipments of Scrap Metal. The control of radioactive discharges and monitoring of environmental radioactivity are covered by the Rules on the Monitoring of Radioactivity.

The two competent authorities for radiation protection are the Ministry of Agriculture and the Environment and the Ministry of Health. The Ministry of Agriculture and the Environment is responsible for licensing and inspections in industry (including nuclear facilities), research, education and administration, while the Ministry of Health has adequate competence for sources used in medicine and veterinary care.

According to the 2002 Act, the design, planning, subsequent use and operation of sources and their handling (including handling of radioactive waste) shall be performed in such a way as to ensure that exposure is as low as reasonably achievable (ALARA), taking into account economic and social factors. Radiation protection experts and technical support organisations are authorised to perform, inter alia, consulting, radiation safety assessments and dose calculations. Two such technical support organisations are authorised in Slovenia to perform specific tasks regarding radiation protection of workers and the public, radiological surveillance, monitoring of individuals, monitoring of the radioactivity of the environment, interventions and so on. Five medical institutions are authorised for health surveillance of workers.

The prescribed annual limit of effective dose for workers is 20 mSv and the annual equivalent dose limit for individual organs or tissue of workers is 500 mSv except in the case of eye lenses, where the annual limit is 150 mSv. In general practice, it has been found in the last decade that exposure of 20 mSv per year was exceeded only in a few cases. Since 1999, the Republic of Slovenia has had a computerised registration system of occupational radiation exposure for workers in the country, including outside radiation workers. In total, about 11,900 workers (together with outside radiation workers) have been registered, with an average of around 1,000 workers per year, working in the nuclear fuel cycle.

The general limit for the annual effective dose for a member of the public is 1 mSv. The annual equivalent dose limit for individual organs and tissue of members of the public is 50 mSv. Dose constraints were used for specific cases (the nuclear power plant, research reactor, uranium mine and central storage facility).

1. Steps to ensure that during the operating lifetime of a spent fuel or radioactive waste management facility the radiation exposure of the workers and the public caused by the facility shall be kept as low as reasonably achievable

The radiation protection standards in radioactive waste management facilities and structures and spent fuel storages were already implemented during the licensing procedure. The Report on the Safety Assessment of Exposed Workers against Radiation is required to be submitted as part of the licensing documentation and the licensee shall provide comprehensive measures in order to protect workers and the public as required in Article 23 ("Basis for radiation protection") of the 2002 Act. In order to implement the ALARA principle, these measures give special attention to the protection of pregnant women, breastfeeding women, students and workers employed by contractors, among others. The licence holder for the operation of a nuclear facility (including radioactive waste storage) shall assure its own special organisational unit for radiation protection, this to be responsible for planning and implementing measures for radiation protection. In all other cases the person responsible for radiation protection could be contracted by the licensee. The individual dosimetry is based on the thermo luminescent (TL) dosimetry or optically stimulated luminescent (OSL) and/or monitoring of workplaces, as appropriate. The dosimetric services are authorised by the Ministry of Health.

According to Article 124 of the 2002 Act and the Rules on the Monitoring of Radioactivity, operational monitoring of radioactivity shall be ensured by the radiation facility or nuclear installation to protect the public and the environment. Operational monitoring of radioactivity shall entail:

- monitoring of radioactive discharges from a radiation facility or nuclear installation into the environment;
- monitoring of environmental radioactivity (in the air, surface and underground waters, and the ground) and monitoring of radioactivity of drinking water, foodstuffs and animal feed as the result of radioactive discharges.

Radioactive discharges are monitored and reported at regular intervals (weekly, monthly, quarterly and annually). Public exposure is estimated annually via all exposure pathways. The operator shall also carry out monitoring of the effects of remediation works in the event of an emergency.

2. Steps to ensure that discharges shall be limited to keep exposure to radiation as low as reasonably achievable and that no individual shall be exposed, in normal situations, to radiation doses which exceed national prescriptions for dose limitation, these paying due regard to internationally endorsed standards on radiation protection

The legal bases for the control of discharges in normal operation are the 2002 Act (Article 124, "Operational monitoring of radioactivity"), the Rules on the Monitoring of Radioactivity, and the Rules on Radioactive Waste and Spent Fuel Management.

According to the 2002 Act, two levels of radiation monitoring ensure that no individual is exposed to radiation above the prescribed dose limits in normal situations.

(a) Monitoring of the discharges from radiation facilities and nuclear installations

Control of radioactive discharges into the environment from nuclear installations has been carried out regularly by the operator. Effectively independent measurements have been provided by the technical support organisations. To a much lesser extent, clearly independent supervision is carried out by the SNSA as the regulatory authority. The discharge limits for nuclear installations were set by the SNSA in relation to the dose constraints. Monitoring of radioactive discharges from nuclear installations and radiation facilities in the Republic of Slovenia started in the early 1980s, with extensive programmes at the Krško NPP (1981), the Žirovski vrh Uranium Mine (1985), the IJS Reactor Infrastructure Centre (1986) and the Central Storage Facility for Radioactive Waste in Brinje (1986). Radioactive discharges from hospitals with nuclear medicine departments are monitored at times to verify if annual effective doses for reference individuals in the environment are below 10 μSv. Rough estimates of discharged activities for very short-lived isotopes are made every year, based on the purchased and applied activity of radioisotopes. The Institute of Oncology regularly orders measurements of radioactivity in its decay tanks by the approved radiation protection expert. When specific activity decreases below authorised limits, liquid waste is discharged to the municipal sewerage system. The Institute keeps all records and reports.

(b) Environmental monitoring of radioactivity

Monitoring of environmental radioactive contamination in the surroundings of nuclear facilities has been performed exclusively by the authorised technical support organisations. Radiation exposures of representative members of the population have been estimated based on measured data and modelling.

Monitoring of radioactivity in the environment is performed in accordance with the Rules on the Monitoring of Radioactivity. The samples are taken from the environment – air, water and soil –, from underground and drinking water, and from foodstuffs and animal feed and are then analysed. The exposure to the public as a result of environmental contamination due to the operation of facilities in the nuclear fuel cycle is estimated and compared with the dose constraints and limits.

An automatic radiation monitoring system in the Republic of Slovenia was developed soon after the Chernobyl accident. At the moment, the entire system comprises on-line data on dose-rate measurements (75 stations) and aerosol radioactivity measurements (3 stations).

During the operating lifetime of the nuclear facility, in the event of an unplanned or uncontrolled release of radioactive materials into the environment, appropriate corrective measures are ensured to control the release and mitigate its effects. See also "Article 25: Emergency Preparedness".

During the last few years, the SNSA has established a comprehensive database on past discharges and environmental radioactivity measurements. The objective of this computerised database is to analyse and visualise the statuses and trends of historical records. All these data could be used as the input data for modelling the radiation exposure of a representative person of a reference group(s).

Measures Taken by Licence Holders

Krško NPP

(a) Radiation Protection

The Radiological Protection Unit at the Krško NPP is organised according to the 2002 Act in order to implement radiation protection measures such as measurements, assessment and keeping records of received effective doses for all workers who have access to the controlled area, regardless of whether they are members of the NPP staff or contractors, inspectors or visitors. Radiation protection related to the management of radioactive waste at the plant site is one of the most important tasks of the Radiological Protection Unit. This task is in compliance with the general radiation protection measures established in the plant.

From the viewpoint of radiological protection, the power plant area comprises the controlled area and the supervised area. The controlled area (the area under constant radiological surveillance) includes the reactor building, the fuel handling building, the auxiliary building, a part of the intermediate building, the primary laboratory, hot machine workshops, the decontamination area, the building for decontamination, and the areas for processing and storage of radioactive waste.

In the controlled area – where irradiation and contamination is highly probable – the Krško NPP staff and contractors must be equipped with regular protection equipment, electronic alarm dosimeters and optically stimulated luminescent personal dosimeters (OSLs). Internal contamination is measured using a whole-body counter before and after work for all workers working in the radiological controlled areas where there is a risk of internal contamination (i.e. during annual outages or major maintenance works).

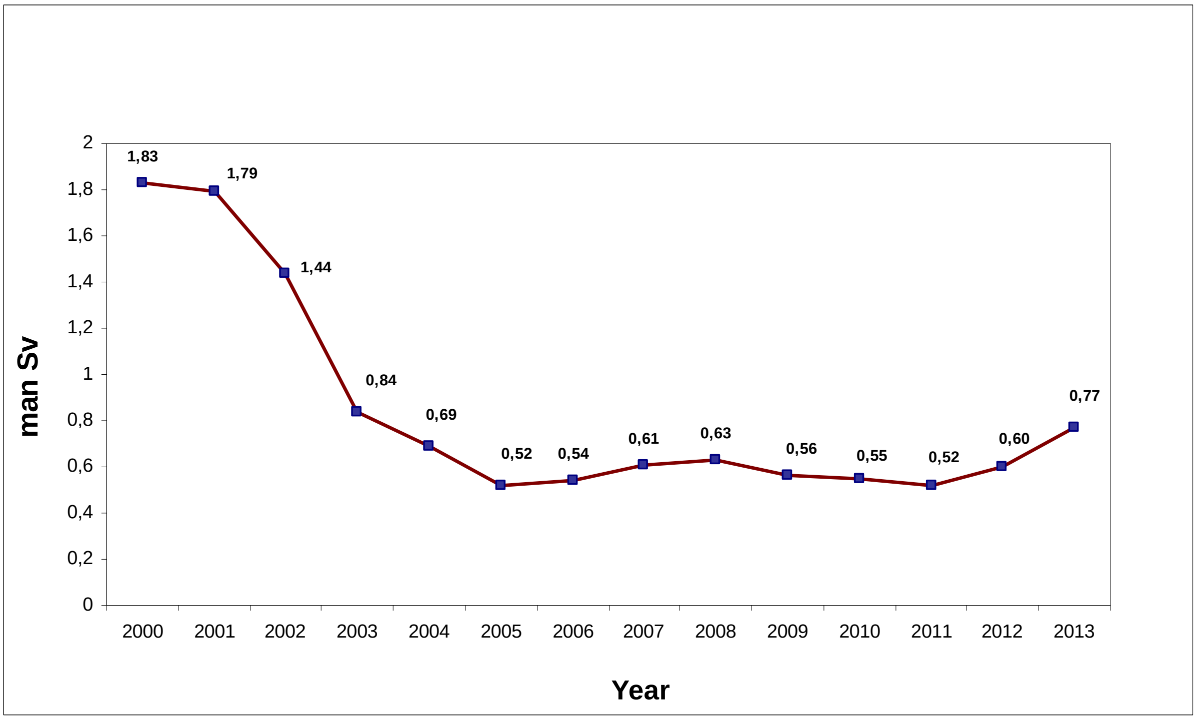
The ALARA Committee of the plant is an advisory body which reports to the General Manager on radiological protection trends of radiation impact on the environment and advises on countermeasures during accidents. The committee is responsible for adopting and reviewing the ALARA programmes. The reduction of personal and collective doses is the primary objective when preparing procedures for spent fuel management. During the ALARA planning procedure, radiological conditions are analysed, personal protection equipment defined and radiological control determined, so all key elements are taken into account.

In 2004, the SNSA approved the Radiological Effluent Technical Specifications as a separate part of the Technical Specification for Operation of the Krško NPP. The Monitoring Programme covers the measurements of liquid and gaseous discharges, measurements of activity in plant systems, the inventory of the onsite radioactive waste storage facility, environmental radioactivity and meteorological measurements, and preparedness for radiation measurements in cases of emergency. The operator is obliged to notify the SNSA in advance about all gaseous discharges into the atmosphere.

Organisational arrangements for controlling the production and release of radioactive discharges and waste are in place. The existing top-level plant policy and waste management programme keep the radiological impact from radioactive discharges and waste within the authorised limits and as low as reasonably achievable. Arrangements for the minimisation of radioactive waste generation are in place. All relevant elements regarding waste minimisation are taken into consideration (the fuel integrity programme, reduction of leakages, the decontamination process, segregation practices, etc.).

The collective dose in 2013 was 1.35 manSv. The three-year average is 0.77 manSv and the trend is illustrated in Figure 7. The maximum individual dose in 2013 was 10.95 mSv, and the average dose per person was 0.86 mSv. From 2000 onwards, following the modernisation of the plant and the replacement of steam generators, the annual collective doses show a decreasing trend. The collective dose in 2013 increased due to extended outage activities (replacement of RTD bypass valves).

Figure 7: **Collective radiation exposure – 3 year rolling average at the Krško NPP in the period 2000–2013**



In 2013 the collective effective dose of workers involved in the processing of radioactive waste in the Krško NPP was 8.29 man mSv, which represents 0.6% of the total collective dose. These figures are lower than before. The maximum individual dose due to waste management was 2.7 mSv in 2011, 3.8 mSv in 2012 and 3.7 mSv in 2013.

(b) Liquid and Gaseous Discharges

In accordance with the licence for operation of the Krško NPP, the total dose constraints for a member of the public are as follows:

- The effective dose constraint at 500 m distance from the reactor and beyond – for doses due to liquid and gaseous radioactivity releases during normal operation – is less than or equal to 50 μSv/year.
- The radiation dose constraint from the radioactive waste storage building and the reactor is less than or equal to 200 μSv at the site fence.

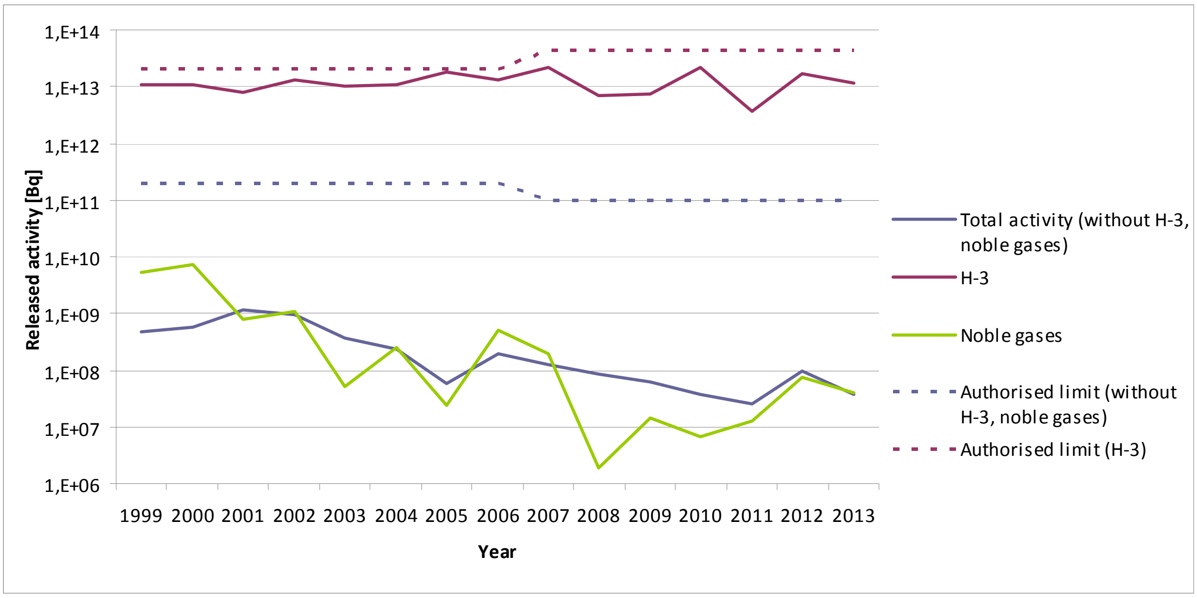
The limits of radioactive discharges into the environment were initially authorised in the Operating Licence of the Krško NPP, issued on 6 February 1984. In 2007 the operating limits were revised and slightly modified in order to assure compliance with the form of Standard Radiological Effluent Controls for Pressurised Water Reactors. The modification was made in order to include the corresponding effective dose as an additional parameter for the control of plant operation performance. For the release of noble gases only, the annual limit of activity is replaced by a dose constraint. In addition, to assure the operation of radioactive waste processing systems, a threshold of activity concentration for monthly projected liquid releases and a dose threshold for projected gaseous releases have been introduced.

Following the power up-rate and transition to an 18-month fuel cycle, the limit for tritium release was raised from 20 to 45 TBq a year. At the same time, the limit for beta/gamma emitters has been reduced from 80 to 40 GBq in a calendar quarter and from 200 to 100 GBq a year. The new limits enable operating flexibility concerning higher tritium releases. The production of tritium in the reactor coolant system is higher due to higher enrichment of the fuel and higher boron concentration in the coolant. The effective dose to a member of the public due to tritium releases is assessed to be less than 0.1 μSv per year for the maximum level of activity.

The regular control of radioactive discharges was set out in the technical specifications for plant operation and comprises measurements of concentrations and flow rates of gaseous and liquid discharges at the source. In addition, dose rates of external radiation and the radioactivity in the air are measured on-site. The competent authorities are regularly informed by the Krško NPP about discharges of radioactive materials into the environment on a daily, weekly, monthly, quarterly and yearly basis.

The liquid radioactive discharges (Figure 8) are released into the River Sava via the Essential Service Water System outlet upstream of the dam. The dominant radionuclides in the liquid discharges are ^{3}H, ^{58}Co, ^{60}Co and some dissolved noble gases. The activities of ^{134}Cs, ^{137}Cs, ^{59}Fe and ^{125}Sb are up to two to three orders of magnitude lower. The main contribution to the dose originates from the radioisotopes of caesium and cobalt. The dose to the reference group due to liquid discharges is assessed to be below 0.1 μSv per year.

Figure 8: **Radioactive liquid discharges from the Krško NPP, in 1999-2013**

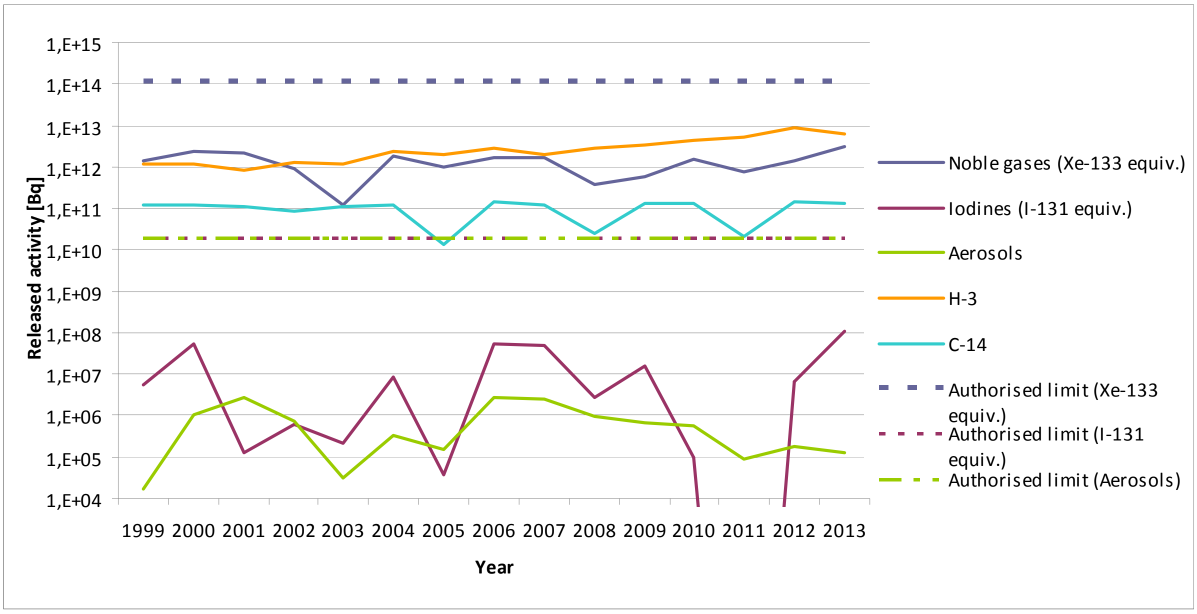


Notes:

- the new limit for fission and activation products is 100 GBq (since 2007);
- the new limit for ^{3}H is 45 TBq (since 2007).

Radioactive gases (Figure 9) from the Krško NPP are released into the atmosphere mainly from the reactor building and fuel handling building ventilation system via the common plant vent. The radiation monitoring system continuously measures and monitors the concentrations of individual radioactive elements at both discharge points. The maximum calculated dose due to inhalation and external radiation caused by gaseous releases at a 500 metres distance from the reactor was 1.21 µSv in 2011, 2.07 µSv in 2012 and 1.51 µSv in 2013.

Figure 9: **Radioactive gaseous discharges from the Krško NPP, 1999–2013**



Notes:

- ^{133}Xe equivalent was effective until 2006; since 2007 only total annual dose limit of 50 µSv has been introduced;
- The released activity of ^{131}I for 2011 was less than the limit of detection.

Conservatively estimated individual exposures for members of the public are based on directly measured discharge values and on model calculations. This amounts to a value of effective dose usually around 0.1 µSv/year for an adult. Dose assessment showed that exposures to members of reference groups have been well below the regulatory limit of 50 µSv/year and less than 0.1% of exposure due to natural radiation.

Central Storage Facility for Radioactive Waste in Brinje

(a) Radiation Protection

Radiation protection in the Central Storage Facility for Radioactive Waste in Brinje includes occupational radiation protection and monitoring of radioactivity in the environment of the storage site (protection of the public).

Radioactive waste management and other activities in the storage facility are performed according to set procedures. For non-regular tasks, the radiation exposure of workers is estimated in advance and optimised in accordance with ALARA procedures. All workers are included in monthly individual dose monitoring performed by the authorised dosimetry service. The radiation exposure data for workers in the Central Storage Facility due to radioactive waste management activities from 2005 to 2013 are given in Table 2.

Table 2: **Radiation exposure of workers at the Central Storage Facility due to radioactive waste management, 2005–2013**

Year	Number of workers	Average [mSv]	Maximum individual dose [mSv]	Collective dose [man mSv]
2005*	20	0.199	1.68	4.07
2006*	15	0.045	0.35	0.9
2007*	27	0.046	0.38	1.23
2008*	21	0.175	1.420	3.68
2009	9	0.032	0.147	0.284
2010	10	0.011	0.040	0.105
2011	9	0.021	0.073	0.192
2012	9	0.014	0.065	0.127
2013	9	0.033	0.092	0.296

Note: * staff of the ARAO and outside workers

Monitoring of workplaces is performed regularly. The measurements include: surveillance of gamma and neutron dose-rate within the Central Storage Facility and determination of gamma and neutron radiation field, surface and air contamination, radon and radon equilibrium equivalent concentrations, and gamma emitters in the samples of waste water.

The characterisation of historical radioactive waste in the Central Storage Facility in Brinje was carried out in 2005 and 2008. During the detailed characterisation process, all institutional LILW which was stored at the storage facility was characterised, sorted, dismantled and re-packed according to the valid waste acceptance criteria for the facility. The non-radioactive waste and waste components were discarded from the facility and the radioactive waste inventory database was updated. Based on the results of the characterisation, rearrangement of packages inside the facility was carried out. After carrying out the repackaging activities, the level of external radiation from the Central Storage Facility was lowered substantially.

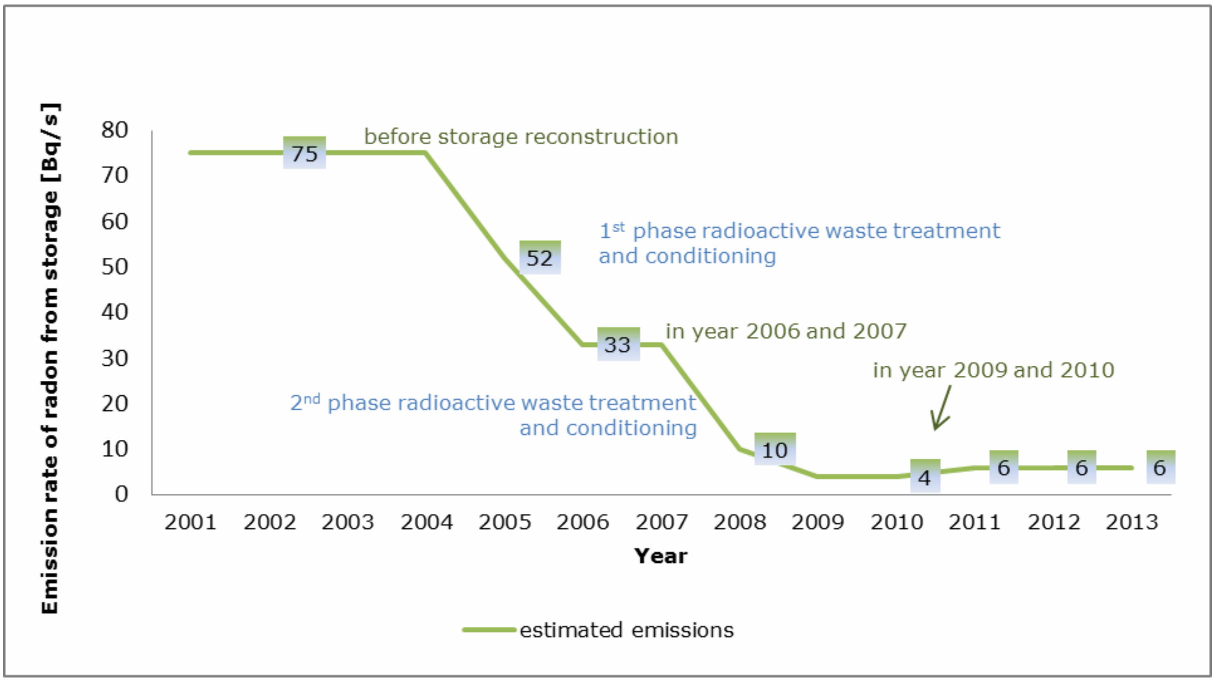
(b) Liquid and Gaseous Discharges

The scope of monitoring covers emissions (measurements of gaseous and liquid discharges) and environmental concentrations of radioactivity. The average emission rate of radon into the environment was 6 Bq/s in 2013. This amounts to a yearly release of 0.2 GBq. There were no liquid discharges from the storage according to measurement data and modelling. After treatment and conditioning of historical waste in 2005 and 2008, the emission rate of radon from the Central Storage Facility was lowered (Figure 10).

In the assessment of dose to the public, two pathways were considered: radon progeny inhalation and external exposure. External exposure due to gamma radiation is based on the results of TLD measurements. Several reference groups have been identified. The annual effective dose for the most exposed representative of the reference group staying in the vicinity of the Central Storage Facility site for a part of his routine work does not exceed 10 µSv/year. The employees working in the nearby research institute facilities receive about 0.9 µSv/year. The annual effective dose received by a farmer who occasionally works in the field near the site is estimated to be around 0.02 µSv.

Conservatively estimated radiation exposure of the public due to the operation of the Central Storage Facility for Radioactive Waste in Brinje is far below the dose constraint of 0.1 mSv/year set in the operational licence for the Central Storage Facility issued by the SNSA in April 2008.

Figure 10: **Emission rate of radon from the Central Storage Facility in the period 2001–2013**



Jožef Stefan Institute Reactor Infrastructure Centre

(a) Radiation Protection

Radiation protection at the Jožef Stefan Institute Research Reactor Infrastructure Centre is implemented and performed by the Radiation Protection Service of the Institute. Altogether 27 persons from the Reactor Department, from the Service and from the Radiochemical Laboratory were exposed to ionising radiation, with an average annual dose of 0.013 mSv in 2013 (not taking into account the neutron dose). The collective annual dose in 2013 was 0.512 man mSv.

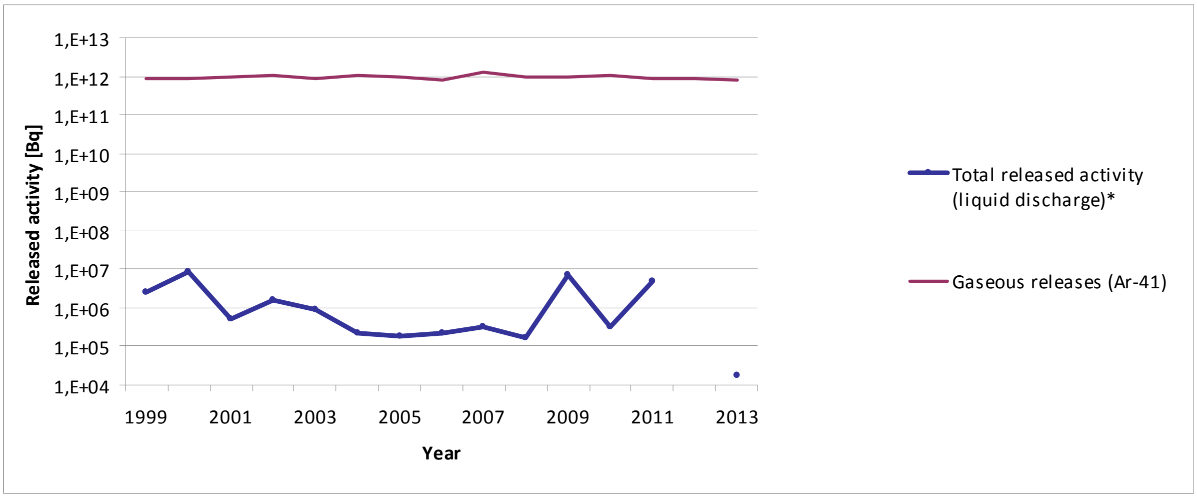
Table 3: **Radiation exposure of workers at the Jožef Stefan Institute Reactor Infrastructure Centre due to radiation practices and radioactive waste management, 2004–2013**

Year	Number of workers	Average [mSv]	Maximum individual dose [mSv]	Collective dose [man mSv]
2004	25	0.039	0.159	0.974
2005	29	0.046	0.222	1.343
2006	27	0.025	0.165	0.683
2007	28	0.034	0.197	0.964
2008	41	0.084	0.861	3.449
2009	29	0.005	0.040	0.147
2010	26	0.008	0.044	0.203
2011	28	0.004	0.032	0.101
2012	29	0.007	0.036	0.189
2013	27	0.019	0.118	0.512

(b) Liquid and Gaseous Discharges

The liquid discharges originated mostly from the radiochemical laboratory using reactor activation products. The annual reactor discharge of ^{41}Ar is proportional to the time of reactor operation and is estimated to be typically about 1 TBq (0.8 TBq in 2013).

Figure 11: **Discharges from the IJS Reactor Infrastructure Centre in the period 2011–2013**



Note: * Liquid discharges for 2012 were less than the limit of detection.

For the exposure of the public only two exposure pathways were considered: external exposure due to ^{41}Ar immersion and ingestion of contaminated released water. In 2013 the total dose received by the representative person of the reference group was estimated to be in the order of 1 µSv/year (0.02 µSv/year for a farmer at a distance of 100 m and 0.52 µSv/year for a permanent resident living in a 0.5-km-distant village). The authorised dose limit for the operation of the research reactor is 50 µSv/year.

Žirovski vrh Uranium Mine

(a) Radiation Protection

Within the scope of decommissioning, the Radiological Protection Unit of Žirovski vrh Mine d.o.o. is responsible for tasks related to radiation protection of workers and the general population.

Measuring occupational exposure to ionising radiation is based on time records for the individual worker relating to their work at different workplaces and on the following workplace measurements:

- measurements of radon and the potential alpha energy of radon progeny in the air;
- measurements of long-lived alpha activity in the air (caused by remediation works at the mine waste piles); and
- measurements of external radiation (measured with TLDs on a quarterly basis).

The main contribution to occupational exposure comes from the radon and radon progeny.

Table 4: **Radiation exposure of workers at the Žirovski vrh Uranium Mine due to radioactive waste management, 1996–2013**

Year	Number of workers**	Average [mSv]	Maximum individual dose [mSv]	Collective dose [man Sv]
1989*	350	5.0	18.00	1.75
1996	55	0.9	2.64	0.05
1997	70	1.3	3.40	0.09
1998	65	1.5	2.97	0.10
1999	60	1.0	1.89	0.06
2000	61	< 1.0	1.95	0.05
2001	64	< 1.3	2.95	0.08
2002	103	1.5	4.58	0.15
2003	133	1.8	5.39	0.24
2004	103	2.1	5.93	0.22
2005	87	0.99	4.60	0.09

Year	Number of workers**	Average [mSv]	Maximum individual dose [mSv]	Collective dose [man Sv]
2006	64	0.34	0.77	0.02
2007	95	0.17	0.40	0.02
2008	102	0.22	1.50	0.03
2009	38	0.34	0.47	0.008
2010	7	0.57	1.32	0.004
2011	7	0.52	1.47	0.0036
2012	8	0.12	0.28	0.0007
2013	9	0.05	0.10	0.0004

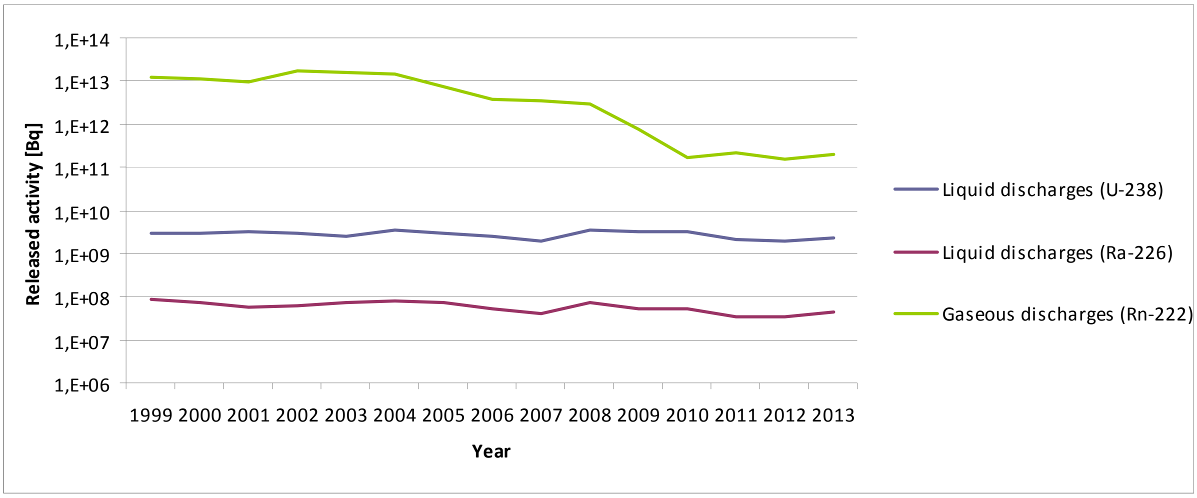
Notes:
* in the period of regular operation; 1989–2001 effective equivalent dose; 2002–2007 effective dose
** staff and contractors (outside workers)

(b) Liquid and Gaseous Discharges

Monitoring of radioactive discharges to the environment was regularly performed during all operational phases (1985–1990) and in the post-operational phase (from 1991 onwards).

The permanent discharges of dissolved long-lived radionuclides in percolating and run-off water from disposal sites and in mine water have been slowing down due to progressive remediation. It is expected that future fluctuations will depend mainly on weather conditions in individual years. Radon release estimation is based on field measurements of radon exhalation rate (Figure 12).

Figure 12: **Radioactive discharges at the Žirovski vrh Uranium Mine in the period 1999–2013**



The impact of the mine discharges extends over an area inhabited by about 330 people. The dose assessment was made for a representative of each reference population group: a 1-year-old child, a 10-year-old child and an adult resident older than 18 years. Inhalation of radon and its progeny is the main contributing factor to the public exposure caused by mining activities. In 2013, the exposure of an adult member of the public was estimated to be 0.09 mSv/year, of which radon and its short-lived products contributed 0.06 mSv/year.

Nuclear Medicine Departments

(a) Radiation Protection

At the Institute of Oncology, occupational exposure is monitored through regular individual monitoring of external exposure and workplace monitoring. The annual dose of the majority of workers from the Institute of Oncology did not exceed the value of 1 mSv in the period 2001–2013. Individual radiological engineers and radiopharmacists, mainly those handling the ^{18}F isotope, receive a higher dose, but still below 5 mSv. The maximum annual dose in 2013 was 4.1 mSv. No worker has exceeded the annual limit of 20 mSv during the past 14 years. All the above-mentioned values reflect the total exposures and include exposure during handling of radioactive waste and its storage. No special tasks regarding radioactive waste are performed and no separate doses related to radioactive waste management are recorded. This is due to the fact that collective doses are very low (less than a few percent of authorized limit of 1 man mSv per year).

Occupational exposure at the University Medical Centre's Department for Nuclear Medicine is monitored through regular individual monitoring and workplace monitoring. All staff are under dosimetric control. In 2013, the effective dose of 81% of workers did not exceed 1 mSv and exposures between 1 and 2 mSv were measured for 19% of workers. The maximum annual dose, of 1.9 mSv, was recorded for a medical nurse from the Section for Thyroid Diseases. The quoted values are the result of overall individual exposures, i.e. not related only to waste management.

Management of radioactive waste at nuclear medicine departments is performed according to set procedures. Personal protection equipment is used where appropriate. Intermediate local storages for waste materials with short-lived contamination are in place elsewhere.

(b) Liquid and Gaseous Discharges

The Institute of Oncology has a system of decay storage tanks in order to control the radioactivity released. The faecal sludge is released into the hospital sewerage system only after a defined period (about four months) required for the activity of the radionuclides to decrease below the prescribed limit.

Liquid discharges from the University Medical Centre's Department for Nuclear Medicine are monitored from time to time (on average every 5–10 years) and are estimated from the administered activities.

Five other small departments of nuclear medicine in the country deal with essentially lower activities of radiopharmaceuticals. Patients are dismissed from hospitals after iodine ^{131}I therapy and no special decay tanks for radioactive discharges are in place, so this kind of discharges are estimated in the same way as above.

In total, less than 0.3 TBq of ^{131}I is released annually into the environment.

Article 25: Emergency Preparedness

1. *Each Contracting Party shall ensure that before and during operation of a spent fuel or radioactive waste management facility there are appropriate on-site and, if necessary, off-site emergency plans. Such emergency plans should be tested at an appropriate frequency.*
2. *Each Contracting Party shall take the appropriate steps for the preparation and testing of emergency plans for its territory insofar as it is likely to be affected in the event of a radiological emergency at a spent fuel or radioactive waste management facility in the vicinity of its territory.*

Regulatory Requirements

The nuclear emergency preparedness and response in Slovenia is regulated in the latest consolidated version of the Protection against Natural and Other Disasters Act and the 2002 Act. There are two authorities with responsibilities and competencies to regulate and supervise emergency preparedness at nuclear facilities. The Administration for Civil Protection and Disaster Relief is responsible for population protection during a nuclear accident and for the organisation of civil protection units at nuclear installations. The SNSA is responsible for regulatory control over on-site procedures and measures related to the on-site emergency plan. Their roles were described in more detail in the First National Report.

Concerning safety, the 2002 Act stipulates that every applicant shall submit, together with the application for a construction permit for a nuclear facility, an operator's emergency plan for the event of a nuclear accident. During trial operation and operation of the nuclear facility, the radiological emergency plan shall be updated, including all changes made during the construction and testing period. The on-site radiological emergency response plan is a constituent element of the safety analysis report.

The 2002 Act provisions mostly focus on intervention measures in the event of an emergency. According to these provisions, the operator needs to be capable of classifying accidents, assessing the consequences of such events and proposing remedial measures. In the operator's emergency plan, the intervention measures should be planned upon the emergency class declared. The operator shall provide to emergency planners all the requested data which it has available. The operator shall maintain emergency preparedness and provide responses as stipulated in the emergency plan. The prompt notification, without undue delay, of any such event is required, and the public needs to be informed about important facts in the emergency plans.

The Regulation on Elaboration of Emergency Plans (Official Gazette of the Republic of Slovenia, Nos. 3/2002 and 17/2006) stipulates that the on-site nuclear emergency plan should be coordinated at the national and local levels and the nuclear emergency plans should be revised at least every five years. Emergency plans are public documents and should be presented to the public within 90 days of their adoption. In 2006, the above-mentioned regulation was supplemented with the requirement which specifies a set of data relevant for the emergency to be supplied to the authorities by companies which are obliged to have an on-site emergency plan.

Overall National Emergency Preparedness Scheme and Off-Site Emergency Plans

The responsibilities and competencies for emergency planning and maintaining emergency preparedness for an accident at a nuclear facility are specified at four levels: operator, local, regional and national. The state is responsible for the local and national radiological emergency response planning and maintenance of the radiological response plans.

The last update of National Nuclear and Radiological Emergency Response Plan (hereinafter National Plan) was in 2010. Besides a possible accident at the Krško NPP, the plan also covers accidents at other nuclear and radiation facilities in the Republic of Slovenia, nuclear or radiological accidents abroad with potential impact on Slovenia, and other radiological accidents involving sources of ionising radiation.

At the end of 2013, an inter-ministerial committee for emergency planning met in relation to the establishing of two working groups for revision of the National Plan and for solving emergency monitoring issues.

A new arrangement of pre-distributing KI pills in a 10-km zone around the NPP, based on the Rules on the Use of Potassium Iodine issued in 2010, was implemented in 2013.

The IJS has a standby Ecological Laboratory with Mobile Unit (ELME), which is a special unit for radiological and emergency response at the national level. It would assist in any radiological emergency. It also performs radiation measurements and interventions in cases of lost or dispersed radioactive materials. Since 2007, the mobile unit of the Institute of Occupational Health has also actively participated in emergency drills in field measurements and testing of radiation monitoring preparedness in the vicinity of the Krško NPP.

Every year there are field radiological measurement exercises for mobile units on routes in the vicinity of the Krško NPP. The field radiological measurements include atmosphere sampling, dose rate and contamination measurements, in-situ measurements and gamma spectrometry of samples. The mobile unit of the Krško NPP, the mobile unit of the Institute of Occupational Safety and ELME all participate in these exercises.

Recently, there has been a decrease of exercising for mobile units. In 2013, there was one joint exercise of the mobile units.

On-site Radiological Emergency Response Plan

Krško NPP

The Krško NPP has competency and sole responsibility for on-site emergency preparedness and response and maintains its on-site radiological emergency response plan (RERP). The on-site RERP is harmonised with the national RERP, which was upgraded in 2010 and updated in 2013.

The Krško NPP's RERP considers the IAEA's recommendations, US 10 CFR 47 NUREG-0654 requirements and post-Fukushima lessons learned. It also covers the spent fuel pool and on-site radwaste facilities.

The objectives of the Krško NPP's RERP are:

- identification and evaluation of the type and classification of an emergency, including beyond design basis accidents;
- taking on-site emergency measures and procedures to assure protection of health and safety of plant personnel and members of the public in the surrounding area;
- identification of the on-site emergency response organisation and responsibilities for the overall command and co-ordination between the on-site and the off-site particular emergency measures;
- identification of additional plant support required in the event of emergency from the off-site support organisation, the Civil Protection Headquarters of Slovenia and other competent authorities;
- identification of emergency response facilities, equipment, communications, protective and other means of managing emergencies;
- taking on-site recovery measures to manage or mitigate the consequences of an emergency and to assure conditions for recovery;
- providing a basis for maintaining on-site emergency preparedness; and
- providing co-ordination between the Krško NPP and off-site local, regional and state authorities to assure effective emergency planning and preparedness, including public information about protective measures.

Jožef Stefan Institute Reactor Infrastructure Centre

The TRIGA Mark II research reactor has an on-site Radiological Emergency Response Plan. Off-site radiological emergencies are covered in the National Radiological Emergency Response Plan. Urgent protective actions for the off-site population are not expected. According to the safety analysis report, the most severe possible accident (total loss of all reactor coolant) would not cause a core meltdown, so no significant radioactive release into the environment is expected even in the worst-case scenario.

The emergency procedures are subject to internal and external verification and approval. The emergency procedures include reactor status data, identification of an emergency situation, description of appropriate actions, raising the alarm, reporting, informing, and responsibilities for the following internal and external emergency events:

- radiological reactor accidents (loss of reactor shielding – primary water, release of radioactivity in the controlled area, release of radioactivity outside the controlled area);
- non-radiological accidents or events (fire in the reactor building, earthquake, sabotage and unauthorised access, riots and demonstrations, off-site chemical emergency due to an accident in the chemical plant in the vicinity of the Reactor Infrastructure Centre).

The most severe operational accident (loss of coolant in the pool) would not significantly affect the spent fuel if it was stored in the reactor pool (since 1999 there has been no spent fuel). The off-site consequences of the gap release from damaged spent fuel elements are negligible.

Central Storage Facility for Radioactive Waste in Brinje

The ARAO has responsibility for on-site emergency preparedness and response and maintains the on-site radiological emergency response plan. The emergency response plan for the Central Storage Facility for Radioactive Waste in Brinje is designed for events identified in the safety assessment as relevant emergency events related to the operation of the facility and handling of radioactive waste. The plan defines the competencies and responsibilities of the personnel responsible for emergency preparedness and the response to the emergency situation. The document will be updated and upgraded in 2014.

Žirovski vrh Uranium Mine

Radiological emergency situations are not expected at either the Jazbec or Boršt disposal sites. As part of the monitoring programme, the surfaces of the Jazbec mine waste pile and the Boršt mill tailings site are inspected regularly, and after heavy rain and earthquakes additional inspections are conducted. The rate of sliding of the base of the Boršt mill tailings site is measured in real time, using a GPS system, at control points on the mill tailings.

Slovenian Nuclear Safety Administration

The SNSA Emergency Plan is harmonised with the National Radiological Emergency Response Plan. It consists of procedures for the SNSA emergency team.

The SNSA emergency team has two subgroups in addition to communicators and other supporting positions – one for analysing any nuclear accident and the other for dose assessment. The team has 19 positions and works in 12-hour shifts.

The SNSA's main role during a radiation emergency is to recommend protective measures for the population to the Slovenian civil protection commander. In addition, the SNSA issues press releases for the public and responds to the media and to public inquires.

For primary communication between major organisations responding to a radiation emergency, a special on-line communication system which is provided by the SNSA – MKSID – is used.

Exercises

In accordance with the rolling programme of the national commission, one national exercise must be organised every three years.

The SNSA emergency response is assured by regular training for the members of emergency expert groups and verification response teams and through exercises, regular testing of equipment and participation in international activities. Each year, the SNSA also actively participates in annual Krško NPP exercises and conducts several internal exercises.

The emergency response training, drills and exercises are an integral part of the Krško NPP radiological emergency preparedness programme. It incorporates the human element with emergency response facilities, emergency equipment and emergency procedures to develop and maintain key emergency response skills and assure the readiness and efficiency of its emergency preparedness and response team.

The programme is based on a routine annual schedule of the activities and includes the plant personnel, plant contractors and off-site support organisations.

Emergency response training consists of initial, continuing (requalification) and specialised (proficiency) emergency response training.

The Krško NPP carries out the following emergency response drills:

- facilities and on-site emergency response organisation activation;
- implementation of severe accident strategies with mobile equipment;
- evacuation and accountability;
- post-accident sampling;
- off-site field monitoring, dose assessment and off-site protective measures recommendations;
- on-site radiation protection and radiological control;
- fire-fighting;
- first aid and medical response; and
- emergency notifications.

The objectives of the drills are verified in an annual on-site integrated exercise. The exercises are prepared by the Exercise Organisation Group, which is also in charge of preparation of the formal scenarios. Within a five-year period, all emergency response segments are tested. The exercises are prepared and conducted regularly using the plant's full-scope simulator, which is also used for the Main Control Room (MCR) simulation. The Krško NPP emergency support organisations and local and governmental agencies also participate in integrated exercises. The last exercise of this kind was conducted in June 2013. A large, two-day national integrated exercise was carried out in October 2008 and the next one is planned for 2014.

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

The Professional Fire Brigade of Ljubljana and the ARAO regularly organise training and practical exercises for the professional fire-fighters at the Central Storage Facility. The Professional Fire Brigade of Ljubljana and the ARAO have good and regular contacts. After adoption of Emergency Response Plan for Central Storage Facility, practical exercise was organized for professional fire-fighters. Local voluntary firefighters were also included. Next practical exercise is planned to be organized after adoption of revision of Emergency Response Plan. In the meantime the upgrade of theoretical training and information exchange is organized annually. The ARAO maintains the required equipment and takes care for professional dosimetry.

International Agreements and International Projects

Slovenia is a party to the Convention on Early Notification of a Nuclear Accident and to the Convention on Assistance in Case of a Nuclear Accident or Radiological Emergency. Slovenia has also signed bilateral agreements with Austria, Croatia, Hungary and Italy on the early exchange of information in the event of a radiological emergency.

Article 26: Decommissioning

Each Contracting Party shall take the appropriate steps to ensure the safety of decommissioning of a nuclear facility. Such steps shall ensure that:

(i) qualified staff and adequate financial resources are available,

(ii) the provisions of Article 24 with respect to operational radiation protection, discharges and unplanned and uncontrolled releases are applied,

(iii) the provisions of Article 25 with respect to emergency preparedness are applied,

(iv) records of information important to decommissioning are kept.

In the Republic of Slovenia there is no nuclear facility in the process of decommissioning (there is ongoing remediation of the two waste disposal sites at the former uranium mine at Žirovski vrh, but these are radiation facilities). In order to assess the financial contribution to the decommissioning fund, the Decommissioning Plan for the Krško NPP is being revised.

Krško NPP

The Agreement between Slovenia and Croatia on the Krško NPP of 2003 requires the preparation of a Decommissioning Plan for the Krško NPP by the Slovenian and Croatian agencies for the management of radioactive waste. In accordance with the Agreement, a review of the Programme for the Decommissioning of the Krško NPP and Disposal of Low- and Intermediate-Level Waste and Spent Fuel was prepared in April 2004. An update of the Decommissioning Programme has to be made at least every five years.

Revision of the Decommissioning Programme was started in September 2008 with the aim of incorporating relevant developments since the first revision, improving the level of detail and the reliability of the decommissioning plan, and proposing updated and more accurate cost estimates and appropriate financing models. The Draft proposal of the Decommissioning Programme of the Krško NPP and Disposal of LILW and High-Level Waste has been prepared by the appointed expert organizations. However the update of the Decommissioning Programme was not adopted by legal representative of the owners as the Intergovernmental Commission did not meet in 2011 through 2013.

(i) Staff and Financial Resources

The Slovenian share of assets for the decommissioning of the Krško NPP is collected and managed by the Fund for the Decommissioning of the Krško NPP. Following the first revision of the Decommissioning Programme in 2004, the levy per kWh_e was increased from approximately 0.2 to 0.3 euro cents. In 2012, the SNSA approved the Ageing Management Programme, which enables the operation of the Krško NPP beyond 2023. The operation of the Krško NPP could be extended from 2023 to 2043 (assuming the successful conclusion of Periodic Safety Reviews in 2023 and 2033). Such a decision would have a significant impact on the Decommissioning Programme, the Decommissioning Fund and the National Programme for the Management of Radioactive Waste and Spent Nuclear Fuel. The decommissioning of the Krško NPP could occur after 2043 and it is assumed that the Krško NPP staff will perform decommissioning together with external contractors.

(ii) Operational Radiation Protection, Discharges and Unplanned and Uncontrolled Releases

There are no specific regulations for the decommissioning of nuclear facilities. All legal requirements and limitations that are applicable to all operating facilities are also applicable to nuclear facilities in the decommissioning process.

(iii) Emergency Preparedness

As no decommissioning is being performed at the moment, there is no need for an Emergency Preparedness Plan. However, it is required and shall be prepared for the application for the licence for decommissioning.

(iv) Records of Information

There is an Engineering Support Department at the Krško NPP; this is in charge of record keeping and of maintaining the database required by regulations, including regarding decommissioning.

Jožef Stefan Institute Reactor Infrastructure Centre

A research project estimating the quantity and composition of LILW resulting from dismantling was carried out. A Decommissioning Plan for the reactor which was prepared in 2007 is currently under revision. At present there are no plans to shut down this reactor in the near future, although the option to finish its operation in 2016 is still open. It has been estimated that not more than 50 tons of LILW would be produced in decommissioning.

Žirovski vrh Uranium Mine

Properly qualified staff are available to accomplish all the remaining tasks and activities at the disposal sites at Žirovski vrh. Adequate financial resources are available for the accomplishing of remediation activities. For this purpose, the Ministry of Agriculture and the Environment assures financial means from the national budget.

The funds necessary for institutional control and monitoring of the Jazbec mine waste pile, the Boršt mill tailings site and the mine water outlet will be assured by the Slovenian Government.

Safety of remediation of the Jazbec mine waste pile and the Boršt mill tailings site is ensured through licensing and regulatory supervision similarly as for the decommissioning of other nuclear or radiation facilities.

Central Storage Facility for Radioactive Waste in Brinje

As provided for in the Resolution on the 2006–2015 National Programme for Managing Radioactive Waste and Spent Nuclear Fuel, the Central Storage for Radioactive Waste will operate at least until the start of operation of the LILW repository in Slovenia. The waste meeting the waste acceptance criteria of the repository will then be transferred thereto. Long-lived waste can either remain in the storage until disposal with high-level waste and spent fuel or can be transferred to the LILW repository site and stored there. Both options are elaborated in the Decommissioning Programme which was prepared in 2012 by the ARAO. After closure, the Central Storage Facility will be decontaminated and released from control. It will not be demolished.

Decommissioning of the facility will be financed from the national budget and fees from waste producers. There has been no final decision on the time of closure of the Central Storage Facility for Radioactive Waste.

SECTIONS G AND H: SAFETY OF SPENT FUEL MANAGEMENT AND SAFETY OF RADIOACTIVE WASTE MANAGEMENT

The Republic of Slovenia has no separate legally binding documents on the safety of spent fuel management and the safety of radioactive waste management. The main legal pillar in this area is the 2002 Act. In this Act the general safety requirements are applicable to both the safety of spent fuel management and the safety of radioactive waste management. Some specific requirements regarding the type of activity are stipulated in separate articles of the 2002 Act. Thus in order to avoid redundancy in the text, the requested information under Sections G and H is presented jointly.

Article 4: General Safety Requirements

Each Contracting Party shall take the appropriate steps to ensure that at all stages of spent fuel management, individuals, society and the environment are adequately protected against radiological hazards.

In so doing, each Contracting Party shall take the appropriate steps to:

(i) ensure that criticality and removal of residual heat generated during spent fuel management are adequately addressed,

(ii) ensure that the generation of radioactive waste associated with spent fuel management is kept to the minimum practicable, consistent with the type of fuel cycle policy adopted,

(iii) take into account interdependencies among the different steps in spent fuel management,

(iv) provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards,

(v) take into account the biological, chemical and other hazards that may be associated with spent fuel management,

(vi) strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation,

(vii) aim to avoid imposing undue burdens on future generations.

Article 11: General Safety Requirements

Each Contracting Party shall take the appropriate steps to ensure that at all stages of radioactive waste management individuals, society and the environment are adequately protected against radiological and other hazards.

In so doing, each Contracting Party shall take the appropriate steps to:

(i) ensure that criticality and removal of residual heat generated during radioactive waste management are adequately addressed,

(ii) ensure that the generation of radioactive waste is kept to the minimum practicable,

(iii) take into account interdependencies among the different steps in radioactive waste management,

(iv) provide for effective protection of individuals, society and the environment, by applying at the national level suitable protective methods as approved by the regulatory body, in the framework of its national legislation which has due regard to internationally endorsed criteria and standards,

(v) take into account the biological, chemical and other hazards that may be associated with radioactive waste management,

(vi) strive to avoid actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation,

(vii) aim to avoid imposing undue burdens on future generations.

The criticality and removal of residual heat generated during radioactive waste and spent fuel management are adequately addressed in the 2002 Act through the approval of the safety analysis report by the SNSA. The content of the safety analysis report is determined in the Rules on Radiation and Nuclear Safety Factors and in non-binding guidance on the content of the safety case for a particular type of nuclear facility.

The requirement that generation of radioactive waste associated with spent fuel management and generation of other radioactive waste is kept to the minimum practicable, consistent with the type of fuel-cycle policy, is assured through the 2002 Act. Paragraph (2) of Article 93 stipulates that any person responsible for the generation of radioactive waste and spent fuel shall ensure that radioactive substances occur in the smallest possible quantities.

The interdependencies among the different steps in spent fuel management and radioactive waste management are addressed through the Resolution on the 2006–2015 National Programme for Managing Radioactive Waste and Spent Nuclear Fuel, adopted by the Slovenian Parliament in 2006. The producers of radioactive waste and spent fuel have to consider the interdependencies among different steps of their management in the safety analysis report and operating licences. The request to consider interdependencies among different steps in spent fuel and radioactive waste management is also provided in the Rules on Radioactive Waste Management that entered into force in May 2006.

The provisions ensuring the effective protection of individuals, society and the environment, by applying suitable protective methods at the national level as approved by the regulatory body, are included within the framework of national regulations.

The biological, chemical and other hazards that may be associated with spent fuel and radioactive waste management are taken into account through the safety analysis report for each particular nuclear and disposal facility. The content of the documentation is prescribed by the regulation issued by the Ministry of the Environment (2002 Act, Article 71), while the content of the safety analysis report for the disposal of spent fuel and radioactive waste (2002 Act, Article 73) and uranium mining and ore processing waste (2002 Act, Article 76) shall be prescribed by the SNSA, which also acts as the licensing authority for the approval of the safety analysis reports.

There are no special provisions for avoiding actions that impose reasonably predictable impacts on future generations greater than those permitted for the current generation in the Republic of Slovenia. This subject is addressed implicitly throughout all legally binding documents in the area of nuclear and radiation safety.

Article 5: Existing Facilities

Each Contracting Party shall take the appropriate steps to review the safety of any spent fuel management facility existing at the time the Convention enters into force for that Contracting Party and to ensure that, if necessary, all reasonably practicable improvements are made to upgrade the safety of such a facility.

Article 12: Existing Facilities and Past Practices

Each Contracting Party shall in due course take the appropriate steps to review:

(i) the safety of any radioactive waste management facility existing at the time the Convention enters into force for that Contracting Party and to ensure that, if necessary, all reasonably practicable improvements are made to upgrade the safety of such a facility,

(ii) the results of past practices in order to determine whether any intervention is needed for reasons of radiation protection bearing in mind that the reduction in detriment resulting from the reduction in dose should be sufficient to justify the harm and the costs, including the social costs, of the intervention.

The Republic of Slovenia has no spent fuel management facilities. The spent fuel that is generated by the operation of the Krško NPP and the IJS Reactor Infrastructure Centre (TRIGA Mark II research reactor) is managed in storage sites that are integrated parts of these nuclear facilities. Similarly, the LILW generated at the Krško NPP is managed and stored in storage sites under the operating licence for the Krško NPP. The legislative provisions for nuclear facilities were applied for the siting, construction and operation of these storage sites.

The facilities that are subject to this paragraph are the Central Storage Facility for Radioactive Waste in Brinje, the Boršt mill tailings site and the Jazbec mine waste pile at the former Žirovski vrh Uranium Mine.

The Central Storage Facility for Radioactive Waste in Brinje was put into operation in 1986, when nuclear legislation was not yet fully implemented. The operation of the storage facility was initially not licensed on the basis of nuclear and radiation safety legislation. The operator (IJS) obtained a licence for the use of this facility on the basis of the Construction Act. In 1998, the SNSA required by decree that the operator apply for an operating licence under the 1984 Act and prohibited further operation of this facility, except for emergency cases.

When the management and operation was transferred to the national waste management organisation, the ARAO, in 1999, the SNSA required that the new operator met the requirements of the above decree. By the end of 2002, plans for reconstruction and modernisation of the facility were prepared. In 2004, all activities on modernisation and refurbishment of the facility were finished.

The refurbishment of the Central Storage Facility for Radioactive Waste in Brinje and the licensing were performed in compliance with the 2002 Act. The licence for trial operation of the Central Storage Facility for Radioactive Waste was issued in 2005 and the licence for normal operation was issued in April 2008.

The remediation of the Žirovski vrh Uranium Mine has been in progress since the termination of operation in 1990. Remedial actions in Jazbec were finished in 2008. The final remediation work on the Boršt disposal has been delayed due to activation of a landslide. From the legal perspective, the uranium mine, the ore processing facilities, and the disposal sites for mining and ore processing waste were not nuclear facilities. The principal Act governing their operation was the Mining Act. This situation changed with the 2002 Act. According to Article 76 of the 2002 Act, the construction of mining or ore processing waste repositories was approved on the basis of SNSA consent. The key document is the safety analysis report.

Article 6: Siting of Proposed Facilities

1. *Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed spent fuel management facility:*
   - *(i) to evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime,*
   - *(ii) to evaluate the likely safety impact of such a facility on individuals, society and the environment,*
   - *(iii) to make information on the safety of such a facility available to members of the public,*
   - *(iv) to consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory.*
2. *In so doing, each Contracting Party shall take the appropriate steps to ensure that such facilities shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of Article 4.*

Article 13: Siting of Proposed Facilities

1. *Each Contracting Party shall take the appropriate steps to ensure that procedures are established and implemented for a proposed radioactive waste management facility:*
   - *(i) to evaluate all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime as well as that of a disposal facility after closure,*
   - *(ii) to evaluate the likely safety impact of such a facility on individuals, society and the environment, taking into account possible evolution of the site conditions of disposal facilities after closure,*
   - *(iii) to make information on the safety of such a facility available to members of the public,*
   - *(iv) to consult Contracting Parties in the vicinity of such a facility, insofar as they are likely to be affected by that facility, and provide them, upon their request, with general data relating to the facility to enable them to evaluate the likely safety impact of the facility upon their territory.*
2. *In so doing, each Contracting Party shall take the appropriate steps to ensure that such facilities shall not have unacceptable effects on other Contracting Parties by being sited in accordance with the general safety requirements of Article 11.*

One of the major tasks in the area of radioactive waste management in the Republic of Slovenia is the siting and construction of the facility for management and disposal of LILW. The decision on siting and construction of the facility for management and disposal of spent fuel has been deferred according to the Resolution on the 2006–2015 National Programme for Managing Radioactive Waste and Spent Nuclear Fuel and the Programme of Krško NPP for Decommissioning and Spent Fuel and LILW Disposal. It is planned to identify sites for the Spent Nuclear Fuel Repository by 2035 and to propose the site by 2055. At present, spent fuel management is part of the operation of the Krško NPP and the TRIGA Mark II research reactor at the IJS Reactor Infrastructure Centre and no immediate activities in siting of the spent fuel repository are envisaged for the near future.

The course of procedure in the licensing process of nuclear facilities such as repositories is stipulated in the 2002 Act, the Environment Protection Act, the Spatial Planning Act, the Act on the Siting of Spatial Arrangements of National Significance in Physical Space, the Construction Act, the Rules JV5, the Decree on Categories of Projects for which an Environmental Impact Assessment is Mandatory, and the Decree on the Content of Reports on the Effects of Intended Activity on the Environment and Method of its Preparation.

The above-mentioned legislation provides the framework for the preparation of the nuclear and radiation safety documentation and documentation for environmental impact assessment. It stipulates which consents and licences are to be issued and the manner of participation of the public.

According to the 2002 Act and the Environment Protection Act, the safety documentation concerning nuclear and radiation safety during the siting of a nuclear facility shall consist of three main documents: a special safety analysis, an environmental impact assessment report and a safety analysis report. The content of all three documents is similar, as they are prepared for the same facility, but they differ regarding the level of details presented.

Assessment of all relevant site-related factors likely to affect the safety of the repository of LILW during its operating lifetime and assessment of the likely impacts of the facility on individuals, society and the environment, taking into account possible evolution of the site conditions of the repository after closure, is assured through various legally binding documents and procedures further discussed in this text.

Article 64 ("Location of a nuclear facility") and Article 65 ("Analysis of the safety of a site for the location of a nuclear facility") of the 2002 Act determine that the selection of a site for the location of a nuclear facility shall be based on a special safety analysis, which will be used to assess all the factors at the site of the nuclear facility which may affect the nuclear safety of the facility during its active life and the impacts of operation of the facility on the population and the environment.

The Environment Protection Act forms the basis for the environmental impact assessment. The Decree on Categories of Projects for which an Environmental Impact Assessment is Mandatory determines that an environmental impact assessment is mandatory for spent fuel management facilities and radioactive waste management facilities and for the disposal of mining tailings and hydro-metallurgical tailings.

The environmental impact assessment is set in Article 51 of the Environment Protection Act during issuing environmental protection consent for a nuclear facility. The SNSA shall propose the content of the environmental impact assessment in the part relating to radiation and nuclear safety. The conditions, the scope and the content of the environmental impact assessment shall be drawn up by the Environmental Agency of the Republic of Slovenia on the basis of the SNSA's proposal.

Public involvement in the siting process is assured through prescribed public hearings, consultations and presentations and by making all the information available to the public. In the siting phase, it takes place in the framework of strategic environmental assessment (SEA) and in the licensing phase in the framework of environmental impact assessment (EIA).

The environmental report, based on the Environment Protection Act, is prepared for strategic environmental assessment. The special safety analysis is also prepared and both documents are subject to public hearing.

A similar procedure is in place for the environmental impact assessment in the licensing phase which is required for obtaining an Environmental Protection Consent from the Environmental Agency of the Republic of Slovenia. The public hearing must last at least 30 days (Article 58 of the Environment Protection Act).

Siting of LILW Disposal

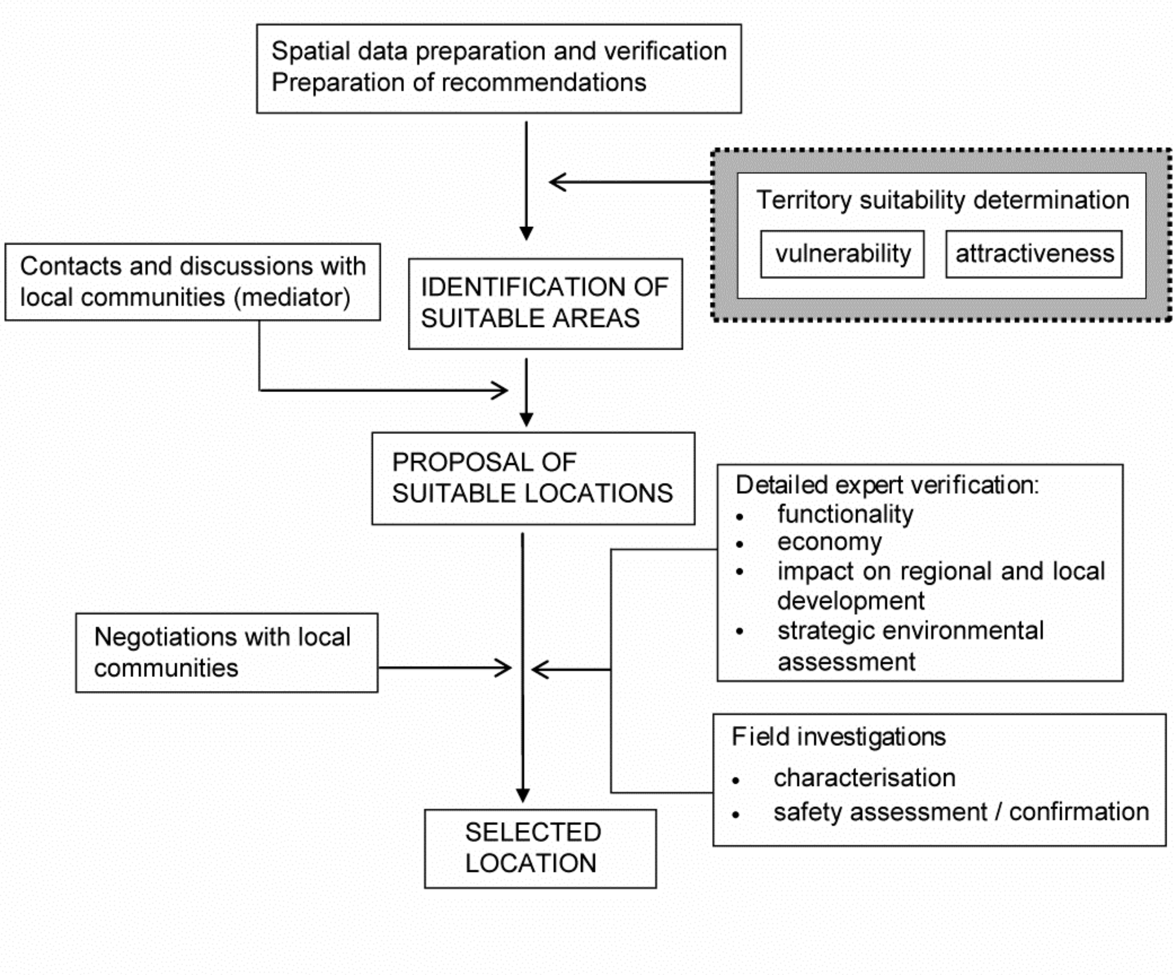
Due to the growing need for a final disposal of LILW, the final solution for the short-lived LILW is the key issue of radioactive waste management in the Republic of Slovenia. The ARAO successfully accomplished the siting procedure for the LILW repository and the site was approved in December 2009.

The ARAO decided on a mixed mode site selection process. This in practice means a combination of technical screening and volunteer siting. It is flexible, transparent and guarantees strong public involvement. According to the IAEA recommendations, it is divided into four stages:

- concept and planning,
- area survey,
- site characterisation, and
- site confirmation.

The mixed mode site selection process is presented schematically in Figure 13.

Figure 13: **Schematic presentation of the combined mode site selection process**



Special attention was devoted to the involvement of local communities in the site selection process. For the first communication with the local communities, an independent mediator was recruited to facilitate negotiations between the community and the Government as the investor. In the second part of the site selection process, so-called local partnerships were established to support the decision-making process and to assure compliance with the Aarhus Convention.

At the end of 2004, the official administrative procedure for the siting of the repository was announced. Based on this, the ARAO invited local communities with a proposal on how to participate in siting. By the end of the first bidding period in April 2005, eight applications from local communities were received.

After preliminary characterisation, the sites were ranked and the three most favourable ones were selected and approved for further field investigations and continuation of the siting procedure. All three selected local communities (Brežice, Krško and Sevnica) are in the vicinity of the Krško NPP site.

By involvement of all stakeholders and the general public through the local partnerships, a communication forum facilitating dialogue with local communities was created. This provides the opportunity for local and national stakeholders to work together on issues that are of common interest and concern.

The municipality of Sevnica soon withdrew from the siting procedure due to strong public opposition to the repository. Similarly, due to strong local opposition, the Municipality of Brežice decided to withdraw its site, though it later proposed a new potential site.

Meanwhile, the procedure for the preparation of the National Spatial Plan for an LILW Repository in Vrbina in the Municipality of Krško continued. Three disposal options were considered for the site – a surface repository, a silo-type repository and a tunnel-type repository. Based on the evaluation, the ARAO proposed construction of the silo type of LILW repository. The Detailed Plan of National Importance for a Low- and Intermediate-Level Radioactive Waste Repository at the Location of Vrbina, Krško Municipality was prepared and adopted at the end of the 2009 by the Slovenian Government.

The location for the LILW repository at Vrbina in the Krško municipality is shown in Figure 14.

Figure 14: **Location for the LILW repository in Vrbina in the Municipality of Krško**

Article 7: Design and Construction of Facilities

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

(i) the design and construction of a spent fuel management facility provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases,

(ii) at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a spent fuel management facility are taken into account,

(iii) the technologies incorporated in the design and construction of a spent fuel management facility are supported by the decommissioning of a spent fuel management facility.

Article 14: Design and Construction of Facilities

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

(i) the design and construction of a radioactive waste management facility provide for suitable measures to limit possible radiological impacts on individuals, society and the environment, including those from discharges or uncontrolled releases,

(ii) at the design stage, conceptual plans and, as necessary, technical provisions for the decommissioning of a radioactive waste management facility other than a disposal facility are taken into account,

(iii) at the design stage, technical provisions for the closure of a disposal facility are prepared,

(iv) the technologies incorporated in the design and construction of a radioactive waste management facility are supported by experience, testing or analysis.

The measures that are prescribed in Articles 7 and 14 of the Convention are assured through the licensing process for the construction of nuclear facilities.

The permit for the construction of a nuclear facility is issued by the Ministry of Infrastructure and Spatial Planning on the basis of the Construction Act; among other conditions is the consent of the SNSA (2002 Act, Article 68). In issuing a consent, the SNSA evaluates the technologies incorporated in the design and construction of the spent fuel management or radioactive waste management facility from the points of view of nuclear and radiation safety and environmental protection.

According to Article 68 of the 2002 Act, an application for consent for a construction permit for a nuclear facility shall include project documentation, a safety analysis report including relevant evaluations, and the opinion of an authorised expert for radiation and nuclear safety. The project shall be compiled in compliance with the design bases according to the provisions of Chapter II of Rules JV5. The contents of the project documentation and the methods of its preparation and revision are prescribed by the rules governing project and technical documentation and, in the case of mining works, with the provisions of the rules governing the method of compilation, sequence, contents and revision of mining works project documentation. The key document governing the technical and safety measures for the construction and operation of a nuclear facility is the safety analysis report. The content of the safety analysis report for the disposal of uranium mining and ore processing tailings and mines is prescribed in detail by the SNSA. The main content of the safety analysis report are prescribed by the 2002 Act and Rules JV5. Detailed content of the safety analysis report for the LILW repository was prepared by the SNSA in a form of guidelines issued in 2012.

Chapter II of Rules JV5 sets the requirements for the design bases for radiation and nuclear facilities and the main principles that the design of the radiation or nuclear facilities should adhere to. It includes general provisions for the design bases and specific provisions for, inter alia, safety functions, physical protection, site conditions, postulated initiating events, normal operation, events and accidents, facility states, capability for decommissioning and emergency preparedness.

Design basis for the LILW repository

The silo repository type was confirmed with the adoption of the Decree on the Detailed Plan of National Importance for a LILW Repository in Vrbina in the Municipality of Krško. The area included in the national spatial plan is 18 ha. The planned LILW repository, with a net area of about 10 ha, includes all structures, systems and components required for its operation as an independent nuclear facility. It is composed of an information centre, and entrance area with an administrative building, a service building, a technological building and a disposal area with two disposal silos as shown in Figure 15.

An area for an additional two silos is reserved for future extension of the capacity if needed. Additionally, there are monitoring structures, physical protection (security) structures, earth-filled platforms and structures of external and landscape arrangement, and infrastructure lines and connections to utility networks. The largest area covers:

- The eastern part of the repository, where access from the Vrbina road is provided and the public building of the repository information centre is constructed;
- A narrow area of the repository intended for administrative/service activities, waste acceptance and conditioning, waste disposal into disposal units, and provision of the physical security of the repository; this area is surrounded by a fence;
- Free surfaces for the repository; and
- Surfaces required for connections to infrastructure.

Areas within the disposal units area and a major part of inner areas of the waste conditioning structure are classified as radiologically controlled areas and are protected by a fence.

With the development of the design and following recommendations and suggestions from the expert missions and international reviews, some optimisations of the design were proposed. The design was analysed in additional studies. The main focus was on silo design (water tightness), the access shaft (incorporation into the silo) and the design of the closing structure of the silo. Additionally, studies have been performed regarding the necessary capacity of the repository, possible optimisations regarding waste packages, characteristics of the backfill material, treatment for disposal (suggested optimisations of waste packages), and disposal of larger components.

Figure 15: **LILW repository facilities as in the Detailed Plan of National Importance for an LILW Repository in Vrbina in the Municipality of Krško**

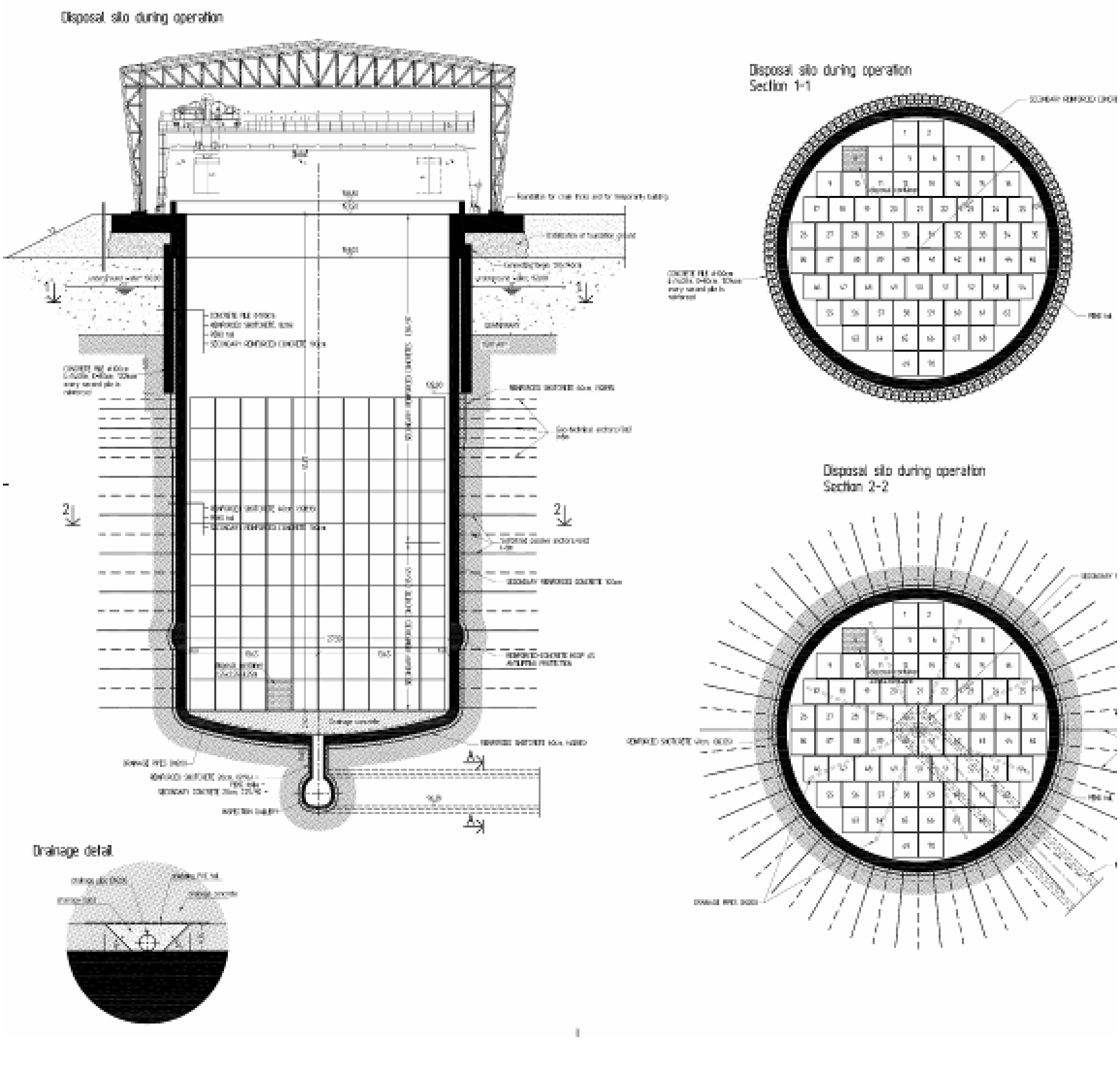
Based on optimisation, a detailed design will be prepared. The detailed design will include modifications to the preliminary design presented below. The silos structure is 33 m high and 27.3 m in diameter (Figure 16). The base of the silo is approximately 55 m below the elevation of the flood protective platform. Into each silo, 700 concrete containers could be placed at 10 levels. Two silos are foreseen in the preliminary design, with an overall capacity of 9,400 m^3 of LILW, which could be placed in 1,400 concrete containers.

Some of the solutions described above will be changed in order to improve and optimise the design in the detailed design phase.

During the insertion of concrete containers, the silo is protected with a temporary hall, where a portal gantry crane is located. The disposal containers will be transported to the handling area near the silo by vehicle and then disposed of using the crane. The empty spaces will then be backfilled with backfilling material. The last layer of containers will be covered with a concrete plate and a layer of fairly impermeable material (e.g. clay).

Flexibility of repository concept was an input to the project to cover as many future developments in the programme as could reasonably be expected. It consists of a modular approach and an intermittent mode of operation. Each silo is an independent unit and the number of silos is expandable. The second silo will be constructed when the first one has been filled and the need for a second one arises. The repository can operate intermittently, i.e. it can be temporarily in standby mode for longer or shorter periods of time. The repository also has the potential to accommodate all LILW from the Krško NPP if it is decided that this will be a joint LILW disposal facility for both Slovenia and Croatia.

Figure 16: **LILW disposal silo and repository layout as in the preliminary design**



Article 8: Assessment of Safety of Facilities

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

(i) before construction of a spent fuel management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out,

(ii) before the operation of a spent fuel management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (i).

Article 15: Assessment of Safety of Facilities

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

(i) before construction of a radioactive waste management facility, a systematic safety assessment and an environmental assessment appropriate to the hazard presented by the facility and covering its operating lifetime shall be carried out,

(ii) in addition, before construction of a disposal facility, a systematic safety assessment and an environmental assessment for the period following closure shall be carried out and the results evaluated against the criteria established by the regulatory body,

(iii) before the operation of a radioactive waste management facility, updated and detailed versions of the safety assessment and of the environmental assessment shall be prepared when deemed necessary to complement the assessments referred to in paragraph (i).

Assessment of Safety before Construction

Assessment of safety before the construction of a spent fuel management facility or a radioactive waste management facility is assured through Article 71 of the 2002 Act. It is ensured through the provision that an application for a licence shall contain project documentation, a Safety Analysis Report and an opinion of an authorised expert for radiation and nuclear safety.

Article 40 of Rules JV5 lays down the general contents of the safety analysis report, which shall provide the following information:

- a site description, a general description of the facility and its normal operation, and a description of how the facility's safety is ensured;
- a description of the programme for trial operation;
- a description of the technical characteristics of the radiation or nuclear facility and a description of performance in all operational states of the facility;
- a description of the facility's design concept and the approach adopted to meet the fundamental safety objectives and a description of the design bases of the radiation or nuclear facility and of their methods of fulfilment;
- a detailed description of the safety functions, of all safety systems, and of safety-related structures, systems and components (SSCs), their design bases and the functioning of all safety-related SSCs in all operational states of the facility;
- a list of regulations and standards applied as the basis for descriptions and safety analyses covered in the safety analysis report;
- a description of the plant organisational set-up of the facility operator intended for ensuring nuclear safety;
- an assessment of safety aspects relating to the facility site;
- a description of safety analyses performed to assess the safety of the radiation or nuclear facility in response to postulated design-basis events and a comparison with the technical acceptance criteria;
- a description of probabilistic safety analyses;
- a description of the emergency operational procedures and of the severe accident management guidelines in the case of a nuclear power plant;

- a description of the emergency plan for the facility and of the facility operator's internal organisational set-up for emergency events and of its alignment with the national protection and rescue plan in the event of a nuclear accident;
- a description of the measures providing for SSC inspection, testing and surveillance, a description of the operational experiences feedback programme, and a description of the ageing management programme;
- a description of the training and education of the personnel;
- operating limits and conditions of safe operation and technical bases explaining expert bases for each operating condition or limit;
- a description of the strategy for protection against radiation – a description of the methods and measures for protection of exposed personnel against ionising radiation, including an assessment of their protection against radiation and an assessment of the exposure of the general population and the environment;
- a description of any radioactive and nuclear materials and other sources of radiation;
- a description of the radioactive waste and spent fuel management programme;
- a description of all activities in the facility's operational phase planned to facilitate termination of operation and decommissioning;
- a description of the quality assurance and management programme;
- an outline of the physical protection of the facility and nuclear and radioactive substances;
- the anticipated and maximum allowable releases of radioactive substances into the environment;
- a programme of meteorological measurements and radioactivity monitoring during operation; and
- in the case of a radioactive waste repository, a spent fuel repository, a hydrometallurgical tailings repository or a mining tailings repository, a plan for long-term surveillance.

The safety analysis report shall be amended when changes in the situation referred to therein arise during the construction or decommissioning of the facility or during the period of trial operation.

Assessment of Safety before Operation

After construction work has been completed, every nuclear facility shall undergo a period of trial operation. Prior to the start of trial operation of a nuclear facility, it is mandatory to obtain the consent of the SNSA. An application for consent for the start of trial operation shall contain a Safety Analysis Report updated with any changes which occurred during construction, an opinion from an authorised expert for radiation and nuclear safety, and other prescribed documentation.

Article 24 of Rules JV5 sets the contents of the application for consent for the start of trial operation of a radiation or nuclear facility.

The SNSA shall issue a consent for trial operation for a fixed period, which may not exceed two years. The consent for trial operation may be extended. There is no right to appeal against refusal of consent for the start of trial operation.

Safety Case and Safety Assessment for the LILW repository

After the end of the siting for the LILW repository, a preparation of the safety case for the licensing thereof was started. The main goal of this phase is to attain confidence that the combination of the repository site and the disposal concept is safe, especially regarding long-term safety. This information is used both in the licence application and to support an environmental impact assessment. As a part of the safety case, the new iteration of safety assessment was prepared. The purpose of this was to develop reasonable assurance that the facility will remain within regulatory safety constraints for a long time into the future, as set in legislation. The safety assessment was undertaken using the methodology of the International Atomic Energy Agency (ISAM), which has become an internationally accepted standard for conducting safety assessments. At each stage of the process, the methodology is intended to focus attention on key issues that need to be addressed to develop confidence that the final decision is well supported and documented and is fully coherent.

The scenario development process for the repository's long-term safety resulted in the identification of five main scenarios for which analyses were conducted. For all these scenarios, detailed models were prepared to calculate the impact of the facility on people and the environment. At the end of the process, all the results were evaluated.

The post-closure safety assessment has shown that the proposed facility meets the regulatory safety criteria for post-closure safety with good margin for all the analyses conducted. This conclusion is contingent on a number of basic assumptions that form the foundation of the safety assessment analyses. While a number of these assumptions require additional study, it is concluded that there is high confidence that the proposed Vrbina repository can meet regulatory constraints with sufficient margin.

Article 9: Operation of Facilities

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

(i) the license to operate a spent fuel management facility is based upon appropriate assessments as specified in Article 8 and is conditional on the completion of a commissioning programme demonstrating that the facility, as constructed, is consistent with design and safety requirements,

(ii) operational limits and conditions derived from tests, operational experience and the assessments, as specified in Article 8, are defined and revised as necessary,

(iii) operation, maintenance, monitoring, inspection and testing of a spent fuel management facility are conducted in accordance with established procedures,

(iv) engineering and technical support in all safety-related fields are available throughout the operating lifetime of a spent fuel management facility,

(v) incidents significant to safety are reported in a timely manner by the holder of the license to the regulatory body,

(vi) programmes to collect and analyse relevant operating experience are established and that the results are acted upon, where appropriate,

(vii) decommissioning plans for a spent fuel management facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body.

Article 16: Operation of Facilities

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

(i) the license to operate a radioactive waste management facility is based upon appropriate assessments as specified in Article 15 and is conditional on the completion of a commissioning programme demonstrating that the facility, as constructed, is consistent with design and safety requirements,

(ii) operational limits and conditions, derived from tests, operational experience and the assessments as specified in Article 15 are defined and revised as necessary,

(iii) operation, maintenance, monitoring, inspection and testing of a radioactive waste management facility are conducted in accordance with established procedures. For a disposal facility the results thus obtained shall be used to verify and to review the validity of assumptions made and to update the assessments as specified in Article 15 for the period after closure,

(iv) engineering and technical support in all safety-related fields are available throughout the operating lifetime of a radioactive waste management facility,

(v) procedures for characterisation and segregation of radioactive waste are applied,

(vi) incidents significant to safety are reported in a timely manner by the holder of the license to the regulatory body,

(vii) programmes to collect and analyse relevant operating experience are established and that the results are acted upon, where appropriate,

(viii) decommissioning plans for a radioactive waste management facility other than a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility, and are reviewed by the regulatory body,

(ix) plans for the closure of a disposal facility are prepared and updated, as necessary, using information obtained during the operating lifetime of that facility and are reviewed by the regulatory body.

Initial Authorisation for Operation

The operating licence is issued by the SNSA only after the Ministry of Infrastructure and Spatial Planning issues, in accordance with the Construction Act, a licence for the use of a facility.

The application for the operating licence shall contain an updated safety analysis report, an opinion from an authorised expert for radiation and nuclear safety, and other documentation prescribed by Article 25 of Rules JV5. The safety analysis report shall be updated with any changes that occur during the trial operation.

A licence shall be issued by the SNSA within 90 days of receiving a complete application and information on the trial operation indicating that all the conditions for radiation and nuclear safety have been fulfilled.

Operational Limits and Conditions

In accordance with Article 71 of the 2002 Act, the proposed operational limits and conditions (technical specifications as part of the safety analysis report) have to be submitted to the regulatory body as a part of the safety analysis report first with the application for consent for trial operation and later with the application for the operating licence.

Article 43 of Rules JV5 sets basic requirements for operational limits and conditions and also defines that they shall be specified for all operational states of the facility.

Article 44 of Rules JV5 defines the contents of the operational limits and conditions, which should contain:

- definitions of terms;
- safety limits;
- limits on operating parameters for safety systems;
- limits on operating parameters and stipulation of the minimum amount of operable equipment, including the number of SSCs important for safety, that should be in operational or standby condition;
- necessary measures in cases of exceeded operating limits and conditions, and the time available for taking such measures;
- requirements for surveillance; and
- requirements for the minimum staffing levels to ensure safe operation in different operational states of the facility.

Article 3 of Rules on operational safety of radiation or nuclear facilities (JV9) defines the application of operational limits and conditions. It is required that the personnel licensed to operate and monitor the technological process in a radiation or nuclear facility shall be highly knowledgeable on the contents, purposes and technical bases of the operational limits and conditions. Information on the operational limits and conditions shall be accessible to all personnel involved in operating the facility. In facilities fitted with a control room, such information shall be available in the control room.

Operational limits and conditions shall be reviewed and kept updated as appropriate in accordance with operational experience and developments in science and technology and upon any modification to the facility that warrants or requires such updates.

Articles 83 and 84 of the 2002 Act outline the procedure for approval of changes to the safety analysis report. The procedure defines three classes of changes according to safety relevance:

1. changes for which it is necessary to notify the SNSA;
2. changes for which the intention of their implementation shall be reported to the SNSA; and
3. changes of significance for radiation or nuclear safety and for the implementation of which a licence from the SNSA shall be obtained.

Rules JV9 define the methodology of assessment and classification of modifications and the method and form of reporting and proposing modifications to radiation or nuclear facilities.

Operation, maintenance, monitoring, inspection and testing

In accordance with Article 25 of Rules JV5, the documentation submitted for the application for an operating licence shall also contain a list of prepared operating procedures, a report on trial operation, a radioactive waste or spent fuel management programme, management system documentation, a decommissioning programme, a programme of following operational experiences, a programme of monitoring ageing, programmes of SSC maintenance, testing and inspection, results of pre-operation monitoring, a safety analysis report, an opinion by an approved radiation and nuclear safety expert, and other prescribed documentation. At the request of the SNSA, the investor or the facility operator of a radiation or nuclear facility shall make licence application reference documentation available.

Periodic safety review

In accordance with Article 81 of the 2002 Act, the operator of a radiation or nuclear facility shall ensure regular, full and systematic assessment and inspection of the radiation or nuclear safety of the facility through a periodic safety review.

The operator shall draw up a report on the periodic safety review and submit it to the SNSA for approval.

Where a report on a periodic safety review indicates the need to change the conditions of operation or the limitations from the safety analysis report with the aim of improving radiation or nuclear safety, the operator shall draw up a proposal for any such changes.

An approved report on the periodic safety review shall be a condition for the renewal of the licence for the operation of the nuclear facility.

The frequency, contents, scope, duration and method of performing periodic safety reviews and the methods of reporting such reviews are defined in Chapter V of Rules JV9.

Exceptional review of the Safety Analysis Report

According to Article 86 of the 2002 Act, the operator shall evaluate and verify the safety of the facility and ensure a review of the concordance of the safety analysis report with the conclusions of the evaluation and verification of safety directly after any emergency at the facility or after the completion of work relating to the mitigation of the consequences thereof.

Engineering and technical support

In-house capabilities have been developed to perform engineering and technical support at the existing nuclear facilities. The Krško NPP, the Jožef Stefan Institute Reactor Infrastructure Centre, the ARAO and the Žirovski vrh Mine are capable of processing minor design changes in-house. The capabilities of preparing purchase specifications, reviewing bids and bidder selection, quality assurance, quality control and engineering follow-up of projects, and review and/or acceptance testing of products are available to a certain extent at all the above facilities. Other engineering and technical support is assured through outsourcing to Slovenian research and engineering organisations or abroad. However, major projects require an open invitation to tender. The Ministry of Education, Science and Sport financially supports research and development projects in the field of nuclear safety in the Republic of Slovenia through a research fund, with the participation of the nuclear industry and the SNSA.

Characterisation and segregation of radioactive waste

According to Article 93 of the 2002 Act and the Rules on Radioactive Waste and Spent Fuel Management, the licence holder shall collect radioactive wastes, classify them with regard to the aggregation state, level and type of radioactivity, report on radioactive waste and spent fuel generation, keep accounting records for the waste, label the waste, provide for processing, transport and storing of waste, and perform activities in such a manner that the lowest possible quantities of radioactive waste are generated, taking into consideration safe working conditions, radiation protection and economic criteria.

Incidents significant to safety

Article 87 ("Reporting on the operation of facilities") of the 2002 Act stipulates that an operator shall submit exceptional reports to the SNSA containing information on:

- equipment malfunction which could cause an emergency, emergencies themselves, and measures taken for the mitigation of the consequences of the defects or emergencies;
- mistakes made by workers while handling or operating a facility which could cause an emergency;

- deviations from operational limitations and conditions; and
- all other events or operational circumstances which significantly affect the radiation or nuclear safety of the facility.

Chapter III of Rules JV9 prescribes detailed requirements for reporting and for the notification of the regulatory body by the operator of a nuclear facility. The regulations distinguish between routine reporting and notification and reporting in the event of an abnormal event. They specify the time period for each report. Reporting criteria are also given and abnormal events are specified.

According to Article 108 of the 2002 Act, the licence holder is required to report to the ministry which issued the operating licence and to other competent agencies on an emergency in the shortest possible time.

Programmes to collect and analyse relevant operating experience

In accordance with Article 60 of the 2002 Act ("The use of experience gained during operational events") the operator of a radiation or nuclear facility shall ensure that programmes of collecting and analysing operating experience at nuclear facilities are implemented.

The method and frequency of reporting on the implementation of operating experience collection and analysis programmes are defined in Chapter II.2 of Rules JV9.

In the assessment, examination and improvement of radiation and nuclear safety, the operator of a radiation or nuclear facility shall take into account the conclusions of the programmes referred to in the first paragraph here.

Decommissioning plans

In accordance with Article 3 of the 2002 Act ("Definitions"), decommissioning of a facility shall mean all the measures leading to a cessation of control over a nuclear or radiation facility pursuant to the provisions of the 2002 Act. Decommissioning includes both decontamination and dismantling procedures and the removal of radioactive waste and spent fuel from the facility.

The legal requirements for approval for decommissioning a nuclear facility form a two-step procedure and are defined in Articles 71 and 80 of the 2002 Act, which prescribe that an investor intending to decommission a radiation or nuclear facility shall attach to an application for the consent for decommissioning and to the project documentation a safety analysis report and the opinion of an authorised expert for radiation and nuclear safety and to an application for the permit for commencement of decommissioning activities the updated safety analysis report, an opinion from an authorised expert for radiation and nuclear safety and other documentation. Detailed contents of the applications are defined in Articles 28 and 29 of Rules JV5.

In the case of decommissioning of a facility, the content of the safety analysis report shall refer to the decommissioning of the facility and the related measures for radiation or nuclear safety.

Two special acts have been approved by the Slovenian Parliament for the decommissioning of nuclear facilities, namely the Act Governing the Fund for Financing the Decommissioning of the Krško Nuclear Power Plant and Disposal of Radioactive Waste from the Krško NPP and the Permanent Cessation of Exploitation of the Uranium Ore and Prevention of Consequences of the Mining at the Uranium Mine at Žirovski vrh Act. Through the legal provisions of these two acts, the legal framework is established for financing and planning of decommissioning activities for the respective facilities.

Article 17: Institutional Measures after Closures

Each Contracting Party shall take the appropriate steps to ensure that after closure of a disposal facility:

(i) records of the location, design and inventory of that facility required by the regulatory body are preserved,

(ii) active or passive institutional controls such as monitoring or access restrictions are carried out, if required, and

(iii) if, during any period of active institutional control, an unplanned release of radioactive materials into the environment is detected, intervention measures are implemented, if necessary.

In the safety analysis report of the repository facilities relating to the time period following the closure thereof, all the possible risks relating to the spent fuel or radioactive waste shall be assessed, as shall be the exposure of the population after the closure and the exposure of the workers working at the repository during the maintenance thereof and the long-term supervision of the repository facility following closure (Article 73 of the 2002 Act).

The plan of long-term supervision of a repository for radioactive waste or a repository for mining or hydro-metallurgical tailings shall include the following:

- the extent and content of the operational monitoring of radioactivity at the repository, the monitoring of natural phenomena affecting the long-term stability of the repository and the functioning of individual parts of the repository; and
- the criteria on the basis of which decisions on the carrying out of maintenance work at the repository shall be made, this dependent on the results of the operational monitoring referred to in the previous indent and on inspection (Article 76 of the 2002 Act).

The records on the location, design and inventory of a facility required by the regulatory body are preserved through the provision of Article 80 ("Application for a permit"), stipulating that it is necessary to attach to the application for the closure permit a safety analysis report, an opinion from an authorised expert for radiation and nuclear safety, and other prescribed documentation.

Article 80 of the 2002 Act further stipulates that the owner or operator of a facility who has obtained a permit for the disposal of spent fuel, radioactive waste, or mine and hydro-metallurgical tailings shall ensure the maintenance and supervision of the disposal in line with the conditions laid down in the safety analysis report.

Article 96 ("Disposal of uranium mining and ore processing waste") of the 2002 Act stipulates that the long-term supervision and maintenance of repositories of mining and hydro-metallurgical tailings resulting from the extraction of nuclear mineral materials shall be responsibility of the ARAO.

The contents of applications for a permit for the closure of a radioactive waste or spent fuel repository or for the closure of a repository for mining or hydrometallurgical tailings are defined in Rules JV5 in Articles 33 and 34 respectively.

Article 10: Disposal of Spent Fuel

If, pursuant to its own legislative and regulatory framework, a Contracting Party has designated spent fuel for disposal, the disposal of such spent fuel shall be in accordance with the obligations of Chapter 3 relating to the disposal of radioactive waste.

Krško NPP

For long-term spent fuel management, a dual-track strategy has been adopted as a reasonable solution in the present situation. The basic reference scenario for the geological disposal has been developed, assuming the disposal of spent fuel in 2065. The option of multinational disposal is kept open.

Jožef Stefan Institute Reactor Infrastructure Centre

At present, no spent fuel from the TRIGA Mark II research reactor is planned for disposal. In 2007, the IJS decided to use the opportunity to ship and permanently dispose of spent fuel within the framework of a US government programme. If the return of spent fuel from the IJS Reactor Infrastructure Centre to the USA does not occur, the spent fuel management will be arranged jointly with the spent fuel disposal of the Krško NPP.

SECTION I: TRANSBOUNDARY MOVEMENT

Article 27: Transboundary Movement

1. Each Contracting Party involved in transboundary movement shall take the appropriate steps to ensure that such movement is undertaken in a manner consistent with the provisions of this Convention and relevant binding international instruments.

In so doing:

(i) a Contracting Party which is a State of origin shall take the appropriate steps to ensure that transboundary movement is authorised and takes place only with the prior notification and consent of the State of destination,

(ii) transboundary movement through States of transit shall be subject to those international obligations which are relevant to the particular modes of transport utilised,

(iii) a Contracting Party which is a State of destination shall consent to a transboundary movement only if it has the administrative and technical capacity, as well as the regulatory structure, needed to manage the spent fuel or the radioactive waste in a manner consistent with this Convention,

(iv) a Contracting Party which is a State of origin shall authorise a transboundary movement only if it can satisfy itself in accordance with the consent of the State of destination that the requirements of subparagraph (iii) are met prior to transboundary movement,

(v) a Contracting Party which is a State of origin shall take the appropriate steps to permit re-entry into its territory, if a transboundary movement is not or cannot be completed in conformity with this Article, unless an alternative safe arrangement can be made.

2. A Contracting Party shall not license the shipment of its spent fuel or radioactive waste to a destination south of latitude 60 degrees South for storage or disposal.

3. Nothing in this Convention prejudices or affects:

(i) the exercise, by ships and aircraft of all States, of maritime, river and air navigation rights and freedoms, as provided for in international Act,

(ii) rights of a Contracting Party to which radioactive waste is exported for processing to return, or provide for the return of, the radioactive waste and other products after treatment to the State of origin,

(iii) the right of a Contracting Party to export its spent fuel for reprocessing,

(iv) rights of a Contracting Party to which spent fuel is exported for reprocessing to return, or provide for the return of, radioactive waste and other products resulting from reprocessing operations to the State of origin.

The Slovenian legislation (the 2002 Act and the Rules on Transboundary Shipments of Radioactive Waste and Spent Fuel) regarding the transboundary movement of radioactive waste and spent fuel is harmonised with Council Directive 2006/117/Euratom of 20 November 2006 on the supervision and control of shipments of radioactive waste and spent fuel and with the Commission Decision of 5 March 2008 establishing the standard document for the supervision and control of shipments of radioactive waste and spent fuel referred to in Council Directive 2006/117/EURATOM.

Transboundary movement is covered in Articles 101–103 of the 2002 Act, Subparagraph 4.9, "Shipments into and out of EU Member States – The import, export and transit of nuclear and radioactive substances and radioactive waste".

The SNSA issues permits for import from, export to, and shipment into and out of other EU Member States and transit of certain radioactive and nuclear materials. Detailed provisions defining for which shipments a permit is necessary are stipulated in the 2002 Act and in the Rules on Transboundary Shipments of Nuclear and Other Radioactive Materials. It is necessary to obtain SNSA consent for shipments from and into other EU Member States and for licences for the import, export or transit of radioactive waste and spent fuel. Before issuing consent or a licence, the SNSA evaluates the measures relating to radiation and nuclear safety throughout the duration of the transport of radioactive waste and spent fuel from the place of origin to the final destination.

The SNSA may refuse to issue an approval for the import, export or transit or radioactive waste and spent fuel if it has concluded that the country of export or the country receiving the consignment does not have the technical, legal or administrative resources necessary for the safe handling of radioactive waste or spent fuel, such as for shipments to a destination south of latitude 60 degrees south.

In addition to the insurance stipulated by customs regulations, an exporter, importer, or other person or body carrying out shipments from and into other EU Member States or the transit of radioactive waste, spent fuel or nuclear substances shall ensure for each consignment thereof financial warranties to a level which guarantees the payment of expenses incurred in:

- a refusal of the shipment by the competent regulatory authority in the destination country or
- the handling ordered by the regulatory authority when it has concluded that there is no assurance for shipments of radioactive waste out of the EU Member States or imported radioactive waste being handled in a manner pursuant to the 2002 Act.

The established legislation implements all obligations under Article 27 of the Convention.

Experience

In the framework of the US and Russian research reactor spent fuel return programmes, seven transits and one export of its own spent fuel were carried out on the territory of the Republic of Slovenia before 2011.

In 2011, no transit permits were issued.

Two transits of nuclear material took place in October and November 2012. The first shipment involved slightly irradiated fuel elements for use in the Austrian TRIGA research reactor in Vienna. The second shipment contained both low and highly enriched uranium, which the same reactor in Vienna was returning to the country of origin (the USA). In the latter shipment, there was also a Pu/Be source destined for the same consignee. Both shipments were transported by lorry via the Šentilj border crossing to the Port of Koper, where the consignment was transferred to a ship (Figure 17).

In 2013, no transit permits were issued.

Figure 17: **Transfer of a container holding the Austrian consignment to a ship in the Port of Koper**

Besides these occasional transits, approximately every three years there is a shipment of radioactive waste from the Krško NPP sent for incineration and melting to another EU Member States. The last shipment was sent in September 2012 and was returned to the Krško NPP in September 2013.

SECTION J: DISUSED SEALED SOURCES

Article 28: Disused Sealed Sources

1. Each Contracting Party shall, in the framework of its national Act, take the appropriate steps to ensure that the possession, re-manufacturing or disposal of disused sealed sources takes place in a safe manner.

2. A Contracting Party shall allow for re-entry into its territory of disused sealed sources if, in the framework of its national Act, it has accepted that they be returned to a manufacturer qualified to receive and possess the disused sealed sources.

In the Republic of Slovenia, radioactive sealed sources are used in medicine, industry and research applications. Minor quantities are also used by certain state institutions (e.g. customs, the police and the army).

Licensing is required for all activities dealing with sealed sources: for purchase and use, for shipments from and to other EU Member States, for import or export, and for transport or transit – the latter based mainly on the activity of the sealed sources. The competent authorities (the SNSA and the SRPA) keep records on sealed sources in use.

In accordance with Article 130 of the 2002 Act, a register of radiation practices and a register of radiation sources shall be maintained. The registers shall be maintained as public registers by the SNSA, except for the register of radiation practices and of radiation sources in health and veterinary care, which shall be maintained as a public register by the SRPA. The contents of the registers are prescribed in Article 131 of the 2002 Act and in Articles 85–87 of the Rules on the Use of Radiation Sources and on Activities Involving Radiation.

The aforementioned Rules also set a basis for termination of the use of radioactive sources. The person carrying out a radiation practice who terminates the use of a radioactive source shall report this, within 15 days, to the SNSA or SRPA. Where radioactive sources are involved, the person carrying out a practice involving radiation shall hand them over, within three months, to the ARAO or to another holder of the licence to carry out a radiation practice, or return it to the manufacturer or supplier. The person carrying out a radiation practice shall, within eight days of the transfer of a radioactive source, send a notification, i.e. a document on the transfer of the radioactive source that records the transfer of the radioactive source to another person, to the SNSA or SRPA.

When the sealed sources are no longer in use, they become radioactive waste. Since 1986, disused and spent sealed sources from small producers have been stored at the Central Storage Facility for Radioactive Waste in Brinje. In 1999, the national public service for managing waste from small producers was established by a governmental decree. The ARAO, being assigned to perform this public service, became responsible for operating the storage and managing of waste from small producers.

Until 2000, acceptance of waste for storing was free of charge. Since then, according to the "polluter pays" principle, each waste producer has had to pay for the acceptance of waste by the Central Storage Facility for Radioactive Waste in Brinje. When accepted into storage, the liabilities for the disused source are transferred to the ARAO, which becomes responsible for further management of the spent sealed source, including future disposal of the waste. It is also the ARAO's responsibility to accept and provide proper further management of waste when its producer or holder is not known (historical waste) or is incapable of paying the fee for transporting, storing and managing the source. The expenses in such cases are covered from the national budget. In cases where sealed sources are found at the premises of scrap dealers, ironworks and so on, the above-mentioned fee is paid by these.

The Republic of Slovenia is not a significant producer of sealed sources. The IJS has practically ceased the production of radioactive sources for the domestic market (no such sources have been produced since the First Report under the Convention in 2003), so the return of exported sources is essentially a hypothetical issue.

However, in 2003 the SNSA started an action to promote the transfer of disused sealed sources that remain with their former users to the ARAO. As a result more than 130 sealed sources of various activities were transferred in the period 2011–2013, including calibration sources and "historical sources". In addition, many radioactive sources and items with added radionuclides once used in defence (e.g. compasses and aiming posts) have been transferred, appropriately treated and safely stored at the Central Storage Facility for Radioactive Waste in Brinje since then. Disused sealed sources from industrial radiography or brachytherapy (^{192}Ir) of high-activity (i.e. Category 2 at the time of manufacturing) are returned to the foreign suppliers. The holders who use ^{192}Ir in industrial radiography replace decayed sources with new ones almost annually. ^{192}Ir that is used in brachytherapy is replaced four times per year. There are up to 20 transfers of such sources per year. In addition, the number of disused ionising smoke detectors with mainly ^{241}Am transferred to the central storage amounted to around 16,300 in the period 2011–2013.

Figure 18: **Radiation News**

Disused sealed sources are one of the regular themes in Radiation News (Sevalne novice in Slovene), which is distributed quarterly to users of radiation sources and other stakeholders in the country. The SNSA, as the main author and distributor of Radiation News, assesses that in its more than ten years, this outreach activity has proved itself to be a positive approach with added value.

Council Directive 2003/122/Euratom of 22 December 2003 on the control of high-activity sealed radioactive sources and orphan sources was transposed into the Slovenian legal system through the Rules on the Use of Radiation Sources and on Activities Involving Radiation. Among other provisions, these lay down that the holders of high-activity sources have to return each disused high-activity source to the supplier or place it in a recognised installation (e.g. the Central Storage Facility for Radioactive Waste). In December 2010, Slovenia reported to the European Commission (EC) on the experience gained through the implementation of this Directive.

Disused sealed sources can also enter into the scrap metal recycling stream. This happens practically everywhere in the world. The Slovenian experience shows that most cases of orphan sources are related to the imports of scrap metal into Slovenia and to transits of such material through the country. In order to minimise the number of sources outside regulatory control, several regulatory and law enforcement measures have been implemented. Customs and police officers are equipped with radiation detection devices in order to prevent illicit trafficking across the border. Since 2002, the SNSA has had an officer on duty 24 hours a day to give advice in cases of discovery of orphan sources. Major scrap metal dealers and recyclers are equipped with portal monitors and hand-held radiation detection equipment. The Decree on Checking the Radioactivity of Shipments of Metal Scrap has been in force since 1 January 2008. This Decree stipulates that every shipment of scrap metal which is either imported or shipped into Slovenia is measured using adequate detection equipment. Such measurements shall be performed only by certified organisations. The experience after six years of validity of this Decree is positive and the awareness, including adequate response, has improved in this regard. Authorised organisations have to provide annual reports. The number of orphan sources which end up in the Central Storage Facility is of the order of two per year.

SECTION K: GENERAL EFFORTS TO IMPROVE SAFETY

Krško NPP

In order to optimise the use of the remaining radioactive waste storage capacity in the Solid Radwaste Storage Facility, a supercompactor has been installed permanently onsite. Burnable waste is periodically sent for incineration and campaigns for radioactive metal waste melting are being prepared.

Incineration of contaminated blow-down ion exchange resins from past operation is planned for the future. The last batches of used and exhausted blow-down resins have been free-released.

The timely construction of the LILW repository is essential for normal operation of the NPP. Contingency plans at the Krško NPP premises have been commenced to overcome the period until the final repository is operable. A new building for handling waste will be built, and the licensing process for the new building is in progress.

As a consequence of the Fukushima accident, stress tests were performed and an action plan on how to improve the safety of operation of the Krško NPP was drawn up. In the light of recent information, new knowledge in spent fuel management in general, and the SNSA decision issued in 2011 regarding the prevention of major accidents and mitigation of the consequences of any that do occur, the Krško NPP assessed the possibility to reduce risk associated with spent fuel, taking into account the change of long-term strategy for spent fuel. Wet spent fuel storage was assessed and compared with dry storage, and the reprocessing (recycling) option was reviewed. Since the current wet storage capacity is not adequate, from both safety and operational capacity points of view, for the commercial operational lifetime (2023), let alone in the event of lifetime extension till 2043, a dry storage option was proposed. To ensure uninterrupted operation and sufficient storage capacity in the spent fuel pool, dry cask storage facility will be operational in 2018.

In this context, the Resolution on the 2006–2015 National Programme for Managing Radioactive Waste and Spent Nuclear Fuel, which expires at the end of 2015, shall also be revised. The ARAO is preparing a technical basis for the revision of the National Programme for Radioactive Waste and Spent Nuclear Fuel Management, which should be adopted next year.

In the meantime, an action plan has been prepared and will be implemented within the Safety Upgrade Programme. This includes several modifications in the area of spent fuel management, such as:

- Installation of permanent sprays around the spent fuel pool; and
- Acquiring a mobile heat exchanger that can be connected to the spent fuel pool and cooled by water.

The Central Storage for Radioactive Waste in Brinje

It is required in the operating licence, valid until 2018, that periodic safety reviews should be performed.

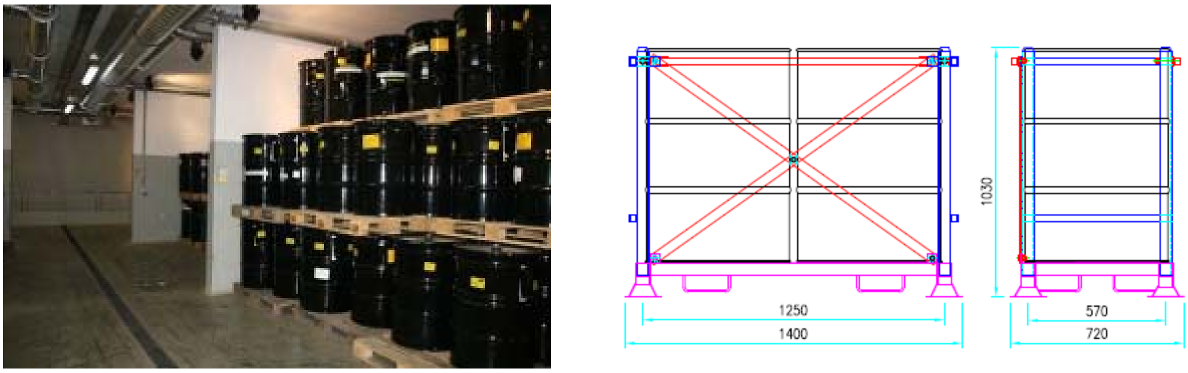
The ARAO shall, no later than 40 months before the expiry of the operating licence, submit the content, scope and timetable of the periodic safety reviews to the SNSA in order to obtain an approval. The operating licence can be extended after successful periodic safety review for another ten years.

The ARAO also recently improved the physical protection plan and carried out many upgrades in the physical and technical protection system, such as revisions of procedures and replacement of equipment for the protection of assets and the facility itself against theft, sabotage and other malevolent human acts. Video surveillance both inside and outside the facility has been ensured and the safety grade of the technical protection system has been raised by one level. The second part of the improvements is planned for the end of 2014 and will include replacement of all doors and windows of the facility with integrated anti-theft protection.

In 2013, the ARAO started with a new revision of the safety case for the storage facility. This is planned to be finished in 2014. The new revision is required because of changes in the facility and new IAEA GSG-3 requirements.

Packages of radioactive waste are arranged in the storage sections on wooden pallets and metal box pallets on three levels. With the aim of improving safety in and the security of the storage, a plan for upgrading the existing storing system was prepared. This is designed to replace the wooden pallets with a pallet self-supporting metal frames. The project will be carried out when the budget is approved.

Figure 19: **The existing storing system in the storage facility and the new designed pallet self-supporting metal frame**



Construction of the LILW Repository

One of the major tasks in the area of radioactive waste management in the Republic of Slovenia was achieved in 2009 by selecting the site for an LILW repository. The next phase is obtaining the licence for its construction. The ARAO is responsible for the LILW repository project in Slovenia. In 2012, it prepared the investment plan and in 2013 it began the process of amending it following the comments made by the responsible ministry and its own supervisory board. The investment plan was adopted in July 2014.

As part of the preparations for the investment, the new version of the safety assessment for the repository was completed in October 2012, and since 2013 the safety report has been in preparation. The field research has continued and all suggested possibilities for optimisation in terms of technical solutions to enhance the LILW repository have been analysed.

Furthermore, research of the geo- and hydrosphere of the chosen micro-location of the first silo have started. The main objective of this research is to ensure the input information needed for the final design and the conclusion of the safety analysis for the repository. Based on these findings, a new modelling of the building site and support measures is foreseen.

The funds for the project are sufficient and will be available via the Fund for the Decommissioning of the Krško NPP.

Decommissioning Programme for NEK

The second revision of the Decommissioning Programme that was prepared in 2011 has not yet been adopted by the Intergovernmental Committee which did not meet in 2011 through 2013, and consequently could not adopt the document. Furthermore the issue of a common LILW disposal solution and a spent fuel management solution between Slovenia and Croatia based on dual ownership of and shared responsibility for the management of radioactive waste from the Krško NPP has not yet been addressed by both countries.

For several reasons, including post-Fukushima measures, implementation of dry storage for spent fuel, and new decommissioning methods and analyses, a new revision of the programme must be made for the Krško NPP.

Jožef Stefan Institute Reactor Infrastructure Centre

The periodic safety review of the TRIGA Mark II reactor and the hot cell laboratories started in 2011 and will be completed in 2014. Also in 2014, a water leakage detection system will be installed; this will alert reactor staff in the event of an internal or external flood. In the same year, the pneumatic transfer system will be upgraded. The whole process will be digitalised, and fewer instances of human error and better traceability of prepared and irradiated samples are expected as a result.

Žirovski vrh Uranium Mine

The basic objectives of the programme of long-term supervision of the waste piles at Žirovski vrh are as follows:

- protection of the health of people, i.e. workers and members of the public living near the mine facilities;
- permanent protection of the environment against the consequences of exploitation of the uranium mine; and
- long-term assurance of supervision, monitoring and maintenance of mine waste piles.

The design of and safety analysis report on final remediation of the Jazbec mine waste pile were realised in 2004 and the design of and safety analysis report of the Boršt mill tailings in 2005. The SNSA issued the consent for the proposed remediation activities. The remediation was completed at the Jazbec and Boršt disposal sites in 2008 and 2010 respectively.

The Government decided that the Jazbec disposal facility is a national infrastructure facility, meaning that the site will remain the property of the state. After the administrative closure of waste piles, the implementation of their long-term supervision will be transferred to the ARAO.

During remediation of the Boršt mill tailing repository, an ancient land slide was activated. This is now moving downhill, together with disposed waste, at a faster rate than foreseen in the project documentation. The situation was evaluated by an expert group, which decided on mitigation activities. The final decision on how the repository will be closed has not yet been adopted. It is planned that additional measures will be implemented to stabilise the base rock sliding under the Boršt mill tailings pile. A decision will be made on the basis of studies which will show what kind of radiological risk there exists. The funds for stabilisation of the landslide at the Boršt site and long-term supervision of the waste piles are assured from the state budget.

Figure 20: **The Jazbec mine waste pile in autumn 2013**

Figure 21: **The Boršt mill tailings site in autumn 2013**

Ljubljana University Medical Centre – Department for Nuclear Medicine

At the University Medical Centre's Department for Nuclear Medicine, the project of the construction of faecal water containers was stopped for financial reasons and due to changes in radiation safety requirements. In 2012, the Department renovated an additional – third – radioactive waste storage room, allowing rotation of the use of storage rooms, with the intention of reducing radiation exposure for personnel.

SECTION L: ANNEXES

(a) List of Spent Fuel Management Facilities

There are no off-site spent fuel management facilities in the Republic of Slovenia.

(b) List of Radioactive Waste Management Facilities

The Central Storage Facility for Radioactive Waste in Brinje, and the Boršt mill tailings site and the Jazbec mine waste pile at the Žirovski vrh Uranium Mine are the only radioactive waste management facilities in the Republic of Slovenia.

(c) List of Nuclear Facilities in the Process of Being Decommissioned

There are no nuclear facilities being decommissioned. The Žirovski vrh Uranium Mine, which is a radiation facility in accordance with the definition in the 2002 Act, is the only facility which is in the process of being decommissioned in the Republic of Slovenia.

(d) Inventory of Spent Fuel

Spent Fuel Pool at the Krško NPP

Table 5: **The number, the average burn-up and the total mass of heavy metal of the fuel assemblies in each fuel batch**

Fuel batch	No. of fuel assemblies	Burn-up [GWd/MTU]	Heavy metal [kg]
1	41	18.6	16,335.0
2	40	24.3	15,788.4
3	40	30.9	15,613.2
4A	25	30.7	9,767.4
4B	16	34.3	6,258.0
5A	40	32.6	15,666.8
5B	2	30.2	780.1
6A	4	38.7	1,563.6
6B	1	36.7	390.6
6C	36	39.5	14,036.0
7A	24	35.9	9,463.0
7B	2	36.4	785.5
7C	20	33.7	7,913.3
8A	16	44.9	6,246.4
8B	8	44.8	3,122.3
KWU	40	34.8	14,980.1
9	12	41.7	4,694.9
10A	8	40.5	3,119.2
10B	12	43.3	4,656.6
10C	8	47.3	3,090.3
11	40	40.1	15,646.9
11B	20	40.2	7,832.8
12	24	44.4	9,317.3
12B	7	43.5	2,724.9
13	40	43.0	15,598.0
14	35	43.0	13,628.6
14B	4	44.5	1,554.2
15	24	46.4	9,290.9
15B	12	37.1	4,702.6
16	16	45.0	6,224.6
16B	8	46.6	3,107.9
17	24	44.3	9,343.7
17B	4	40.1	1,568.8
18	28	43.7	10,741.6
19	30	44.0	11,558.7
20	28	45.1	10,843.4
21	22	44.3	8,507.0
22A	12	41.6	4,653.9
22B	32	46.8	12,353.9
23B	32	48.9	12,328.4
24B	8	52.1	3,068.8
25B	4	50.8	1,539.2
26B	8	52.5	3,067.3
FRSB1	1	27.8	60.4
SBFR1	1	35.8	0.2

Spent Fuel Pools at the IJS Reactor Infrastructure Centre

There are no spent fuel elements stored in the spent fuel pools at the IJS Reactor Infrastructure Centre.

(e) Inventory of Radioactive Waste

Radioactive Waste Storage facilities at the Krško NPP

Table 6: **Radioactive waste inventory in the Krško NPP Solid Radwaste Storage Facility on 31 December 2013**

Type of waste	No. of drums	Volume [m³]	Net weight [kg]	Total beta/gamma activity [Bq]	Specific activity beta/gamma [Bq/m³]
Incineration products (A)	109	22.672	28,553	8.18E+09	3.61E+08
Blowdown Resins (BR)	84	16.800	12,902	3.27E+09	1.95E+08
Compressible Waste (CW)	13	2.704	1,420	2.45E+08	9.06E+07
Evaporator Bottom (EB)	2	0.416	361	2.70E+08	6.49E+08
Filters (F)	117	24.104	44,367	1.59E+11	6.60E+09
Other (O)	5	1.040	659	1.07E+09	1.03E+09
Supercompacted Waste (SC)	617	197.440	181,763	1.69E+10	8.56E+07
Spent Resins (SR)	689	143.312	197,886	2.31E+12	1.61E+10
Supercompacted Waste (ST)	1,968	1,701.367	2,135,936	6.70E+12	3.94E+09
Primary (PR) and blowdown (BR) resins and dry concentrate (DC) in tube-type container (TI)	162	140.778	84,522	1.02E+13	7.25E+10
TOTAL	**3,766**	**2,250.633**	**2,688,369**	**1.93E+13**	**8.62E+09**

The specific radionuclides (beta, gamma) are ^{58}Co, ^{60}Co, ^{134}Cs and ^{137}Cs.

The description of waste types and acronyms used are as follows:

- Evaporator Bottom (EB) - the residue from evaporating waste water, containing boric acid, solidified in vermiculite cement packed in 208 l drums.
- Filters (F) - spent filters from the primary water purification and liquid waste processing system, packaged in standard 208 l steel drums with inner concrete biological shield.
- Spent Resins (SR) - spent ion exchange resins from purification systems, embedded in 208 l drums with vermiculite cement.
- Compressible Waste (CW) - waste arising mostly from using personal protective clothes, coveralls, shoe covers, plastics etc., packed into 208 l drums.
- Other (O) - miscellaneous waste arising during operation and maintenance activities like contaminated used parts, cables, hoses, valves, concrete, wood etc., packed in 208 l drums.
- Supercompacted waste (SC) - radioactive waste of type Compressible Waste supercompacted and packed in 320 l carbon steel overpacks (campaign conducted in 1988 and 1989).
- Supercompacted waste (ST) - radioactive waste of type Compressible Waste and Evaporator Bottom, supercompacted, Spent Resins inserted and packed in tube-type container.
- Incineration products (A) - ashes, dust and other residues from incineration of combustible waste.
- Primary Resins (PR) - spent ion exchange resins from primary water purification systems dried and packed in stainless steel drums with 3 cm thick walls as biological shield.

- Blowdown Resins (BR) - resins arising from purification system of secondary system, packed in stainless steel drums.
- TI package as Primary Resins (PR), Blowdown Resins (BR) and Dry Concentrate (DC) additionally inserted in tube-type containers (3 drums of Primary Resins/Blowdown Resins/DC in 1 tube-type container).

Types of packages in the Solid Radwaste Storage Facility are as follows:

- 208 l standard drum, designed in accordance with ANSI DOT-17H standard, appropriate for the following solid wastes: Compressible Waste, Other, Filters, Spent Resins and Evaporator Bottom.
- 320 l overpack, used solely for packaging of compressed standard 208 l drums from the first supercompaction campaign.
- 200 l Stainless Steel heavy drum with biological shield (150 l of usable volume), used for dried primary spent resins (Primary Resins) tested as Type A Package in accordance with IAEA Safety Standards.
- 200 l Stainless Steel heavy drum without biological shield, used for secondary spent resins (Blowdown Resins) and dried concentrate (DC) tested as Type A Package. The use of stainless steel drums with biological shields started after the In-drum drying system for volume reduction was introduced.
- 200 l heavy carbon steel drum with coating, a limited number of this type of drums were filled with secondary spent resins (Blowdown Resins) and dried concentrate (DC). Periodic inspection of these drums is required to confirm corrosion resistance.
- 100 l drums containing ash from incineration. These drums are immobilised with concrete in 208 l drums.
- tube-type container, usable volume 869 l with a welded lid, is an overpack, used in the second supercompaction campaign. Tested as IP 2 container according to IAEA Safety Standards.
- tube-type container, usable volume 864 l with a flanged lid used for in-drum drying system products and other types of radioactive waste as a preferred final package for interim storage in a solid radwaste storage facility, awaiting transport to off-site disposal area. Tested as IP 2 container in accordance with IAEA Safety Standards.

Table 7: **Radioactive waste inventory in the Decontamination Building - Decontamination area, on 31 December 2013**

Type of radioactive waste	Number of pieces	Volume [m³]	Mass [kg]	Contamination [Bq/dm²]	Packaging
Rx old head – CRDM	4	3	1,200	500	PE foil
Rx old head – DRPI	4	3	600	400	PE foil
Reactor screw tensioners	5	5	5,200	100	PE foil
Concrete blocks	4	10	19,000	100	PE foil

Table 8: **Radioactive waste inventory in the Decontamination Building - Old steam generators area, on 31 December 2013**

Type of radioactive waste	Number of pieces	Volume [m³]	Mass [kg]	Activity/ Contamination/ Dose Rate	Packaging
Steam generators*	2	600	646,000	< 3.00E+12 Bq	N/A
Radlok containers (from 1 to 10)	10	36	2,500	10,000 Bq/dm²	PE reservoir
Regenerative and refuelling water heat exchanger	2	4	4,500	3,5 mSv/h	Metal container
Maintenance department equipment	2	2	1,900	1 mSv/h	Metal container
Steel ropes	8	1	1,300	300 Bq/dm²	Container
Tools for pressure monitoring of the reactor vessel temporary sealing lid	1	2	1,300	100 Bq/dm²	Metal container
Temporary lid seal of old steam	4	4	1,300	6,000 Bq/dm²	Metal container

Type of radioactive waste	Number of pieces	Volume [m³]	Mass [kg]	Activity/ Contamination/ Dose Rate	Packaging
generators					
Temporary reactor vessel lid	1	1.4	1,300	1,600 Bq/dm²	Metal container
Framatome steam generators equipment	4	1	1,300	4,000 Bq/dm²	Metal container
Rotor supports of the reactor coolant pumps	1	3	800	3,000 Bq/dm²	Metal container
Reactor coolant pumps equipment	2	4	1,000	4,000 Bq/dm²	Metal container
Spent parts of the reactor coolant pumps	1	2	800	5,000 Bq/dm²	Metal container
Inner parts of the CSAPCH01 pump	1	1	500	6,000 Bq/dm²	Metal container
Old cranes for removal of reactor vessel screws	4	1	300	400 Bq/dm²	PE foil
Support plates of the steam generators from no. 6 container	10	1	2,000	400 Bq/dm²	PE foil
Old Rx real ring	1	1	500	2 mSv/h	PE foil
New Rx seal ring	1	1	500	400 Bq/dm²	Stainless steel container
Diving equipment	2	2	300	500 Bq/dm²	Container
Temporary Rx seal ring	1	16	1,500	500 Bq/dm²	Metal container
Reactor coolant pumps elevator	1	2	500	300 Bq/dm²	Metal container
Compressible waste press	1	2	400	100 Bq/dm²	PE foil
Reactor coolant pumps convenient elevator	3	2	200	100 Bq/dm²	Metal container
INETEC equipment	2	5	2,500	5,000 Bq/dm²	Metal container
Supercompactor cylinder and vacuum pump	4	1	1,000	20,000 Bq/dm²	PE foil
Lead shields	18	18	24,000	100 Bq/dm²	Metal containers
Reactor coolant pump motor base	2	2	700	4,000 Bq/dm²	Metal containers
Rod position digital system cables	4	4	1,000	500 Bq/dm²	Wooden containers
Spare winch for fuel handling	1	0.5	300	500 Bq/dm²	PE foil
Steam generators drying equipment	1	1.5	200	-	Metal container
Reactor coolant pump motor equipment	4	1	300	400 Bq/dm²	Metal container
SEG for WP equipment	2	6	4,000	5,000 Bq/dm²	Metal container
RCP motor oil cooler	1	1	1,000	100 Bq/dm²	N/A
Ingots *	80	14	55,000	< 50 µSv/h	Steel ingots
Packages from Solid Radwaste Storage Facility**	250	50	30,000	< 100 µSv/h	barrels
RCP01 motor stator	1	4	8,200	500 Bq/dm²	Metal stand
VA pump motor (RB-126)	4	4	4,000	100 Bq/dm²	PE foil
SS heat exchanger	2	0.5	200	100 Bq/dm²	Metal containers
Rx head - old	1	21	70,000	2 mS/h	Container
Concrete blocks	3	25	90,000	5 µSv/h	PE foil
Containers	5	150	40,000	6,000 Bq/dm²	Container
TOTAL	**448**	**997.9**	**1,003,100**		

Notes:
* Material is temporarily stored in the old steam generators storage.
** Packages awaiting transport to external incineration facility.

Central Storage Facility for Radioactive Waste in Brinje

Table 9: **Quantity of stored radioactive sources at the end of the year 2013**

Waste categories	Number of packages	Radionuclides	Activity (Bq)
T1 (solid, compressible, combustible)	91	^{226}Ra, ^{60}Co, ^{241}Am, ^{109}Cd, ^{108}Ag, ^{238}U, ^{57}Co, ^{232}Th, ^{3}H	8.9E+08
T2 (solid, compressible, non-combustible)	127	^{226}Ra, ^{60}Co, ^{241}Am, ^{109}Cd, ^{108}Ag, ^{238}U, ^{3}H, ^{238}U, ^{14}C	1.7E+10
T3 (solid, non-compressible, combustible)	16	^{226}Ra, ^{60}Co, ^{232}Th	1.1E+08
T4 (solid, non-compressible, non-combustible)	191	^{226}Ra, ^{60}Co, ^{109}Cd, ^{137}Cs, ^{108}Ag, ^{238}U, ^{14}C, ^{232}Th, ^{133}Ba	1.4E+11
ZV0 (smoke detectors)	274	^{241}Am, ^{226}Ra	1.5E+10
ZV1 (spent sealed sources with: A≤3,7 GBq)	139	^{226}Ra, ^{60}Co, ^{241}Am/Be, ^{238}U, ^{232}Th, ^{63}Ni, ^{55}Fe, ^{90}Sr, ^{106}Ru, ^{3}H	4.4E+11
ZV2 (spent sealed sources with: 3,7 GBq<A≤37 GBq)	28	^{226}Ra, ^{152}Eu, ^{60}Co, ^{137}Cs, ^{85}Kr, ^{241}Am/Be, ^{133}Ba	6.9E+11
ZV3 (spent sealed sources with: 37 GBq<A≤370 GBq)	9	^{152}Eu, ^{241}Am, ^{60}Co, ^{133}Ba, ^{241}Am/Be	1.3E+12
ZV4 (spent sealed sources with: A>370 GBq)	2	^{60}Co	5.9E+11
TOTAL	**877**		**3.2E+12**

Total volume: 92.4 m³

Total mass: 50 tons

Jazbec mine waste pile at the Žirovski vrh Uranium Mine

Table 10: **Mine waste and other debris at the Jazbec mine waste pile, situation at the end of the year 2013**

Deposited	mine waste and red mud 1982-1990 (mine ore production), contaminated material, technological equipment 1991-2007 (decontamination, demolition)
Final arrangement	2008
Surface, total	67,325 m^2 (the area of the mine waste pile inside the drainage channels) 74.239 m^2 (the area inside safety fence of the mine waste pile)
Altitude	bottom 427 m, top 509 m (above sea level)
Volume of disposed waste	854,500 m^3 of mine waste, 126,000 m^3 of low grade uranium ore, 34,000 m^3 of red mud, 2,600 m^3 of filter cake from mine water treatment station, 181,000 m^3 of contaminated soil and rubble from uranium ore processing facilities and crash station demolition, 800 m^3 of technological equipment from uranium ore processing facilities and crash station, **total volume of disposed material is 1,198,900 m^3**
Amount of disposed waste	1,366,589 t of mine waste, 200,684 t of low grade uranium ore, 48,000 t of red mud, 4,220 t of filter cake from mine water treatment station, 289,723 t of contaminated soil and rubble from uranium ore processing facilities and crash station demolition, 1,209 t of technological equipment from uranium ore processing facilities and crash station, **total amount of disposed material is 1,910,425 t**
Average specific activity of disposed material	7.7 kBq/kg mine waste (53 g U_3O_8/t), 65 kBq/kg red mud (^{230}Th 97%), 34.4 kBq/kg filter cake (236 g U_3O_8/t), 29.2 kBq/kg low grade uranium ore (200 g U_3O_8/t), < 2 kBq/kg contaminated soil and rubble
Total activity of disposed material	**21.7 TBq**
Dose rate, average	0,12 μGy/h (covered with final layer)

Note: most of the ^{230}Th was not contained in the mill tailings, but remained in the so-called red mud as a neutralisation by-product.

Boršt mill tailings site at the Žirovski vrh Uranium Mine

Table 11: **Boršt mill tailings site with basic data, situation at the end of the year 2013**

Deposited	mill tailings 1984-1990 and mine waste 1984-2004, contaminated material 2008-2009
Final arrangement	2010 arrangement of the mill tailings, till 2013 remediation of the mill tailings base rock sliding
Surface, total	42,000 m^2 (mill tailings surface), 67,923 m^2 (surface inside the safety fence of the mill tailings)
Altitude	bottom 535 m, top 565 m (above sea level)
Volume of disposed waste	339,000 m^3 of mill tailings, 70,000 m^3 of mine waste, 6,543 m^3 contaminated materials **total volume of disposed material is 415,543 m^3**
Amount of disposed waste	610,000 t of mill tailings, 111,000 t of mine waste, 9,450 t contaminated materials, **total amount of disposed material is 730,450 t**
Average specific activity of disposed material	78.2 kBq/kg mill tailings, 10.2 kBq/kg mine waste
Total activity of disposed material	**48.8 TBq**
Dose rate, average	0.14 μGy/h (covered with final layer)

Note: Specific activity of contaminated materials has not been measured, however it was low.

(f) References to National Acts, Regulations, Requirements, Guidelines, etc.

Besides the 2002 Act and the regulations which cover spent fuel and radioactive waste management (see Article 19 of the Report) the Acts and regulations stated below should also be mentioned.

Nuclear and Radiation Safety, Physical Protection, Safeguards, Quality Assurance

On the basis of the 2002 Act, the following decrees and regulations for carrying into effect radiation protection and nuclear safety provisions are in force:

- Rules on the Specialist Council on Radiation and Nuclear Safety (Official Gazette RS, No. 35/2003),
- Rules on Functioning of the Expert Council for the Issues of Ionising Radiation Protection, Radiological Activities, and the Use of Radiation Sources in Human and Veterinary Medicine (Official Gazette RS, No. 62/2003),
- Rules on the Requirements of Using Ionising Radiation Sources in Healthcare (Official Gazette RS, No. 111/2003),
- Rules on the Requirements and Methodology of Dose Assessment for the Radiation Protection of the Population and Exposed Workers (Official Gazette RS, No. 115/2003),
- Rules on Health Surveillance of Exposed Workers (Official Gazette RS, No. 2/2004),
- Rules on the Obligations of the Person Carrying Out a Radiation Practice and Person Possessing an Ionising Radiation Source (Official Gazette RS, No. 13/2004),
- Rules on Approving of Experts Performing Professional Tasks in the Field of Ionising Radiation (Official Gazette RS, No. 18/2004),
- Rules on the Method of Keeping Records of Personal Doses Due to Exposure to Ionising Radiation (Official Gazette RS, No. 33/2004),
- Decree on the Areas of Limited Use of Space Due to a Nuclear Facility and the Conditions of Facility Construction in these Areas (Official Gazette RS, Nos. 36/2004 and 103/2006),
- Decree on Activities Involving Radiation (Official Gazette RS, Nos. 48/2004 and 9/2006),
- Decree on Dose Limits, Radioactive Contamination and Intervention Levels (Official Gazette RS, No. 49/2004),
- Rules on Inputs from and Outputs in the EU Member States and on Import and Export of Radioactive Waste (Official Gazette RS, Nos. 60/2004 and 80/2005),
- Rules on the Conditions to be Met by Primary Health Care Centres for Breast (Official Gazette RS, No. 110/2004),
- Program on Systematic Monitoring of Working and Residential Environment and Raising Awareness about Measures to Reduce Public Exposure Due to the Presence of Natural Radiation Sources (Official Gazette RS, No. 17/2006),
- Rules on the Use of Radiation Sources and on Activities Involving Radiation (Official Gazette RS, No. 27/2006),
- Rules on Radioactive Waste and Spent Fuel Management (Official Gazette RS, No. 49/2006),
- Rules on Authorised Experts on Radiation and Nuclear Safety (Official Gazette RS, No. 51/2006),
- Decree on the implementation of Council Regulations (EC) and Commission Regulations (EC) on the radioactive contamination of foodstuffs and feedstuffs (Official Gazette RS, Nos. 52/2006 and 38/2010),
- Rules on the Monitoring of Radioactivity (Official Gazette RS, Nos. 20/2007 and 97/2009),
- Decree on Safeguarding of Nuclear Materials (Official Gazette RS, No. 34/2008),
- Decree on Checking the Radioactivity for Shipments of Metal Scrap (Official Gazette RS, No. 84/2007),
- Rules on the Transboundary Shipment of Nuclear and Radioactive Substances (Official Gazette RS, No. 75/2008),

- Rules on Transboundary Shipments of Radioactive Waste and Spent Fuel (Official Gazette RS, No. 22/2009),
- Rules on Operational Safety of Radiation and Nuclear Facilities (Official Gazette RS, Nos. 85/2009, 9/2010-corr. and 87/2011),
- Rules on Radiation and Nuclear Safety Factors (Official Gazette RS, No. 92/2009),
- Rules on the Use of Potassium Iodine (Official Gazette RS, No. 59/2010),
- Rules on providing qualification for workers in radiation and nuclear facilities (Official Gazette RS, No. 32/2011),
- Rules on physical protection of nuclear facilities, nuclear and radioactive materials, and transport of nuclear substances (Official Gazette RS, No. 17/2013),
- Order on establishing a program of basic training program and periodic retraining of security personnel performing physical protection of nuclear facilities, nuclear or radioactive materials and transport of nuclear substances (Official Gazette RS, No. 12/2013).

On the basis of the 1984 Act, the following regulation for carrying into effect radiation protection and nuclear safety provisions is still in force:

- On Maximum Permitted Levels of Radioactive Contamination of Human Environment and on Decontamination (Official Gazette SFRY, Nos. 8/87 and 27/90), Regulation Z-9 – approximately half of the provisions of the regulation have been derogated, the other half are still in force.

Third Party Nuclear Liability

- Act on Liability for Nuclear Damage (Official Gazette RS, No. 77/2010),
- Ordinance on determining the persons to whom the conclusion of the insurance of liability for nuclear damage is not obligatory (Official Gazette RS, No. 110/2010),
- Third Party Liability for Nuclear Damage Act (Official Gazette SFRY, Nos. 22/78 and 34/79) - The Act shall cease to apply on the day Act on Liability for Nuclear Damage enters into force (4 April 2011), except the provision of Article 20 which shall apply until a full application of the Act on Liability for Nuclear Damage,
- Act on Insurance for Nuclear Damage Liability (Official Gazette RS, Nos. 12/80 and 17/91) - The Act shall cease to apply on the day Act on Liability for Nuclear Damage enters into force (4 April 2011),
- Decree on Establishment of the Amount of Limited Operator's Liability for Nuclear Damage and on Establishment of the Amount of Insurance for Liability for Nuclear Damage (Official Gazette RS, No. 110/2001) – The Decree shall apply until a full application of the Act on Liability for Nuclear Damage.

Civil Protection and Disaster Relief

- Protection Against Natural and Other Disasters Act (consolidated text - Official Gazette RS, Nos. 51/2006 and 97/2010),
- Decree on the Contents and Drawing up of Protection and Rescue Plans (Official Gazette RS, Nos. 3/2002, 17/2002, 76/2008 and 24/2012),
- National Emergency Response Plan for Nuclear and Radiological Accidents, Version 3.0, 2010.

Administrative

- Public Administration Act (consolidated text - Official Gazette RS, Nos. 113/2005, 126/2007, 48/2009, 21/2012, 47/2013 and 12/2014),
- Inspection Act (consolidated text - Official Gazette RS, Nos. 43/2007 and 40/2014),
- General Administrative Procedure Act (consolidated text - Official Gazette RS, Nos. 24/2006, 126/2007, 65/2008, 47/2009, 8/2010 and 82/2013).

Energy and Environmental

- Energy Act (consolidated text - Official Gazette RS, No. 17/2014),
- Decree on the Transformation of the Krško NPP, p.o. into the Public Limited Company NPP Krško, d.o.o. (Official Gazette RS, Nos. 54/98, 57/98, 59/2002 and 10/2003),

- Environment Protection Act (consolidated text - Official Gazette RS, Nos. 39/2006, 49/2006, 66/2006, 112/2006, 33/2007, 57/2008, 70/2008, 108/2009, 48/2012, 57/2012 and 92/2013),
- Decree on the Categories of Activities for which an Environmental Impact Assessment is Mandatory (Official Gazette RS, Nos. 78/2006, 72/2007, 32/2009, 95/2011 and 20/2013),
- Decree on the Criteria for the Determination of the Compensatory Amount due to the Limited Use of the Environment in the Area of a Nuclear Facility (Official Gazette RS, Nos. 134/2003 and 100/2008),
- Instruction on the Methodology of Preparing Reports on Environmental Impact (Official Gazette RS, No. 70/96),
- Permanent Cessation of Exploitation of the Uranium Ore and Prevention of Consequences of the Mining in the Uranium Mine at Žirovski vrh Act (consolidated text - Official Gazette, RS, No. 22/2006),
- Decree Determining the Area and of the Compensatory Amount due to the Limited Use of the Environment in the Area of Žirovski vrh Uranium Mine (Official Gazette RS, Nos. 22/2008 and 50/2009),
- Decree on the Content of Report on the Effects of Intended Activity to the Environment and Method of its Preparation (Official Gazette RS, No. 36/2009),
- Decree on criteria for determining the likely significance of environmental effects of certain plans, programmes or other acts and its modifications in the environmental assessment procedure (Official Gazette RS, No. 9/2009),
- Decree laying down the content of environmental report and on detailed procedure for the assessment of the effects on certain plans and programmes on the environment (Official Gazette RS, No. 73/2005),
- Fund for Financing Decommissioning of the Krško Nuclear Power Plant Krško and Disposal of Radioactive Waste from the Krško NPP Act (consolidated text - Official Gazette RS, Nos. 47/2003 and 68/2008).

Transport, Export and Import

- Act on Transport of Dangerous Goods (consolidated text - Official Gazette RS, Nos. 33/2006, 41/2009 and 97/2010),
- Decision on the Publication of Amendments to Annexes A and B of the European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR; Official Gazette RS, Nos. 9/2003, 66/2003, 9/2005, 9/2007, 125/2008, 97/2010 and 14/2013).

Export of dual-use items

- Act Regulating the Exports of Dual-Use Goods (Official Gazette RS, Nos. 37/2004 and 8/2010),
- Regulation on Procedures for Issuing Authorisations and Certificates and on Competence of the Commission for the Control of Exports of Dual-Use Items (Official Gazette RS, Nos. 34/2010 and 42/2012),
- Decree on Restrictive Measures against Iran and on Implementation of Council Regulation (EU) No 961/2010.

General

- Decree on Administrative Authorities within Ministries (Official Gazette RS, Nos. 58/2003, 45/2004, 86/2004, 138/2004, 52/2005, 82/2005, 17/2006, 76/2006, 132/2006, 41/2007 and 64/2008, 63/2009, 69/2010, 40/2011, 98/2011, 17/2012, 23/2012, 82/2012, 109/2012, 24/2013, 36/2013, 51/2013 and 43/2014),
- Maritime Code (consolidated text - Official Gazette RS, Nos. 120/2006, 88/2010 and 59/2011),
- The Criminal Code (consolidated text - Official Gazette RS, Nos. 50/2012 and 63/2013),
- Minor Offences Act (consolidated text - Official Gazette RS, Nos. 29/2011, 43/2011, 21/2013 and 111/2013),
- Spatial Planning Act (Official Gazette RS, Nos. 33/2007, 108/2009, 80/2010, 57/2012 and 109/2012),

- Act regarding the siting of Spatial Arrangements of National Significance in Physical Space (Official Gazette RS, Nos. 80/10, 106/10 and 57/2012),
- Construction Act (consolidated text - Official Gazette RS, Nos. 102/2004, 92/2005, 93/2005, 111/2005, 120/2006, 126/2007, 57/2009, 108/2009, 61/2010, 20/2011, 57/2012 and 110/2013),
- Decree on the Detailed Plan of National Importance for Low and Intermediate Level Waste Repository at Vrbina in the Krško Municipality (Official Gazette of Republic of Slovenia, Nos. 114/09 and 50/2012),
- Decree on Establishment of a Public Agency for Radwaste Management (Official Gazette RS, Nos. 5/91, 45/96, 32/99, 38/2001, 41/2004 and 113/2009),
- Decree on the Method and Subject of and Conditions for Performing a Public Utility Service of Radioactive Waste Management (Official Gazette RS, Nos. 32/99 and 41/2004),
- Price list of public service of radioactive waste management (Official Gazette RS, No. 102/2000),
- Standardisation Act (Official Gazette RS, No. 59/99).

Multilateral and Bilateral Treaties, Conventions, Agreements/ Arrangements

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

Multilateral Agreements

- Statute of the International Atomic Energy Agency (including the Amendment of Article VI and XIV),
- Agreement on the Privileges and Immunities of the International Atomic Energy Agency,
- Convention on the Physical Protection of Nuclear Material (including the Amendment from 2005),
- Convention on Early Notification of a Nuclear Accident,
- Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency,
- The IAEA Incident Reporting System (IAEA-IRS),
- Convention on Nuclear Safety,
- Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water,
- Treaty on the Non-proliferation of Nuclear Weapons,
- Treaty on the Prohibition of the Emplacement of Nuclear Weapons and other Weapons of Mass Destruction in the Sea-Bed and the Ocean Floor,
- European Agreement Concerning the International Carriage of Dangerous Goods by Road (ADR),
- Convention on International Railway Carriage (COTIF) including Appendix B (RID),
- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management,
- Comprehensive Nuclear-Test-Ban Treaty,
- Convention on Third Party Liability in the Field of Nuclear Energy of 29 July 1960, as Amended by the Additional Protocol of 28 January 1964 and by the Protocol of 16 November 1982,
- Convention of 31 January 1963 Supplementary to the Paris Convention of 29 July 1960, as Amended by the Additional Protocol of 28 January 1964 and by the Protocol of 16 November 1982,
- Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention,
- Agreement between the Kingdom of Belgium, the Kingdom of Denmark, the Federal Republic of Germany, Ireland, the Italian Republic, the Grand Duchy of Luxembourg, the Kingdom of the Netherlands, the European Atomic Energy Community and the International Atomic Energy Agency in Implementation of Article III, (1) and (4) of the Treaty on the Non-Proliferation of Nuclear Weapons,
- Protocol Additional to the Agreement between the Republic of Austria, the Kingdom of Belgium, the Kingdom of Denmark, the Republic of Finland, the Federal Republic of Germany, the Hellenic

Republic, Ireland, the Italian Republic, the Grand Duchy of Luxembourg, the Kingdom of the Netherlands, the Portuguese Republic, the Kingdom of Spain, the Kingdom of Sweden, the European Atomic Energy Community and the International Atomic Energy Agency in implementation of Article III, (1) and (4) of the Treaty on the Non-Proliferation of Nuclear Weapons.

Bilateral Agreements

- Arrangement between the SNSA and the US NRC for the Exchange of Technical Information and Co-operation in the Nuclear Safety Matters,
- Agreement between the Government of the Republic of Slovenia and the Government of the Republic of Hungary on the Early Exchange of Information in the Event of a Radiological Emergency,
- Agreement between the Republic of Slovenia and the Republic of Austria on the Early Exchange of Information in the Event of Radiological Emergency and on Common Interests in the Field of Nuclear Safety and Radiation Protection,
- Arrangement between the Nuclear Safety Administration of the Republic of Slovenia and the Federal Ministry of Agriculture and Forestry, Environment and Water Management of the Republic of Austria regarding Co-operation in the Field of Radiation Protection and Strengthening of the mutual Exchange of Data of the Aerosol Monitoring Systems,
- Arrangement between the Nuclear Safety Administration (SNSA) of the Republic of Slovenia and the Institute for Environmental Protection and Research (ISPRA) of the Republic of Italy for the early exchange of information in the event of a radiological emergency and co-operation in nuclear safety matters,
- Agreement between the Republic of Slovenia and the Republic of Croatia for the Early Exchange of Information in the Event of a Radiological Emergency,
- Agreement between the Government of the Republic of Slovenia and the Government of the Slovak Republic for the Exchange of Information in the Field of Nuclear Safety,
- Arrangement between the Nuclear Safety Administration of the Republic of Slovenia and the Council for Nuclear Safety of South Africa for the Exchange of Technical Information and Co-operation in the Regulation of Nuclear Safety,
- Arrangement between the Nuclear Safety Administration of the Republic of Slovenia and the Ministry of Science and Technology of the Republic of Korea for the Exchange of Information and Co-operation in the Field of Nuclear Safety,
- Arrangement between the Slovenian Nuclear Safety Administration and the Directorate for Nuclear Safety of the French Republic on the Exchange of Information and Cooperation in the Field of Nuclear Safety,
- Treaty between the Government of the Republic of Slovenia and the Government of the Republic of Croatia on the Regulation of the Status and Other Legal Relations Regarding Investment, Exploitation and Decommissioning of the Krško NPP,
- Agreement between the Republic of Slovenia and the United States of America concerning Cooperation in the Prevention of the Proliferation of Weapons of Mass Destruction,
- Agreement between the Government of the Republic of Slovenia and the Government of the Republic of Canada for Co-operation in the Peaceful Uses of Nuclear Energy,
- Arrangement between the Nuclear Safety Administration (SNSA) of the Republic of Slovenia and the Institute for Environmental Protection and Research (ISPRA) of the Republic of Italy for the early exchange of information in the event of a radiological emergency and co-operation in nuclear safety matters,
- Revised Supplementary Agreement between the International Atomic Energy Agency and the Government of the Republic of Slovenia concerning the Provision of Technical Assistance by the International Atomic Energy Agency to the Government of the Republic of Slovenia.

International acts which are not international treaties

- Memorandum of Understanding between the Slovenian Nuclear Safety Administration and the State Office for Nuclear Safety of the Czech Republic on the Exchange of Information on Nuclear and Radiation Safety Matters,
- Memorandum of Understanding between the Slovenian Nuclear Safety Administration and the Macedonian Radiation Safety Directorate on the Exchange of Information on Nuclear and Radiation Safety Matters,
- Memorandum of Understanding between the European Nuclear Safety Regulators Group and the International Atomic Energy Agency for International Peer Review Missions to the EU Member States,
- Memorandum of Understanding between the Slovenian Nuclear Safety Administration and the State Regulatory Agency for Radiation and Nuclear Safety of Bosnia and Herzegovina on the Exchange of Information on Nuclear and Radiation Safety Matters,
- Memorandum of Understanding between the Slovenian Nuclear Safety Administration and the National Nuclear Agency of the Republic of Albania n the Exchange of Information on Nuclear and Radiation Safety Matters.

(g) References to Official National and International Reports Related to Safety

- Angus, M. J., Moreton, A. D., Wells, D. A.: Management of Spent Sealed Radioactive Sources in Central and Eastern Europe, Contract B/-5350/99/6161/MAR/C2. March 2001.
- WAMAP Mission to the Socialist Federal Republic of Yugoslavia: Travel Report, IAEA, April 1991.
- EUR 19154, Radioactive Waste Management in the Central and Eastern European Countries. [prepared by] European Commission; Nuclear Safety and the Environment. Brussels; Luxembourg: Office for Official Publications of the European Communities, 1999.

(h) References to Reports on International Review Missions Performed at the Request of a Contracting Party

- CASSIOPEE, Study on Radioactive Waste Management Schemes in Slovenia: Final Report, Services Contracts 97-0289.00, 97-0379.00, PHARE: ZZ 9423/0301, ZZ 9528/0301. December 1998.
- End of Mission Report on "Decommissioning of the Žirovski vrh Mine Complex (RUŽV)": Radiation Safety during Decommissioning of Uranium Mines, (SLO/9/003-3&4). IAEA, February 1996.
- Feasby, D. G.: End of Mission Report on "Remediation of Žirovski vrh, Uranium Mine and Milling Site": Assessment of Remediation Programme and Planned Remediation of Žirovski vrh Mine, (SLO/3/002-02). IAEA, March 17-22, 1997.
- Glendon W. Gee.: End of Mission Report on "Geotechnical Engineering/Soil Science Assessment": Remediation of Žirovski vrh Uranium Mine and Milling Site, (SLO/3/002-03). IAEA, July 7-13, 1997.
- Report of the International Regulatory Review Team (IRRT) to Slovenia, IAEA/NSNI/IIIT/99/5, TC Project RER/9/052. December 1999.
- WISMUT. Evaluation of the Technical and Economic Measures Planned in Relation to the Closeout of the Uranium Ore Mine. June 2001.
- ZETTWOOG, P.: Final Report of Mission on "Decommissioning of the Žirovski vrh Mine Complex (RUŽV)", IAEA/TCA, (SLO/3/002-01). February 10-15, 1997.
- OSART Mission (IAEA), October 17 to November 20, 2003 and Follow-up Visit, November 7 - 11, 2005.
- WANO Peer Review Mission, March 12 - 30, 2007.
- WATRP IAEA Mission, Review of ARAO's Documentation and Technical Programme for the Development of the Slovenian National Repository for Low and Intermediate Level Radioactive Waste, January 21-25, 2008.

- INSARR (Integrated Safety Assessment for Research Reactors) performed a safety review of the TRIGA Reactor, November 12-16, 2012.
- IAEA Expert Mission, 27-28 August 2009, (Alain Van Cotthem, František Fiedler).
- IAEA Expert Mission, 8-10 March 2010;(M. Garamszeghy, J-M. Potier& L.Valencia).
- IAEA Expert Mission, 18-20 January 2011; (J. Pacovsky, R. Chaplow).

Besides, there were two additional international reviews of the LILW Repository Preliminary design:

- Peer Review of LILW Repository Preliminary Design, Vrbina, Krško; Technum - Tractebel Engineering; Technical note N° P.001189.050-001.A; June 2010.
- Review of the Preliminary Design of the Vrbina LILW Repository, URS, May 2010.

(i) Other Relevant Material

General Description of the Krško NPP

The Krško NPP is the only nuclear power plant in the Republic of Slovenia. The Krško NPP commenced operating in autumn of 1981. It has been operating commercially since 1983. It is equipped with a Westinghouse pressurised light water reactor. At present, the gross electrical output is 727 MWe and the net output is 696 MWe. The previously installed capacity of 676 MWe net electrical output was updated due the low pressure turbines replacement in 2006. In 2004, the Krško NPP started operating with eighteen-month fuel cycles.

Figure 22: **The Krško NPP**

The Krško NPP was designed and operates in accordance with the Slovenian safety regulations and the operating license. The Krško NPP systematically observes the regulations and industrial standards of the USA, which is the supplying country.

The regulations followed in the design, construction and operation of the Krško NPP were divided into the following categories:

- The US 10 CFR Code of Federal Regulations as applicable to the design of the Krško NPP;
- Regulatory guidelines issued by the US regulatory authority;
- The US ANS/ANSI, ASME, IEEE industrial standards;
- IAEA standards and guidelines;
- The existing Acts and standards of the former SFRY and the Republic of Slovenia.

The bases for using these regulations are derived from the contract with Westinghouse, from the licenses issued and from the agreement between the IAEA and the SFRY (on the Krško NPP project).

Table 12: **Some technical data on the Krško NPP**

Reactor Thermal Power	MW	1,994
Gross Electrical Output	MW	727
Net Electrical Output	MW	696
Thermal Efficiency Factor	%	36
CONTAINMENT		
Height	m	71
Inside Diameter	m	32
Outside Diameter	m	38
Steel Shell Test Pressure	MPa	0.357
REACTOR COOLING SYSTEM		
Chemical Composition		H_2O
Additives		H_3BO_3
Number of Cooling Loops		2
Total Mass Flow	kg/s	9,220
Pressure	MPa	15.41
Total Volume	m^3	197
Temperature at Reactor (Vessel) Inlet	°C	287
Temperature at reactor (Vessel) Outlet	°C	324
Number of Pumps		2
Pump Capacity	m^3/s	6.3
Pump Driving Power	MW	5.22
NUCLEAR FUEL		
Number of Fuel Assemblies		121
Number of Fuel Rods Per Assembly		235
Fuel Rod Array in Fuel Assembly		16 x 16
Fuel Rod Length	m	3.658
Clad Thickness	cm	0.0572
Clad Material		Zircaloy-4, ZIRLO
Fuel Chemical Composition		UO_2
Pellet Diameter	mm	8.191
Natural Pellet Length	cm	1.346
Enriched Pellet Length	cm	0.983
Annular Pellet Length	cm	1.173
Standardised Pellet Length	cm	1.27
Total Weight of Nuclear Fuel	t	48.7
CONTROL RODS		
Number of Control Rod Assemblies		33
Number of Absorber Rods Per Assembly		20
Total Weight of Control Rod Assembly	kg	53.07
Neutron Absorber		Ag-In-Cd
Percentage Composition	%	80-15-5
Diameter	mm	8.36
Density	g/cm^3	10.16
Clad Thickness	mm	0.445
Clad Material		SS 304

Krško NPP Structures

All principal structures of the Krško NPP are located on a solid reinforced concrete platform which is situated upon the Pliocene sandy-clay sediments of the Krško basin. The structures are designed and constructed to resist the hazard of earthquakes.

The Reactor Building, where the Reactor, the Reactor Coolant System and the Safety Systems are installed, consists of the inner cylindrical steel shell and the outer reinforced concrete shield building. The Containment Airlock is equipped with a sealed passage chamber with double doors. Numerous piping and cable penetrations are double sealed. The Auxiliary Building, the Component Cooling Building, the Fuel Handling Building, the Diesel Generator Building and the Turbine Building are located adjacent to the Reactor Building.

Cooling water and essential service water intake structures are located on the bank of the Sava River above the Sava River dam, which maintains the adequate water level. The cooling water discharge structure is below the Sava River dam. In addition, cooling towers are provided for cooling circulating waters in case of low water flow of the Sava River.

Reactor Coolant System

The Westinghouse pressurised light water reactor with two cooling loops consists of the reactor vessel with its internals and head, two steam generators, two reactor coolant pumps, pressurizer, piping, valves, and reactor auxiliary systems. Demineralised water serves as reactor coolant, neutron moderator and for dilution of the boric acid solution. In the steam generator the reactor coolant gives up its heat to the feedwater on the secondary side of the steam generator to generate steam. Reactor coolant pressure is maintained by the pressurizer, which is supported by electrical heaters and water sprays which are supplied with water from the cold leg of the reactor coolant. The data necessary for reactor control and reactor protection are provided by the neutron flux, reactor coolant temperature, flow rate, pressurizer water level and pressure detectors.

Reactor power is regulated by control rods. The control rods drive mechanism is attached to the reactor head, while the absorber rods extend into the reactor core.

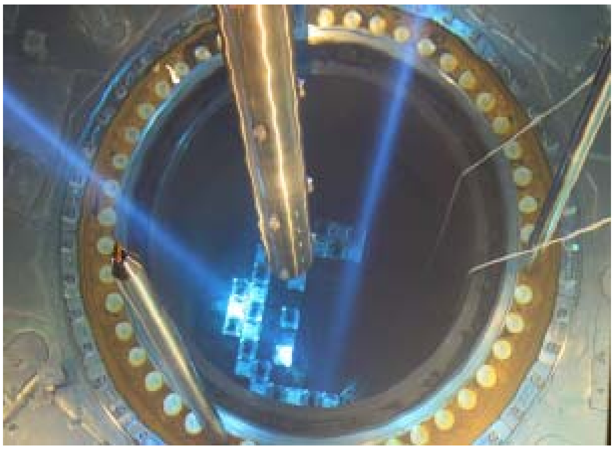
Long-term core reactivity changes and core poisoning with fission products are compensated by means of boric acid concentration change in the reactor coolant.

Nuclear Fuel

The reactor core is composed of 121 fuel assemblies. Each fuel element consists of fuel rods, top and bottom nozzles, grid assemblies, control rod guide thimbles and instrumentation guide thimbles. The fuel rods contain ceramic uranium dioxide pellets welded into zircaloy-4 or ZIRLO tubes. Uranium oxide fuel is shaped into sintered pellets and is enriched with ^{235}U.

Every 18 months approximately a half of the fuel assemblies are removed and fresh fuel is loaded. Fresh fuel assemblies are kept in the Fresh Fuel Storage. During refuelling, fuel assemblies are removed from the reactor through the flooded transfer canal penetrating the containment vessel into the spent fuel pool. During refuelling, the reactor is open and the reactor cavity is flooded. The refuelling machine removes the spent fuel assemblies from the reactor core and replaces them with the fresh ones. Fuel assemblies remain in the reactor core for three years. Spent fuel assemblies are kept under water in the spent fuel pool, where they are cooled.

Figure 23: **Krško NPP reactor core**



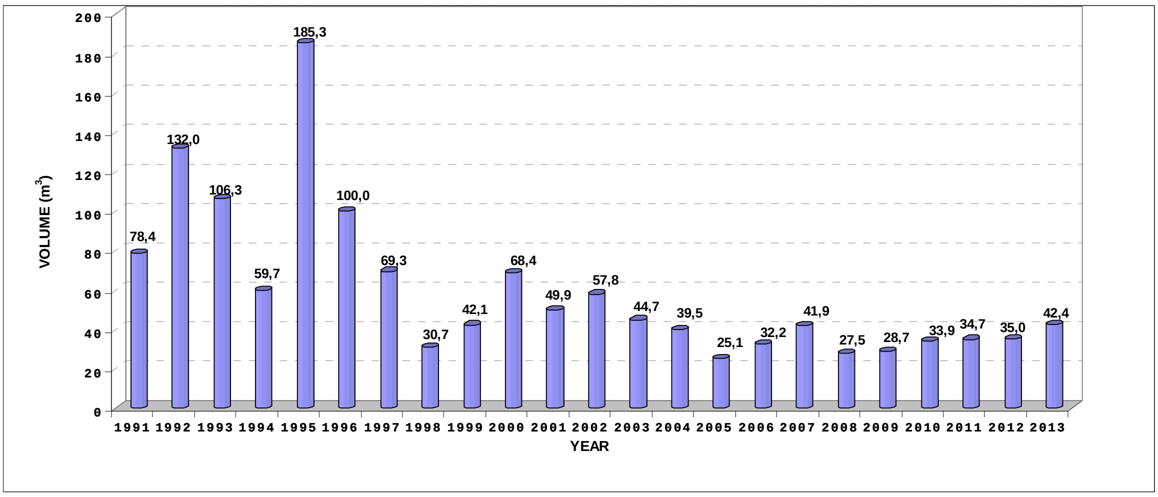
Performance Indicators of the Krško NPP

The volume of Low and Intermediate-Level Solid Radioactive Waste is one of the performance indicators of the Krško NPP. The purpose of the Low-Level Solid Radioactive Waste indicator is to monitor progress toward reducing the volume of low-level waste production which will decrease storage, transportation and final disposal needs and improve public perception of the environmental impact of nuclear power. This indicator is defined as the volume of low-level solid radioactive waste that has been processed and is in final form ready for disposal during a given period. The volume of radioactive waste that has not completed processing and is not yet in final form is not included. Low-level solid radioactive waste consists of dry active waste, sludge, resins and evaporator bottoms generated as a result of nuclear power plant operation and maintenance. Low-level refers to all radioactive waste that is not spent fuel or a by-product of spent fuel processing.

It can be noticed that the trend of produced volume of low-level radioactive waste is positive, i.e. the amount of produced waste is lower from year to year. Contributors to that trend are the improvement of the systems for radioactive waste treatment and the introduction of a highly restrictive programme for radioactive waste management control. The systems for radioactive waste treatment were improved by introducing the In-drum Drying System into operation, reconstruction of the Waste and Boron Evaporator Packages and installation of the supercompactor.

One of the highest priorities in the Krško NPP in the last ten years has definitely been to reduce the volume of produced low-level solid radioactive waste. The Krško NPP goal for the period 2005-2007 was ≤ 45 m^3 and for the period 2008-2013 ≤ 35 m^3. This task was more or less fulfilled as it can be seen from the following chart, only in 2013 the amount of LILW exceeded the goal (Figure 24).

Figure 24: **Annual production of LILW at the Krško NPP**



General Description of the TRIGA Mark II Research Reactor

The TRIGA Mark II research reactor is a part of the IJS Reactor Infrastructure Centre. A view of the IJS Reactor Infrastructure Centre is shown in Figure 25.

Figure 25: **View of the IJS Reactor Infrastructure Centre**

The reactor is a typical 250 kW TRIGA Mark II light-water reactor with an annular graphite reflector cooled by natural convection.

Figure 26: **The reactor body**

The core is placed at the bottom of a 6.25 m high open tank with 2 m in diameter filled with demineralised water. The core has a cylindrical configuration. In total there are 91 locations in the core, which can be filled either by fuel elements or other components such as control rods, a neutron source, irradiation channels, etc. The core lattice has an annular but not periodic structure. The elements are arranged in six concentric rings. Each location corresponds to a hole in the aluminium upper grid plate of the reactor. The core is supported by a bottom grid plate that in addition provides accurate spacing between the fuel elements. The top grid plate also provides accurate lateral positioning of the core components.

A graphite reflector enclosed in an aluminium casing surrounds the core. There are two horizontal irradiation channels running through the graphite reflector and the tangential irradiation channel. Other horizontal channels extend only to the outer edge of the reflector.

Fuel Elements

The TRIGA fuel element is a cylindrical rod with stainless steel cladding. There are cylindrical graphite slugs at the top and bottom ends which act as axial reflectors. In the centre of the fuel material is a hole which is filled by a zirconium rod. Between the fuel meat and the bottom graphite end reflector is a molybdenum disc. The fuel is a homogeneous mixture of uranium and zirconium hydride. The basic data on the TRIGA fuel element is given in Table 13 and Table 14.

Table 13: **Data on the standard TRIGA fuel element**

Component	Dimension [cm]	Material	Density [g/cm^3]
Fuel element			
Outer diameter	3.8		
Element length	72.1		
Fuel material		U-ZrH	6.0
Outer diameter	3.6		
Inner diameter	0.64		
Height	38.1		
Zr rod		Zr	6.5
Diameter	0.64		
Height	38.1		
Axial reflector		Graphite	1.6
Diameter	3.6		
Height upper	6.6		
Height lower	9.4		
Supporting disc		Mo	10.2
Thickness	0.079		
Cladding		SS-304	7.9
Thickness	0.025		
Top and bottom ends		SS-304	7.9
Height top	10.4		
Height bottom	7.6		

Table 14: **Standard TRIGA fuel element**

Total mass of uranium [g]	278.0
Mass of ^{235}U [g]	55.4
U in U-ZrH [wt.%]	11.9
Enrichment [wt.%]	19.9
H/Zr atom ratio	1.6