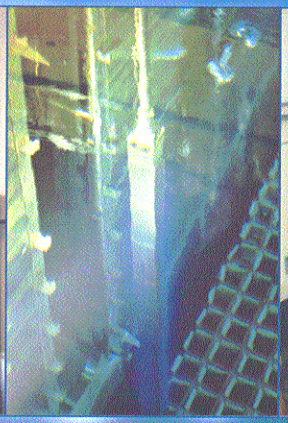
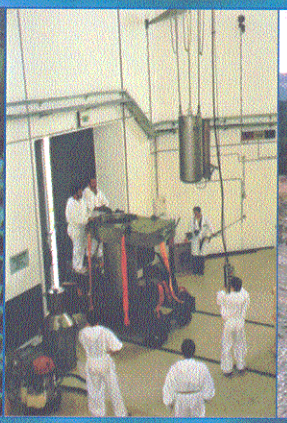
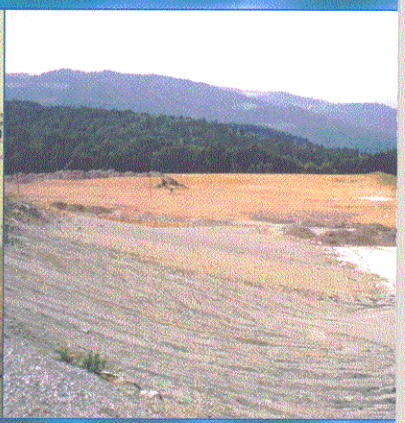
REPUBLIC OF SLOVENIA
MINISTRY OF THE ENVIRONMENT, SPATIAL PLANNING AND ENERGY
SLOVENIAN NUCLEAR SAFETY ADMINISTRATION

The First 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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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 Krško NPP, the Jožef Stefan Institute, the Agency for Radwaste Management, the Žirovski Vrh Uranium Mine and the Slovenian Radiation Protection Administration.

The report was adopted by the Government of the Republic of Slovenia in April 2003.

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Addendums on CD:

1. SNSA Annual Report 2001, Nuclear and Radiation Safety in Slovenia.
2. Act on Ionising Radiation Protection and Nuclear Safety, unofficial translation of the Slovene language published in Official Gazette of the Republic of Slovenia, No.67, 26.7.2002, pages 7603-7635.
3. Regulation Z-3 "On the method of collecting, accounting, processing, storing, final disposal and release of radioactive waste into the environment" , Off. Gaz. SFRY, No. 40/86.

Glossary

ADR	European Agreement Concerning the International Carriage of Dangerous Goods by Road
ALARA	As Low As Reasonably Achievable
ARAO	Agency for Radioactive Waste Management
CFR	Code of Federal Regulations
EB	Evaporator Bottoms
EIA	Environmental Impact Assessment
ERWR	European Radioactive Waste Regulator's Forum
EU	European Union
IAEA	International Atomic Energy Agency
ICRP	International Commission for Radiation Protection
IJS	Jožef Stefan Institute
ISOE	International System on Occupational Exposure
LILW	Low and Intermediate Level Waste
LLRW	Low Level Radioactive Waste
NPP	Nuclear Power Plant
OECD/NEA	Organisation for Economic Co-operation and Development/Nuclear Energy Agency
PHARE	Central and Eastern European Countries Assistance for Economic Restructuring
PWR	Pressurised Water Reactor
RAMG	Regulatory Assistance Management Group
RS	Republic of Slovenia
SAR	Safety Assessment Report
SFRY	Socialistic Federative Republic of Yugoslavia
SNSA	Slovenian Nuclear Safety Administration
SR	Spent Resins
SRSF	Solid Radwaste Storage Facility
SS	Stainless Steel
TLD	Thermo Luminescent Dosimeter
U.S.A.	United States of America
U.S. 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; one operating nuclear power plant, one research reactor and one Central Interim Storage for Radioactive Waste from small producers. In addition, there is also a uranium mine and mill in a decommissioning stage at Žirovski Vrh. 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: 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 Sava river in the south-eastern part of Slovenia. It is a Westinghouse two-loop pressurised water reactor with power of 676 MW_e. Construction started in 1974; the first fuel loading was accomplished in May 1981 and the plant was synchronised to the grid in October of the same year. Full power was reached in August 1982 and an approval for the beginning of commercial operation was granted in February 1984. The Krško NPP was built as a joint project of the electrical utilities of the Republic of Slovenia and those of neighbouring Croatia.

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 plant is owned by state-owned Slovenian and Croatian electrical power companies. It is operated by the public enterprise the Krško NPP which reports to the Ministry of Environment, Spatial Planning and Energy of the Republic of Slovenia.

The Jožef Stefan Institute Reactor Centre (IJS Reactor Centre) is a part of the Jožef Stefan Institute. It is located in Brinje in the vicinity of Ljubljana. It has a **TRIGA Mark II** reactor which is a 250 kW_{th}, General Atomic open-pool type research reactor. It was an IAEA project 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, for production of isotopes for medicine and industry and for education. Fuel elements are kept in the reactor building of the IJS Reactor Centre. In addition to spent fuel, the reactor produces a minor amount of Low and Intermediate Level Waste (LILW).

The research reactor is operated by the Jožef Stefan Institute, a public research institute financed through the Government of the Republic of Slovenia.

The Žirovski Vrh Uranium Mine was in operation in the period from 1984 to 1990. Its lifetime production was 610,000 tons of ore corresponding to 452.5 tons (U_3O_8 equivalent) of yellow cake. Both the mine and the mill are undergoing decommissioning and remediation of surface disposal of 1,548,000 tons of mine waste and red mud and 593,000 tons of mill tailings respectively.

The Žirovski Vrh Uranium Mine terminated its regular operations in 1990. This was influenced by economic reasons, since the yellow cake production was no longer competitive.

The Republic of Slovenia, as the owner of the Žirovski Vrh Uranium Mine, established a company called Žirovski Vrh Uranium Mine d.o.o. in order to achieve the permanent closure of the mine (Act on Permanent Closeout of Uranium Ore Exploitation and Prevention of Mining Consequences in the Žirovski Vrh Uranium Mine (Off. Gaz. of the Republic of Slovenia (RS), No. 36/1992)) and Act on Changes and Amendments to the Act on Permanent Closeout (Off. Gaz. RS, No. 28/2000).

In order to perform the decommissioning and restoration of the mining and ore processing sites, the Slovene Government established the public enterprise Žirovski Vrh Uranium Mine and provided the necessary financial resources.

The Central Interim Storage for Radioactive Waste in Brinje, situated at the IJS Reactor Centre, about 15 km north-east of Ljubljana, 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 interim storage was transferred from the IJS to the Agency for Radioactive Waste Management (ARAO).

The ARAO is a non-profit organisation of the Slovene Government which provides a state-owned public service for radioactive waste management. It is financed through the state budget and partially through the Fund for the Decommissioning of the Krško NPP.

Governmental Policy

The governmental polices in the area of the safety of spent fuel management and of the safety of radioactive waste management are set in comprehensive nuclear legislation comprised of domestic Acts, regulations and international agreements. Based on the legislation, a number of measures have been implemented to protect the environment and human society against 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 competent in the area of nuclear safety and radioactive waste management. It was established in 1987. Previously, the functions of the regulatory body were held by the Committee of Energy and Industry.
- Establishment of ARAO as a state-owned public institution for radioactive waste management (1991).
- Establishment of Žirovski Vrh Uranium Mine, a public enterprise for the decommissioning of uranium production sites (1992).
- Establishment of the Fund for the Decommission of the Krško NPP (1995).

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

The Strategy of Energy Use and Supply of the Republic of Slovenia, adopted by the Slovene Parliament in 1996. In this document the following policy was adopted:

- The long-term aim is to abandon electricity generation based on nuclear power in a safe, ecological, as well as economically acceptable way. Based on this the construction of any new nuclear power plants is not foreseen.
- The strategic objective is to maintain a high operational safety level at the Krško NPP during its planned operation until 2023, including a high level of safety after shutdown, as well as to gradually establish conditions for its safe decommissioning.
- The implementation of these measures should be regularly monitored by the Slovene Government and in the case of changed circumstances, the date of shutdown should be adjusted accordingly. To ensure the highest level of nuclear safety and plant availability during the plant's operation, the projects recommended by international review missions need to be implemented.

The Decommissioning Plan for the Krško NPP (hereinafter the Plan) was produced and approved by the Slovene Government in September 1996. In this document the following policy was adopted:

- For the purpose of cost assessment for decommissioning and radioactive waste and spent fuel management, and for the estimation of the contribution to the decommissioning fund, various options were evaluated from the radiological-safety, financial and political aspects.
- Immediate dismantling was decided on as the most appropriate option. Due to many uncertainties in the Plan, the Slovene Government decided to update the Plan at a frequency of three to five years.

- Based on the Plan, the Slovene Government decided that the Krško NPP must contribute 0.61 Slovenian tolar for every kWh of generated electricity to the decommissioning fund.

According to the new Act on Ionising Radiation Protection and Nuclear Safety (Off. Gaz. RS, No. 67/2002 - hereinafter referred to as the 2002 Act) the **National programme for radioactive waste and spent fuel management** shall be adopted by the Slovene Parliament as a part of the national programme for the protection of the environment pursuant to the regulations on environmental protection.

The technical groundwork for the National Programme for Radioactive Waste and Spent Fuel Management, together with a detailed description of the measures relating to the reduction of the occurrence of radioactive waste, to the treatment thereof prior to disposal and to its disposal, and the measures relating to the treatment and disposal of spent fuel, shall be carried out and communicated to the ministry competent for the environment by the ARAO. The operative programmes within the national programme of the radioactive waste and spent fuel management shall be drawn up by the ARAO and adopted by the Slovene Government. The operative programmes shall be adopted for a maximum of four years.

By the end of 2002 the Slovene Government had considered the need for the disposal of LILW. It was decided to site and construct the LILW disposal as required in the proposed EU draft Directive on Radioactive Waste and Spent Fuel Management.

The following internet sites are available for additional information:

- Slovenian Nuclear Safety Administration: *http://www.gov.si/ursjv/*
- Krško NPP: *http://www.nek.si/*
- Jožef Stefan Institute Reactor Centre: *http://www-rcp.ijs.si/*
- Jožef Stefan Institute: *http://www.ijs.si/*
- Agency for Radwaste Management: *http://www.gov.si/ARAO/*
- 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.skladnek.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 on 25 February 1999 in the Parliament of the Republic of Slovenia. The Convention entered into force in the Republic of Slovenia on 18 June 2001.

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. In order to provide fluent reading, certain information is provided in form of attachments and referred to in the text. The information provided in the report presents the status at the end of 2002.

In the following sections, the fulfilment of each of Articles 3 - 32 of the Convention is evaluated separately. Based on the evaluation 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 September 1996 the Slovene Government adopted the **Strategy for Long-term Spent Fuel Management**. The preparation of a long-term spent fuel management programme for the Krško NPP's fuel was strongly influenced by the specific situation in the Republic of Slovenia:

- a small nuclear programme (only one NPP),
- the planned phasing out of nuclear energy after 2023 (at the end of the scheduled lifetime of the Krško NPP).

In the strategy of long-term spent fuel management, a deferred final decision is recommended as the only reasonable solution in the present situation. It also makes it possible to reconsider different options, including the possibility of reprocessing of spent fuel, as well as new technological developments. This provides the opportunity of responding to and joining the project of a regional repository, if this idea, which seems so attractive to countries with small nuclear programmes, is implemented.

This strategy also includes short-term solutions for spent fuel storage. In the first stage, an increase of the existing capacity of the spent fuel pool at the Krško NPP was proposed. The spent fuel pool re-racking project, started in May 2002, has been completed and will allow plant operation for the designed plant lifetime.

According to the current strategy, the decision on final solution of spent fuel disposal in the Republic of Slovenia will be adopted by 2020. It is planned to dispose of the spent fuel by the year 2050. Until then the fuel will be stored in the Krško NPP spent fuel pool or in dry storage at the reactor site.

The above mentioned strategy is being reviewed in the process of preparation of the National Programme for Radioactive Waste and Spent Fuel Management. The current solution of the deferred decision until 2020 will most probably be changed also in the view of proposed EU draft Directive on Radioactive Waste Management. As Slovenia is by any definition a country with a small nuclear programme, the new National Strategy for Radioactive Waste Management will seriously consider options for regional disposal of spent nuclear fuel or its export to a third country.

Spent fuel long-term management for research reactor fuel is based on the following facts and principles:

- present status: no spent fuel elements on site,
- future options:
  - no fresh fuel purchasing, operation with the available fresh fuel as long as technically feasible (at least until 2013, if possible until 2023) and managing spent fuel according to the Strategy for Long-term Spent Fuel Management or
  - to stop operating the research reactor in 2006 and return all remaining fuel to the U.S.A..

(ii) Spent Fuel Management Practices

The Republic of Slovenia has no spent fuel management facilities. The spent fuel that is generated by the operation of the Krško NPP and IJS Reactor Centre (TRIGA Mark II research reactor) is managed in 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. Total storage capacity of the spent fuel pool is 828 fuel assemblies. Approximately 80% of the capacity of the spent fuel pool (total 663 locations) was occupied by the end of 2002. 121 storage locations are kept free for emergency core unload. Based on a discharge rate of 36 fuel assemblies per cycle the storage is sufficient until 2003.

The existing spent fuel racks are designed without neutron poison controls. Each rack is composed of individual vertical cells, which are fastened together to form modules. These modules are vertically supported on the floor of the spent fuel pool via module base plates. Modules are of two types containing 72 and 63 cells each. A total of 12 modules with 828 cells are provided (8 times 72, plus 4 times 63 cells). 12 cells out of 828 are designed to receive failed fuel assemblies. Spent fuel racks are designed to withstand shipping, handling, normal operating loads (impact and dead loads of fuel assemblies) as well as Safe Shut-down Earthquake and Operating Base Earthquake seismic loads meeting Seismic Category I and American Institute of Steel Construction requirements.

Reracking of the spent fuel pool

The pool was reracked for the first time in 1983, increasing its capacity from 180 to 828 fuel assembly storage locations. The project involved the replacement of the original Westinghouse racks with higher density racks. The spent fuel pool cooling capacity was increased in 1985 by installing an additional heat exchanger. In 2002 a new reracking project of the spent fuel pool was started in order to facilitate the operation of the Krško NPP until the end of its design lifetime in 2023. The reracking project was finished in March 2003 and an increase of the storage capacity of the spent fuel pool to 1694 fuel assemblies was achieved.

Technical characteristics of spent fuel pool

The spent fuel pool structure is made of reinforced concrete. The walls and the bottom of the pool are covered with SS liner. Underneath the liner plates there is a system of embedded leak collection channels. The racks consist of SS cells which are connected in modules. The modules are of free-standing type, connected together by welded plates and crosses.

A spent fuel pool leak detection system is provided to monitor the integrity of the liner of the spent fuel pool, fuel transfer canal and 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 cask loading area may be drained.

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

Water purification system with a spent fuel pool demineralizer and filter is designed to provide adequate purification to permit unrestricted access of plant personnel to the spent fuel storage area, and 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 so 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 (10 CFR, Part 20, limit for unrestricted access for plant personnel).

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 purification loop provided removes fission products and other contaminants from the water. By maintaining radioactivity concentrations in the spent fuel cooling water at $18.4 \cdot 10^{4}$ Bq/cm^{3} (ß and γ radiation) or less, the dose at the water surface is 0.025 mSv/h or less, thus allowing unrestricted access for plant personnel.

Criticality analysis for spent fuel pit racks was performed as a design basis criterion. Calculations were performed for an infinite array of cells with a spacing of 296.4 mm by 304.8 mm to verify that the configuration is critically safe. To simulate the maximum critical conditions, an infinite array of a cluster of four adjacent assemblies oriented in a closely packed configuration was considered. This closely packed configuration with the adjustments for fabrication and erection tolerances was analysed to verify that k_{eff} + 3 sigma does not exceed 0.95.

Long-term spent fuel management

At the moment the final decision for a long term spent fuel management is in force. All the spent fuel is stored in the spent fuel pool until another decision is made. To minimise the amount of spent fuel and reduce fuel costs, the Krško NPP extends the burnup of fuel elements. The average spent fuel burnup in the spent fuel pool is 36.3 GWD/MTU while the last spent region has an average burnup of 44.3 GWD/MTU. The trend is obviously growing and will continue. The Low Leaking Loading Pattern was introduced in the design years ago. With this type of design additional reduction of the spent fuel production was achieved.

IJS Reactor Centre

Spent fuel can be stored in two spent fuel pools at the reactor. The two spent fuel pools are part of the TRIGA Mark II research reactor and they are not considered as independent storage sites. Their design and safety analysis are presented in the Safety Analysis Report (SAR) for the TRIGA Mark II research reactor. The first spent fuel pool was constructed with the reactor in 1966 and is no longer in use (hereinafter referred to as 'the old pool'). The second was constructed in 1992 (hereinafter referred to as 'the new pool'). Its capacity is 195 spent fuel elements. It is located in the basement of the reactor hall building. It is accessible by the crane through the lid in the reactor hall floor. The pool is 3.5 m deep and is plated with SS sheets. It is equipped with an on-line water radioactivity monitor.

Both pools have been empty since 1999, when all spent fuel elements (total 219) were shipped to the U.S.A. for final disposal and only 94 fresh fuel elements remained in the reactor building. Due to the return of the spent fuel to the U.S.A., the spent fuel pools are empty at present. An environmental impact report, safety analysis and emergency procedures were prepared for the transportation of the spent fuel for final disposal in the U.S.A.. The new pool is maintained operational and prepared for immediate use if necessary.

A detailed criticality analysis of the spent fuel racks design was performed according to the requirements and standards normally applicable to power reactor storage pools (due to lack of appropriate research reactor spent fuel storage criticality safety). Heat removal is not applicable for TRIGA Mark II research reactor fuel. A safety analysis of accidents with spent fuel during normal operation and fuel handling was performed and are included in the SAR.

(iii) Radioactive Waste Management Policy

The National Programme for Radioactive Waste and Spent Fuel Management is to be one of the key documents in the field of radioactive waste management. The ARAO prepared the "Proposal of Strategy on Low and Intermediate Level Waste Management" in order to evaluate the time schedule for the siting and completion of LILW repository. This document was however never adopted as an official document. In light of the 2002 Act stipulating the preparation and approval of the National Programme for Radioactive Waste and Spent Fuel Management, the Strategy on Low and Intermediate Level Waste Management will be used in the preparation of the National Programme.

In the draft document, LILW management is treated as an integral process, covering all stages from waste generation to waste disposal. Site selection and the construction of a repository for short-lived LILW is the principal goal. The limited storage capacities at nuclear facilities call for decisions and practical solutions by 2013.

The national structure of 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 a state-owned public service for radioactive waste management) are involved in the process of radioactive waste management. The Krško NPP is responsible for radioactive waste management at the location of the Krško NPP. The ARAO has the responsibility for collection, transporting, treatment, storing and disposing of LILW coming from the small producers in the Republic of Slovenia. The ARAO also has the responsibility for the disposal of all radioactive waste coming from the Krško NPP when applicable.

The final location of disposal of LILW has not been decided yet. According to the plans, the dates for siting and disposal of LILW are 2008 and 2013 respectively as set in the EU draft Directive.

(iv) Radioactive Waste Management Practices

Within the scope of the Convention, the Central Interim Storage for Radioactive Waste in Brinje, the Boršt mill tailings 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 and by the operation of the small producers of radioactive waste (IJS Reactor Centre, industry, research and medicine) is managed in storage sites at the Krško NPP and the Central Interim Storage for Radioactive Waste in Brinje.

The Central Interim Storage for Radioactive Waste in Brinje

After delivery the radioactive waste is stored in the centralised storing facility for waste from small producers, located in Brinje near Ljubljana. The facility is operated by the ARAO. In the past the government financed the storage of waste. In 2000 the "polluter pays" principle was introduced also into the segment of small producers of waste. The producers now pay the costs of waste management, including the cost of storing, treatment and conditioning and future disposal of waste. With the acceptance of waste all liabilities for further waste management are transferred to the ARAO.

In order to comply with regulatory requirements, a campaign has been started to refurbish the storage. The objective was to obtain an operating license according to the 2002 Act. The licensing procedure for reconstruction and modernisation has already been initiated. According to the schedule, it is expected that the reconstruction and modernisation of the facility will be carried out by the end of 2003. The repacking and conditioning of waste is planned in several steps over the next few years.

The Žirovski Vrh Uranium Mine

There are three temporary waste disposal sites and two permanent disposal sites: the Jazbec mine waste pile and the Boršt mill tailings site. The temporary mine waste disposal sites contain about 100,000 m^3 of mine waste rock that will be relocated to the Jazbec mine waste pile.

The general goal of the site rehabilitation project is to minimise, to the lowest reasonable scope, radiological and chemical long-term affects on the environment. The major objective is the decontamination of sites, buildings, structures and equipment, so that the items or land can be reused, properly disposed of in approved facilities or opened for the public.

In the remediation of the mine, part of the opened slopes, where the stability of the surface above the mine is in question, will be backfilled with mine waste or mill waste. All horizontal and vertical entrances into the mine will be sealed air tight. Institutional water and air monitoring will be needed in future.

Through remediation of the uranium processing plant the mill liquids have been neutralised and decontaminated. Reusable materials and equipment have been decontaminated. The ore processing area and buildings have been decontaminated or demolished. After rehabilitation, the ore processing area will be in free public use. Contaminated waste materials (scrap metal, plastics, building debris) were disposed either into the mine or the Jazbec mine waste pile. No regular monitoring will be needed after the rehabilitation of the mill site in future.

At the Jazbec mine waste pile there are 1,415,000 tons of mine waste (< 70 g U_3O_8/t) and 48,000 tons of red mud from raffinate neutralisation. The area is 51,000 m^2. To divert background and underground water, two 400 mm diameter polyethylene pipelines and concrete conduits have been built. A network of drainage pipes leads underground water into the main pipelines. Through remedial action the mining debris and the Jazbec mine waste pile will be isolated from surface and rainfall waters with a multilayer cover to prevent contaminants dissolution. The underground water drainage pipelines and concrete conduits shall be repaired to prevent ground and surface water intake and to assure long-term stability.

All other mine debris piles will be removed and disposed to this site. Institutional water, ground water, ground water level and air monitoring will be needed in future.

The Boršt mill tailing disposal site is situated on a hillside 535 m to 570 m above sea level. During the short operational life of the tailing disposal ca. 600,000 tons of mill tailings and 73,000 tons mine waste were deposited there. The area is 41,000 m^2. Practically all tailing materials are sands and slimes under 28 mesh (0.5 mm). Average activity for Radium 226 is 8700 Bq/kg. The Rn exhalation rate is 1 - 10 Bq/m^2s. The whole area faces a geomechanical stability problem due to landslides. Some slopes were temporary covered by soil, and grass was seeded to protect the surface against rainfall erosion. A project of permanent rehabilitation and solution of the problem of the Boršt mill tailing disposal site is under preparation. Solutions should be provided for: geomechanical stability of the landslide area using groundwater drainage tunnels and drainage boreholes, protection of the mill tailings against background eaters, preventing the dissolution of the undesired soluble components into the underground waters and into surface waters, covering the mill tailings with natural materials in order to prevent excessive Radon exhalation, recultivation of the surface to prevent erosion caused by rainfall waters. The multilayer cover will be composed of compacted clay, small rocks, rocks and sand, soil and rocks, humus and grass. Institutional water, ground water, ground water level and air monitoring will be needed in future.

Krško NPP

A radioactive waste management programme, approved by the management of the Krško NPP, has been issued followed by a technical report. The Krško NPP finds that this document is a valuable source of inputs for future decision making and long-range planning in the area of radioactive waste. Generation rates in the future are predicted based on the present situation and future options. The future free storage capacity for the radioactive waste storages at the Krško NPP is extrapolated. 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 have been enhanced.

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 plant radioactive waste storage sites. The systems are constructed for collecting, processing, storing and packaging of waste in a suitable form and to minimise releases into the environment. Three fundamental systems are used for radioactive waste management, namely 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 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 the 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, an evaporator and two demineralizers. This system is designed to receive, segregate, process, recycle, and discharge liquid radioactive waste. The system design considers potential personnel exposure and assures that quantities of radioactive releases into the environment are As Low As Reasonably Achievable (ALARA).

The Liquid Waste Processing System also collects and processes potentially radioactive waste for recycle or for release. This system consists mainly of two sub-systems. The liquid radioactive waste arising from the reactor coolant system is processed by the Boron Recycling System.

Liquid waste is released from liquid waste monitoring tanks into the discharge channel. The discharge valve is interlocked with a process radiation monitor and closes automatically when the activity concentration in the liquid discharge exceeds a pre-set limit.

The blow-down water from the steam generators is purified separately. The radioactivity of the water discharged into the Sava river is substantially lower than the maximum permissible concentration.

All solid radioactive wastes generated during plant operation, maintenance activities and servicing are collected in the Solid Radioactive Storage Facility (SRSF).

Used ion exchangers, evaporator concentrates, used filters, and other contaminated solid wastes such as paper, towels, working clothes, laboratory equipment, and various tools are major solid wastes. Solid wastes are compressed and encapsulated in 208 l steel drums. These drums are temporarily kept in the SRSF within the plant area.

Solid radioactive wastes, including spent resins, are processed by the **Solid Radioactive Waste Processing System**, which is designed for providing a means of conditioning radioactive spent resins or boric acid solid wastes generated by the Krško NPP, providing adequate equipment shielding for preparation and for storage of conditioned wastes pending shipment to an appropriate disposal facility and providing a means of conditioning miscellaneous dry radioactive waste. The solid radioactive waste processing system is designed for packaging all solid wastes in standard 208 l drums. Spent resins, evaporator bottoms and chemical drain tank effluents are encapsulated in the drums, while the solid compressible wastes are compressed directly into the drums. Incompressible wastes are packed in the drums without further processing.

Radioactive waste volume reduction programme

Numerous programme improvements, design changes and work practices improvements have been pursued at the Krško NPP to decrease the generation rate of radioactive wastes of different types. With the 18-month fuel cycle, the generation of radioactive wastes will be additionally reduced.

An aggressive approach to work practices in the radiologically controlled area resulted in a decrease in solid radioactive waste generation in terms of activity. The entry of potential radioactive waste materials into the radiologically controlled area is controlled. Segregation techniques for collecting non-contaminated materials separately are used, which allows waste streams to be processed separately. A variety of decontamination techniques is used followed by exemption/clearance of decontaminated materials. Metal materials exceeding exemption/clearance levels are stored onsite awaiting melting. Plant personnel and subcontractors working in the radiologically controlled area are given comprehensive training on the suppression of radioactive waste generation.

To reduce the volume of solid radioactive waste to be stored, two super compaction campaigns have been carried out. The original Westinghouse procedure for evaporator bottoms and spent resins treatment was replaced with a treatment of these types of wastes called the In-drum Drying System. The drying and volume reduction process for spent resin takes place in the drying tank. 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 SS heavy drums with biological shields (150 l of usable volume). Dried secondary spent resins are filled into 200 l SS drums without biological shields. The drying and volume reduction process for evaporator bottoms converts the concentrate into dry solid waste products with low residual moisture and no free-standing water. During the process the solid waste product is formed inside the 200 l SS heavy drums. The Krško NPP has begun the incineration of combustible wastes.

The hazards 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 the preferred final package as an overpack in the plant radioactive waste storage facility. Any new type of radioactive waste resulting from a new technology applied is evaluated, approved by the SNSA and incorporated into the SAR.

Safety Review

At the Krško NPP, a Periodic Safety Review has been clearly determined and aimed at verifying that the operation of the NPP remains safe when judged against current safety objectives and practices and that adequate arrangements are in place to maintain an acceptable level of safety. The methodological approach is intended to be systematic, rigorous and transparent. The Milestones and Project Management Plan has been going on since April 2001. Environmental Impact is one of the factors to be addressed by the Periodic Safety Review. It includes several elements, including the storage and handling of radioactive wastes, radioactive material release limits, records, off-site monitoring and alarm systems.

The Krško NPP radioactive waste storage operation is in accordance with the SAR. In the original project, radioactive waste storage was designed as a five-year interim storage. Some design changes have been conducted to increase storage capacity, including improved packaging. The storage period was extended indefinitely. A plant packaging inspection programme has been established to monitor container integrity because of prolonged storage. A smoke detection system was installed.

Small Producers of Radioactive Waste in the Republic of Slovenia

Management of radioactive waste generated by small producers (medical and industrial applications, research activities) is delegated to the state-owned public service (2002 Act and Governmental Ordinance, 1999). The national waste management agency ARAO is authorised to perform this public service. It includes: receiving of waste at the producer's premises, transport of waste, treatment and conditioning, storing and future disposal of waste. The ARAO is also responsible for management of radioactive waste in case of industrial accidents and for historical waste.

- **IJS Reactor Centre**

  During the lifetime of the TRIGA Mark II research reactor, only a small amount of solid radioactive waste is produced (total 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 exchanger 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 Interim Storage 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 in a special 20 m^3 decay tank. After measuring the isotope concentration and activity, the liquids are released to the Sava river 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 e.g. industrial radiography, thickness, level and density gauges, moisture detectors, eliminators of static electricity, lightning preventers, etc. In the Republic of Slovenia, more than 100 different organisations possessed about 550 sealed sources at the end of 2002. Not all of them are in use. In the past, spent and disused radioactive sources were either returned to the suppliers or shipped to the Central Interim Storage for Radioactive Waste in Brinje.

  Since the late 1990s, spent and disused radioactive sources have been temporarily stored on-site until the refurbishment of the Central Interim Storage for Radioactive Waste in Brinje is accomplished. Only in urgent cases are disused sources, which could pose a threat to the workers, public and environment, transferred to the Central Interim Storage for Radioactive Waste in Brinje. However, there are still some tens (50-80) of spent sources waiting for the refurbishment to be completed.

Requirements for use and storage of disused radioactive sources and waste are determined in the 2002 Act, Articles 9 to 16. Prior to the commencement of radiation practices it shall be necessary to obtain a license. The applicant must 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 use of the radiation source.

- **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. Few of them use unsealed sources for therapy. The main users are the Institute of Oncology and the Ljubljana Medical Centre - Department of Nuclear Medicine. There are no radiopharmaceuticals factories in the Republic of Slovenia.

The Institute of Oncology imported - among other sources - 0.69 TBq of I-131 while the Department of Nuclear Medicine imported 0.58 TBq of I-131 in the year 2001. All other users imported 0.16 TBq of I-131. Only the Institute of Oncology uses decay storage tanks in order to control releases of radioactive effluents. Others release the effluents directly into sewage systems. It is estimated that around 0.3 TBq of I-131 is released annually into the environment.

The short lived radioactive waste (In-111, Ga-67) which is produced during medical practice is stored locally at the users' locations. After decay the material is transferred to the disposal site. Small amounts of solid radioactive waste (in total less than 1 MBq of Co-60 or Ir-192) are also temporary stored at local storage sites.

(v) Criteria used to define and categorise radioactive waste

Categorisation of radioactive wastes is specified by Regulation Z-3 "On the method of collecting, accounting, processing, storing, final disposal and release of radioactive waste into the environment" (Off. Gaz. SFRY, No. 40/86) as follows: "Solid radioactive wastes are materials with specific activity greater than 10^8 Bq/m^3 for beta and gamma emitters, and greater than 10^7 Bq/m^3 for alpha emitters or, alternatively with the surface contamination greater than 5000 Bq/m^2 for beta/gamma emitters and greater than 500 Bq/m^2 for alpha emitters". Liquid and gaseous radioactive wastes according to Regulation Z-3 are "waste and gaseous state containing radionuclides in amount greater than derived concentrations for air and drinking water for groups of members of the public".

According to the specific activity, radiotoxicity and technology for processing, **solid and liquid** radioactive wastes are categorised as follows:

Table 1: Solid and liquid radioactive wastes categorisation.

Category of radioactive waste		Specific activity A_{sp} [Bq/m³]	Description of the category
I. High-level		$A_{sp} > 5 \cdot 10^{14}$	• high beta/gamma and significant alpha activity • high radiotoxicity • high heat output (cooling is necessary)
II. Intermediate-level	with alpha emitters	$5 \cdot 10^{14} > A_{sp} > 5 \cdot 10^{9}$	• intermediate beta/gamma • significant alpha • intermediate radiotoxicity • low heat output
	with beta/ gamma emitters	$5 \cdot 10^{14} > A_{sp} > 5 \cdot 10^{7}$	• intermediate beta/gamma • insignificant alpha • low/intermediate radiotoxicity • insignificant heat output
III. Low-level	with alpha emitters	$5 \cdot 10^{9} > A_{sp}$ $\frac{A_i}{IK_i} \geq 1$	• low/intermediate beta/gamma • low alpha • low/intermediate radiotoxicity • insignificant heat output
	with beta/ gamma emitters	$5 \cdot 10^{7} > A_{sp}$ $\frac{A_i}{IK_i} \geq 1$	• low beta/gamma • insignificant alpha • low radiotoxicity • insignificant heat output

where A_i is the measured specific activity of a single radionuclide and IK_i (Bq/m³) is the derived radionuclide concentration in drinking water for the group of members of the public.

According to the specific activity, radiotoxicity and processing technology, **gaseous radioactive wastes** are categorised as follows:

Table 2: Gaseous radioactive wastes categorisation.

Category of radioactive waste	Specific activity A_{sp} [Bq/m³]	Description of the category
I.	$\sum_i \frac{A_i}{IK_i} > 10^4$	may not be released into the environment without treatment
II.	$1 < \sum_i \frac{A_i}{IK_i} \leq 10^4$	may not be released into the environment without treatment
III.	$\sum_i \frac{A_i}{IK_i} \leq 1$	may be released into the environment

where IK_i is the measured specific activity of a single radionuclide in air.

The categorisation is the same for all radioactive wastes, both those generated in connection with the use of nuclear energy and by small producers.

There is no specific regulation in the Republic of Slovenia addressing the release of very low contaminated materials generated inside the radiologically controlled area of the nuclear power plant.

In order to address this problem, a working group was established to support the safety authority in the definition of clearance levels and for peer review of the procedure for controlling unconditional release proposed by the Krško NPP.

The final decision of the working group and the authority was to interpret the existing national regulation, implementing similar levels as already specified in the European Union (Definition of Clearance Levels for the Release of Radioactively Contaminated Buildings and Building Rubble, Final Report, BS-Nr. 9707-5, EC Contract C1/ETU/970040, Brenk Systemplanung, Aachen, May 1999) and in Germany (Clearance of Materials, Buildings and Sites with Negligible Radioactivity from Practices subject to Reporting or Authorisation, Recommendation by the German Commission on Radiological Protection (SSK), February 1998) referenced recommendations.

New subordinate regulations on radioactive waste management and classification of radioactive waste are being drafted.

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.*

This Convention shall apply to the safety of the spent fuel management in the Krško NPP and in IJS Reactor Centre. No spent fuel reprocessing is foreseen.

This Convention shall apply to the safety of the operating waste in the Krško NPP, of the decommissioning waste from the Žirovski Vrh Uranium Mine and of the waste from small non-power applications which are stored in the Central Interim Storage for Radioactive Waste in Brinje.

The 2002 Act does not stipulate special legal provision for the spent fuel or radioactive waste that occur within military or defence programmes. Therefore the same legal provisions are applicable to such waste. However it should be noted that the amount of radioactive waste which occurs in the defence programme is very small in the Republic of Slovenia.

Section D: Inventories and Lists

Article 32, Paragraph 2: Reporting

This report shall also include:

(i) 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 spent fuel management facilities. The spent fuel that is generated by the operation of the Krško NPP and IJS Reactor Centre (TRIGA Mark II research reactor) is managed in storages that are an integral part 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 its license, and is therefore not considered an independent nuclear facility. The fuel handling building consists of a spent fuel pool and related fuel handling system, which enables the handling of spent fuel. A description of the main parts of the fuel handling building of the Krško NPP is as follows:

Table 3: Description of the fuel handling building.

Elevation (elevation is in meters. The elevation 100 is a reference level-ground level)	**Description**
100.30	spent fuel pool and bridge area, new fuel storage area, fuel handling building access bay, hot machine shop, spent fuel pool pumps and heat exchangers room and fire protection equipment room.
107.62	decontamination area, cask unloading area, new fuel stripping area and skimmer pumps room.
115.55	new fuel stripping area.

There were 604 spent fuel assemblies in the spent fuel pool at the end of 2002. The fuel batches of spent fuel assemblies with corresponding region numbers can be seen in Section L, Annex d. These fuel assemblies will probably never return to core, unless emergency core loading will have to be performed.

There are four criteria which define the Krško NPP's spent fuel:

- All Westinghouse standard type fuel assemblies including Siemens KWU fuel are considered spent. Fuel batch No.1 to No.8B are standard fuel type. There are 352 such assemblies in the spent fuel pool. Three standard fuel assemblies were in the core during the 18th fuel cycle (ended in May 2002).
- Vantage 5 fuel type including fuel batch No.15 and No.15B are spent. Ten of 248 fuel assemblies out of this series were in the 18th fuel cycle. As a result there are 238 such spent fuel assemblies in spent fuel pool.
- There are two leaking Vantage 5 fuel assemblies with very low burnup. These two assemblies can be repaired and reused in future cycles. Therefore they will be excluded from the spent fuel series.
- Fuel assemblies from fuel batches No.16 and No.16B with average burnup higher than 40 GWD/MTU which are in the spent fuel pool are considered as spent fuel. There are 16 such spent fuel assemblies.

IJS Reactor Centre

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

(iii) List of the Radioactive Waste Management Facilities

The Central Interim Storage for Radioactive Waste in Brinje and the Boršt mill tailings site and 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 license for the Krško NPP.

Central Interim Storage for Radioactive Waste in Brinje

The storage is a near-surface concrete building with the roof covered with a soil layer. 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 x 25.7 m with a height of 3.6 m. The useful capacity of the storage is about 500 m^3, the remaining small area is intended for workers, for loading and unloading the waste and for internal transport. The storage section at the back end of the building is deeper relative to the level of the other sections, and is intended for storage of more active spent sources.

The facility is equipped with a ventilation system for reducing radon concentration and air contamination in the storage facility. The water and sewage collecting system is designed as a closed system to retain all liquids from the storage facility, and is connected to a special 20 m^3 decay tank at the IJS Reactor Centre. The electricity supply system is used for illumination of the storage facility, for heating of auxiliary rooms and for the powering of ventilation. The storage facility is also protected by an alarm system which is connected to a 24-hour security service.

The Jazbec Mine Waste Pile at the Žirovski Vrh Uranium Mine

The Jazbec mine waste pile is located on the north-eastern slope of the Žirovski Vrh hill. The steep slopes of the site are temporary covered with soil; the thickness of the soil is up to 0.3 m.

The Jazbec mine waste pile is a central disposal site for all radioactive materials except mill tailings. The following materials were deposited:

- mine waste with low uranium content,
- red mud from uranium ore processing,
- radioactive contaminated wastes (debris, rubble) from dismantling of processing buildings, crushing structures, contaminated technological equipment,
- contaminated soil due to mine activities.

The Boršt Mill Tailings Site at the Žirovski Vrh Uranium Mine

The Boršt mill tailings site is located on the slope of the hill, at an altitude above 535 m. During operation and construction of the Boršt mill tailings site, some mine waste was used to consolidate the surface used for construction of the roads for mill tailings transportation. The mill tailings are temporary covered with soil, the thickness of soil is up to 0.3 m.

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

Krško NPP

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

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 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 (immobilisation, packaging). The conditioned waste is transported to the Solid Radwaste Storage Facility by forklift or electric-powered cart using a special shield when necessary.

Solid Radwaste Storage Facility (SRSF), an interim storage, originally built as a 5-year storage. Its operating license was extended in 1988 due to the lack of a final repository. It is a reinforced concrete structure, seismic qualified, located adjacent to the Auxiliary Building. Total area is 1470 m^2; after 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 SRSF is variable and is dependent on waste generation rates and waste management plans. The inner area is divided into 6 fields by 60 cm interior concrete walls; the exterior walls as well as the ceiling are 100 cm thick, providing appropriate insulation. The facility has provisions for storing different solid radioactive wastes separately and retrieving them for further processing (supercompaction, incineration, melting, clearance after decay of radionuclide) or disposal at a later time.

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

(iv) Inventory of Radioactive Waste

Central Interim Storage for Radioactive Waste in Brinje

Currently around 60 - 70 m^3 of radioactive waste is kept in the storage with an estimated total mass of 65 to 75 tons. According to the type of package, the waste is divided into three categories: waste packed in drums, contaminated or activated bulky items and spent sealed sources.

The drums contain mostly contaminated material such as paper, glass and plastic material with induced radioactivity caused by neutron exposure in the research reactor. Different contaminated or activated metal tubes and metal pieces that are too big to fit into the drums are stored as special bulky items. Disused sealed sources are stored in the original shielding containers.

The total activity of the waste at the end of 2002 was estimated at 2900 GBq. It is expected that during normal operation the Central Interim Storage for Radioactive Waste will receive approximately 2 m^3 of radioactive waste annually. The list of radioactive waste is enclosed in Section L, Annex e, Table 14.

The Jazbec Mine Waste Pile and Boršt Mill Tailings Site

Mine wastes and other debris at the Jazbec and Boršt sites with basic data are summarised in Section L, Annex e, Table 15 and Table 16, stated at the end of the year 2002.

Krško NPP

See Section L, Annex e, Tables 11, 12 and 13.

(v) 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.

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 other measures taken to fulfil the obligations of 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.

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(1) Safety of Spent Fuel and Radioactive Waste Management

In July 2002 the Parliament of the Republic of Slovenia adopted a new 2002 Act (see Addendum 2 to the Report). As defined in the first article of this Act, its main purpose is "to regulate ionising radiation protection, with the aim of reducing the detrimental effects on health and reducing to the lowest possible level radioactive contamination of the environment due to ionising radiation resulting from the use of radiation sources, while at the same time enabling the development, production and use of radiation sources and performing radiation practices". It also regulates radioactive waste and spent fuel management.

(2i) National Safety Requirements and Regulations

In addition to the main principles (among others also "justification", "optimisation", "ALARA" and "prime responsibility for safety" principles), 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 the handling of radiation or use of 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 and radioactive waste and spent fuel,
- physical protection of nuclear materials and facilities,
- non-proliferation and safeguards,
- administrative tasks and inspection and
- penal provisions.

The 2002 Act entered into force on 1 October 2002. From that day two previous Acts cease to apply, namely:

- Act on Radiation Protection and the Safe Use of Nuclear Energy (1984 Act),
- Act on Implementing Protection Against Ionising Radiation and Measures on the Safety of Nuclear Facilities (1980 Act).

The 2002 Act provides that the regulations which have been issued on the basis of 1984 Acts shall apply until new regulations stipulated by 2002 Act are issued. Based on the 1984 Act, ten (10) regulations for carrying into effect radiation protection and four (4) regulations for carrying into effect nuclear safety provisions are in force.

One of the most important regulations is Regulation Z-3 "On the method of collecting, accounting, processing, storing, final disposal and release of radioactive waste into the environment" (Off. Gaz. SFRY, No. 40/86).

The radiation protection area is also partially covered within the Act on Health Inspection.

Within the legislative and regulatory framework which covers spent fuel and radioactive waste management, the regulations stated below should be mentioned:

- Decree on Establishment of a Public Agency for Radioactive Waste Management (Off. Gaz. RS, No. 5/91, 45/96, 32/99 and 38/01),
- Ordinance on the Method and Conditions of Discharging the Public Service for Radioactive Waste Management (Off. Gaz. RS, No. 32/99),
- Act on the Fund for Financing Decommissioning of the Krško NPP and Disposal of Radioactive Waste from the Krško NPP (Off. Gaz. RS, No. 75/94, 35/96 and 24/03),
- Act on Cessation of Exploitation of the Uranium Mine (Off. Gaz. RS, No. 36/92, 28/00).

(2ii) Licensing System

A system of licensing of spent fuel and radioactive waste management is provided in the 2002 Act. In Article 57 there is a general prohibition which provides that:

"No nuclear facility, radiation facility or less important radiation facility may be constructed, tested, operated or used in any other way, or permanently cease to be used without a prior approval or authorisation pursuant to this Act."

With regard to the prescribed measures on radiation protection or nuclear safety, facilities shall be classified as nuclear facilities, radiation facilities and less important radiation facilities. This shall be done pursuant to a governmental order which determines the criteria for the classification (Article 55). But the basic determination of facilities, which also classifies nuclear 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, a facility for storing, processing or disposal of low and intermediate radioactive waste."

Since the facilities for storing or depositing nuclear fuel and low, medium and high level radioactive waste are defined by the 2002 Act as nuclear facilities, the entire spectrum of licensing requirements (for siting, construction, trial operation, operation, decommissioning and/or closure of repository) has to be taken into consideration by the applicant (investor or operator of the facility).

In the licensing process the investor/operator must attach to the license application in addition to the project documentation also an SAR and the independent opinion of a radiation and nuclear safety expert. This requirement holds for each and every radiation or nuclear facility. But the 2002 Act also provides specific requirements in the case of an application for construction of a facility for the disposal of spent fuel or radioactive waste; such project documentation must contain, in addition to an SAR and an expert opinion, also (Article 73):

- financial warranties for carrying out all the necessary tasks until the closure of the repository,
- financial warranties for the payment of the costs for long-term supervision of the repository after the closure thereof,
- statement on the free-of-cost transfer of the ownership of the land occupied by the repository to the state and the plan of transfer.

Although the ministry responsible for the environment shall define in detail the content of the SAR for repository facilities after the closure thereof, such a report shall cover, based on the provision of the 2002 Act itself, the assessment of:

- all possible risks due to the spent fuel or radioactive waste,
- exposure of the population after the closure,

- exposure of the workers working in the repository during the maintenance thereof and during the long-term supervision of the repository facility.

The long-term supervision plan of the repository facility must 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,
- the criteria on the basis of which decisions on carrying out maintenance work at the repository shall be made dependent on the results of the operational monitoring referred to in the previous indent and on inspection.

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

- on radioactive waste and spent fuel management,
- on the state-owned public service for radioactive waste management,
- on the state-owned public service for the disposal of waste from energy producing nuclear facilities,
- on repositories of mining and hydro-metallurgical tailings,
- on state-owned public commercial institutions,
- on the national programme of radioactive waste and spent fuel management,
- on national infrastructure facilities.

On the basis of the provisions of the 2002 Act, the Regulation on the Method of Collecting, Accounting, Processing, Storing, Final Disposal and Release of Radioactive Waste into the Environment (Regulation Z-3, Off. Gaz. SFRY, No. 40/86) remains in force. Regulation Z-3 (Addendum 3 of the Report) contains the following (detailed) provisions:

- on categorising of radioactive wastes,
- on collecting of radioactive wastes,
- on accounting of radioactive wastes,
- on processing of radioactive wastes,
- on storing and final disposal of radioactive wastes,
- on release of radioactive wastes,
- on labelling of radioactive wastes.

As described earlier, in 1999 the Government of the Republic of Slovenia passed an Ordinance on the Method and Conditions of Discharging the Public Service for Radioactive Waste Management (Off. Gaz. RS, No. 32/99). This Ordinance contains 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 method of establishing the price,
- on inspection.

The public commercial institution for radioactive waste referred to in Article 97 of the 2002 Act was established already in 1991 as the ARAO (Governmental Ordinance on Establishment of a Public Agency for Radioactive Waste Management - Off. Gaz. RS, No. 45/96, 32/99, 38/01).

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

The spent fuel and radioactive waste management facilities are defined by the 2002 Act as nuclear facilities. Consequently, all relevant licenses are needed, including the operating license. The operation of such a facility without a license is prohibited according to Article 57 of the same Act.

In the penal provisions of the 2002 Act it is foreseen that a financial penalty of between 300,000 and 30,000,000 Slovenian tolars (EUR 1,300 to 130,500) shall be imposed on a legal entity which violates the above stated prohibition; in addition to this a financial penalty of between 30,000 and 1,500,000 Slovenian tolars (EUR 1,300 to 6,500) shall be imposed on any responsible person appointed by a legal entity for the same violation.

(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,
- order to terminate radiation practices or use of a radiation source in the case when the inspector finds that a proper license was not issued, or if there is a failure in following prescribed methods for handling the radiation source or radioactive waste. An appeal against such a decision of an inspector shall not hinder its execution.

The 2002 Act has only one article on inspection, since the general Act on Inspection (Off. Gaz. RS, No. 56/02) prescribes the general principles of inspection, its organisation, status, the rights and duties of inspectors, inspection measures and other issues in relation with inspection, which is to be followed also by nuclear and radiation safety inspectors.

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

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

(2vi) Allocation of Responsibilities

As described above, the legislative framework (especially the 2002 Act and Governmental Ordinance of 1999) provides a clear allocation of responsibilities of the bodies involved in the different steps of spent fuel and radioactive waste management (producer, holder, mandatory state-owned public services, regulatory body) as well as a system of documentation and reporting.

The Minister of Environment, Spatial Planning and Energy shall classify radioactive waste with regard to the level and type of radioactivity, and determine the radioactive waste and spent fuel management, and the extent of reporting on radioactive waste and spent fuel. This regulation must be issued within 9 months of the coming into force of the 2002 Act.

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

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.

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1. Regulatory Body - Slovenian Nuclear Safety Administration (SNSA)

The SNSA was established at the end of 1987 by the Act on Changes and Supplements to the Act on Organisation and Field of Activities of the Republic's Regulatory Bodies, Organisations and Services within the Executive Council of the Republic of Slovenia (Off. Gaz. RS, No. 37/87). Before 1988 the Energy Inspectorate, which was part of the Committee of Energy and Industry, had the main regulatory and inspection functions, relying heavily on the opinion of the Expert Commission on Nuclear Safety. Like many other countries, the Republic of Slovenia also recognised the need for separating the "promotion" of nuclear energy from "regulation". This was also in accordance with the IAEA Safety Standards. Therefore the SNSA was established as an independent, functionally autonomous body dealing with all matters concerning nuclear safety. It had two organisational divisions, the Safety Analysis and Legislative Division and the Inspections Division. The SNSA was directly responsible to the Government. In 1991 a new Act on Organisation in the Working Field of the Ministries was adopted. According to this act, the SNSA came under the Ministry of the Environment, Spatial Planning and Energy and reports to its minister.

The SNSA's decrees can be appealed to the same Ministry. However, the 2002 Act restricts the right to appeal of the licensee if the technical issues have been resolved in the field of radiation and nuclear safety. The 2002 Act does not allow appeals against decisions on a ban or temporary prohibition of the use of radioactive source (Art. 3/9), against decisions on rejection or confirmation of the changed assessment of risk of radiation exposed workers (Art. 26/7), against decisions on rejection or confirmation of consent to the start of trial operation (Art. 78/8), against decisions on the implementation of periodic safety reviews (Art. 81/4), against decisions on rejection or confirmation of changed proposals important for nuclear or radiation safety (Art. 84/3), against decisions on the revocation of licenses or against ordering the suspension of operation of nuclear or radiation installations (Art. 116/2) and against decisions on termination of license (Art.117/4).

The Director of the SNSA is the head of the regulatory authority and also represents the SNSA. On the Governmental and Parliamentary level, the SNSA is represented by the Minister. The Director is responsible to the Minister for his work and for the work carried out by the SNSA. He is appointed and removed by the Government on the motion of the Minister. The organisation of the SNSA is prepared by the Director and approved by the Government on the motion of the Minister.

Senior civil servants are also appointed by the Government on the motion of the Director, with the consent of the Minister, while others are appointed by the Director himself.

The Slovenian Nuclear Safety Administration performs inter alia specialised technical and developmental administrative tasks and tasks of inspection supervision related to:

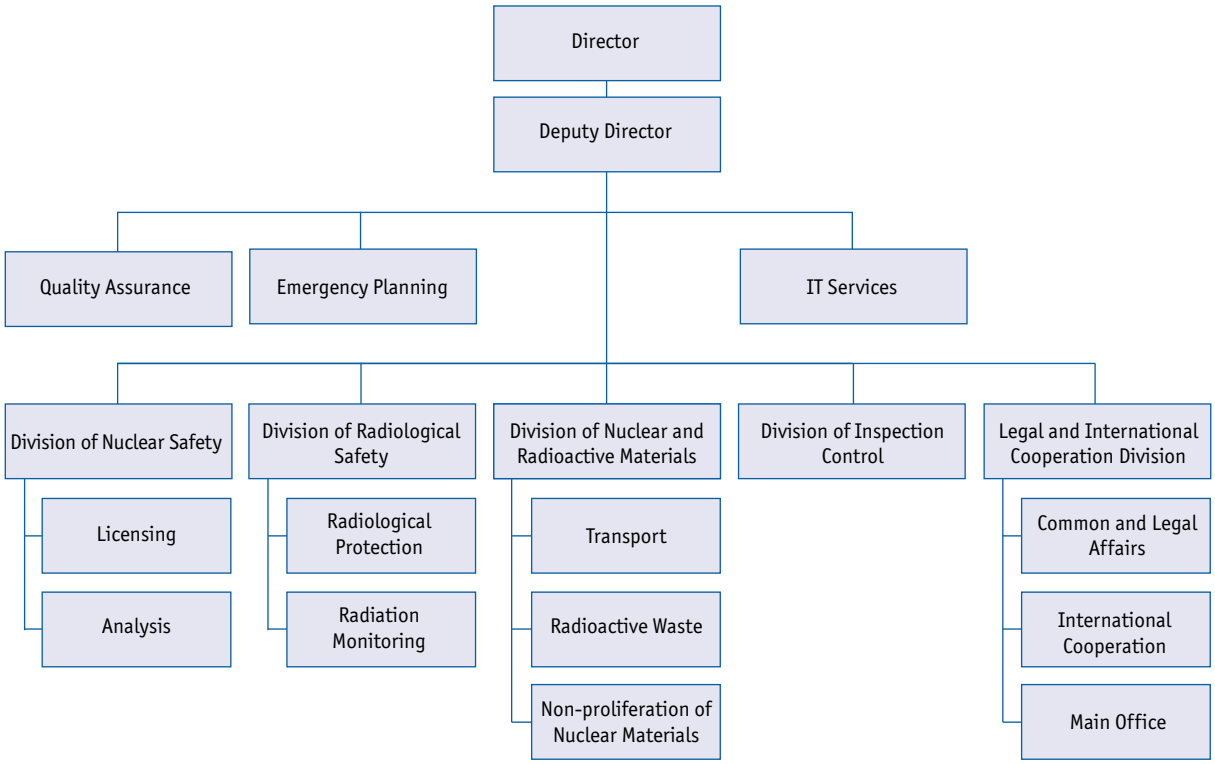
- nuclear and radiation safety,
- carrying out practices involving radiation and use of radiation sources, except in medicine or veterinary medicine,
- protection of the environment against ionising radiation,
- physical protection of nuclear materials and facilities,
- non-proliferation of nuclear materials and safeguards,
- provision of radiation monitoring,
- liability for nuclear damage.

Organisation

The SNSA is organised into five divisions. These are:

- Nuclear Safety Division,
- Radiological Safety Division,
- Nuclear and Radioactive Materials Division,
- Inspections Division,
- Legal and International Co-operation Division.

Organisational chart of the SNSA:



The staff of the SNSA is interdisciplinary, consisting of employees with different educational backgrounds: physicists, mechanical, electrical, chemical and mining engineers, metallurgists, geologists, biologists, lawyers, sociologists, librarians and administrative workers.

The SNSA had 46 employees at the end of the year 2002. The in-force Rules of Internal Organisation and Job Systematisation of the SNSA envisages 65 permanent jobs. The 46 employees had the following professional qualifications: there were 7 PhDs, 12 Masters of Science, 23 university graduates, 1 employee with an associate degree and 3 employees with secondary education. The structure of the employees at the end of the year 2002 was as follows: the director, the deputy director, 34 senior civil servants, 6 civil servants, 4 members of technical staff.

Regulatory matters related to spent fuel and radioactive waste management are dealt with by the Nuclear and Radioactive Materials Division.

Budget

The budget of the SNSA is determined on the basis of the turnover of the previous year, taking into account new needs which have to be well justified. The budget is the only source for financing the SNSA's basic activities.

The SNSA's salaries, material and other expenses, projects and investments are financed solely through the national budget. There are also very limited extra-budgetary sources to cover the direct extra costs of the licensing process.

Although the SNSA is a part of the Ministry of Environment, Spatial Planning and Energy, it still has it's own share in the Ministry's budget and is unrestricted in the execution of its share. The composition of the SNSA's budget for 2002 and SNSA's budget for the period from 1993 to 2002 is shown below.

Table 4: The composition of the SNSA's budget for 2002.

SNSA's budget	in U.S. $	in EUR
Salaries	1,222,809	1,155,429
Material and other expenses (material expenses, publications, occupational safety, expert commission, maintenance of preparedness, safeguards, monitoring for early exchange of information, legislation, foreign co-operation, radiological protection)	442,977	418,568
Projects (research projects, IAEA membership fee, co-operation with U.S. NRC in research programmes, donation for the Chernobyl shelter fund)	452,977	427,726
Investments	82,783	78,221
Total	**2,201,233**	**2,079,944**

** exchange rate as per January 2003.*

Table 5: The SNSA budget in 1993- 2002.

Year	**Budget** (in U.S. $*)
1993	1,033,000
1994	955,000
1995	1,194,000
1996	1,325,000
1997	1,329,000
1998	1,182,000
1999	1,689,000
2000	1,708,000
2001	1,799,000
2002	2,000,000

** exchange rate as per January 2003.*

2. Effective independence

The SNSA, which is organised within the Ministry of Environment, Spatial Planning and Energy, is a part of the state administration. With regard to the Act on State Administration (Off. Gaz. RS, No. 52/02) the SNSA is independent body within the Ministry of Environment, Spatial Planning and Energy in administrative decisions. The Director of the SNSA is directly subordinate to the Minister and reports to the Minister, but in administrative decisions is independent from the Minister or any other body within the Ministry. The Act on State Administration and the 2002 Act de iure established the independence of the SNSA.

Section F: Other General Safety Provisions

Article 21: Responsibility of the License 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 license holder for the safety of nuclear and radiation facilities and also for the safety of spent fuel or radioactive waste management is one of the main principles of the 2002 Act.

Article 57 of the 2002 Act furthermore provides the 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 cease 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 are found or produced in the facility, must be ensured by the operator".

The system of licenses is set up to assure that facilities are designed, constructed, commissioned and prepared for operation with the national or international codes, standards and experience. The Article 73 of the 2002 Act requires the following for the disposal of spent fuel and radioactive waste:

"If an application for approval refers to the construction of a facility for the disposal of spent fuel or of radioactive waste, the investor must in addition to the project documentation and the safety report attach the following:

- SAR relating to the period after the closure of the repository facility,
- the opinion of an appointed expert for radiation and nuclear safety,
- financial warranties for carrying out all the necessary tasks until the closure of the repository,
- financial warranties for the payment of the costs of long-term supervision of the repository after the closure thereof,
- a statement on the free-of-cost transfer of the ownership of the pieces of land occupied by the repository to the state and the plan of transfer.

A clear requirement for the handling 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 must ensure that the radioactive waste

and spent fuel are handled in the way prescribed and the transfer of the burden of disposing of radioactive waste and spent fuel to future generations is avoided as far as possible. The person responsible for the occurrence of radioactive waste and spent fuel must ensure that the wasted radioactive substances are produced in the smallest possible quantities.

The costs of radioactive waste and spent fuel management shall be paid by the person responsible for its occurrence or by the holder of the waste if the possession of it is transferred from the person responsible for its occurrence, or if he acquires it in any other way.

If the person responsible for the occurrence of radioactive waste or spent fuel is not known, the state shall take the responsibility for its management.

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 both adequate financial and human resources to support the safety of facilities for spent fuel and radioactive waste management during their operating life-time and for decommissioning.

Krško NPP

(i) Human Resources

The Krško NPP has the overall responsibility for design, engineering, construction, license application, operation, fuel management, procurement and quality assurance as well as for radioactive waste management. There are several divisions, such as: the Technical Division which is responsible for operating, maintenance and technical services, the Engineering and Nuclear Oversight Division responsible for design, engineering, configuration management, licensing, procurement engineering, project management and independent safety assessments, the Quality Systems Division, Administrative Division and Financial Division. There are qualified personnel at all positions designated to perform different activities needed for radioactive waste and spent fuel management.

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 and Nuclear Oversight Division, is responsible for special nuclear materials accountability and control as well as for spent fuel management. Handling processes themselves are 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 Operating Division.

Personnel Qualifications and Experience

All technical posts at the Krško NPP are assessed. Minimum requirements in terms of educational qualification, number of years' experience in relevant positions and certified competence to undertake certain tasks have been established by the Krško NPP.

The qualifications consist of the basic formal education and of special knowledge. Special knowledge involves basic principles of operation of nuclear power plants, radiological protection, work safety etc. The courses and training exercises are organised by the Training Department, which also takes care of qualification record keeping.

Training

All personnel working at the plant receive basic induction 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 entering the radiologically controlled area, with the objective of ensuring they have a sufficient understanding of the principles of ionising radiation to enable them to work safely in the controlled area. A more advanced course is provided to personnel permanently working in the controlled area or with systems that contain radioactive material. Specialist health physics personnel 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 purchased from abroad.

(ii) Financial Resources

The income from the sale of electricity is sufficient to cover the operating expenses. The Krško NPP invests in continuous adjustment of the safety level of its installation, to account for the development of the state of the art in science and technology over the entire operating life.

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

The Krško NPP is also obliged to assure the funds for the decommissioning and the final disposal of radioactive waste and spent fuel.

The decommissioning of the Krško NPP is regulated through the Act on the Fund for Financing the Decommissioning of the Krško NPP and on Radioactive Waste Disposal from the Krško NPP (Off. Gaz., RS, No. 75/94). Based on this Act, the Fund for Decommissioning of the Krško NPP was established. The Fund is a legal entity. It has a mandate to collect financial resources.

In order to assess the needed financial resources, the Government prepared a document entitled "Development of a Site Specific Decommissioning Plan for the Krško NPP" in April 1996. The main objective of the study was to prepare a comprehensive estimate of decommissioning costs, a detailed schedule of the associated activities, distribution of primary and secondary mass (i.e. decommissioning waste), man-power necessary for dismantling and decommissioning of the plant, and expected occupational exposure. A further task of the study was to include a cost estimation for the disposal of operational LILW and for the management and disposal of spent fuel, which were not considered as an integral part of decommissioning. Based on this Plan, the Krško NPP is currently contributing to the Decommissioning Fund.

The Plan considers several possible methods for its implementation as well as the financing and scheduling. The Decommissioning Plan will be updated on a regular basis. The first revision is currently being carried out.

IJS Reactor Center

(i) Human Resources

The reactor operation staff (full-time staff present 4 reactor operators, 4 radiological protection technicians with head of radiological protection group and part-time staff present head of reactor operation and secretary) are responsible for spent fuel and radioactive waste handling and managing. The staff is appropriately trained and equipped.

TRIGA Mark II operation staff are responsible for and trained to perform specific tasks in spent fuel management and radioactive waste management as follows:

- handling of fresh fuel,
- safeguarding and inspection of fresh fuel,
- in-core and in-reactor handling of irradiated fuel,
- handling and transportation of irradiated fuel inside reactor hall,
- handling of (irradiated) fuel in the spent fuel pool,
- handling and work with sealed and open radioactive sources,
- decontamination,
- identification and packing of LILW.

Specific knowledge, training, skills and certificates required from reactor operators for these tasks:

- radiological protection certificate,
- crane operator certificate,
- forklift driver certificate,
- welder certificate,
- remote manipulation skills.

The personnel also have some practical experience with spent fuel shipment projects and preparing of spent sealed source for storage.

(ii) Financial Resources

The financial resources for maintaining and improving the safety of spent fuel and radioactive waste management at the reactor are provided within the budget for reactor operation (the total budget is EUR 200,000 per year). Financial provisions for decommissioning are not provided. However, the Republic of Slovenia is the owner of the facility, so it will have the final responsibility to assure financial resources for proper decommissioning.

ARAO

(i) Human Resources

At present the ARAO has a staff of fourteen. It is organised into four units: planning and development, disposal, operations and joint services.

The educational structure of the ARAO reflects its professional attitude towards its responsibilities. 50 % of employees have graduate degrees, 29 % postgraduate and only 21 % secondary school education. The personnel covers different fields: physics, chemistry, geology, hydro-geology, metallurgy, low and economics. Several employees have past experience in reactor physics, nuclear engineering and other engineering and scientific fields. Professional improvement is an important part of the ARAO's policy. On-the-job training is a standard activity of all employees. The staff also participates regularly at various training courses, workshops and seminars. The preparation of lectures, papers and other contributions is also regarded as part of the learning process.

(ii) Financial Resources

The ARAO's activities are financed from three different sources:

- the state budget,
- the Decommissioning Fund for the Krško NPP,
- fees for storage and future disposal of waste.

The annual budget varies depending on planned activities for the current year. In last five years the income has gradually increased from EUR 0.75 mill. to EUR 1.3 mill. in 2002.

Žirovski Vrh Uranium Mine

(i) Human Resources

At the beginning of the year 2002 the Žirovski Vrh Uranium Mine was transformed into the public limited company Žirovski Vrh Uranium Mine. At the same time a new company organisation was also established. The basic activities of the public limited company are:

- to prepare plans for and close down the uranium mine,
- to prepare plans and to carry out environmental protection,
- to prepare measures against the consequences of the uranium mine exploitation,
- to carry out other activities required for the closure of the uranium mine.

The Žirovski Vrh Uranium Mine has an adequate and experienced staff of 47 people, the majority of whom are workers, miners and managerial staff. It is standard practice that additional expertise and production of plant as well as major remedial activities are contracted on a commercial basis.

(ii) Financial Resources

Adequate financial resources are available to support the safety of radioactive waste management during the decommissioning.

Until recently the functioning of the Žirovski Vrh Uranium Mine was assured through the state budget. Such financing was not sufficient to perform capitally intensive tasks. For this reason the Government of the Republic of Slovenia secured sufficient financial resources through a loan from the European Investment Bank. The budget will assure the completion of work by the end of 2006. The financial resources for institutional monitoring will be provided by the Government of the Republic of Slovenia.

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.

The 2002 Act explicitly requires Quality Assurance (QA) measures to be taken for all activities related to nuclear and radiation facilities, from the design stage to operation and then to the decommissioning stage (Article 63). Operators of radiation or nuclear facilities must implement in a planned and systematic way measures to meet quality requirements for constituent parts, for management and control systems of technological processes, or for constructions, including computer software and related services. Facility managers must set up and implement a QA programme.

Krško NPP

It is the policy of the Krško NPP to operate the plant in a manner which ensures the safety and health of the public and the on-site personnel. It is also the policy of the Krško NPP to comply with the requirements of Appendix B to Title 10, Part 50 of the United States Code of Federal Regulations (10 CFR 50), as concerns the operating license and applicable codes, standards and guidelines.

The QA policy for the Krško NPP is established by the General Manager and is defined in the Statement of Policy and Authority, which is a part of the Krško NPP QA Plan. This policy is implemented through the Krško NPP QA Plan and procedures for the operation phase of the plant. The QA Programme, which includes the Statement of Policy and Authority, the plan and the procedures, constitutes a part of the Krško NPP Manual.

The requirements and responsibilities identified by the QA Plan are implemented through the Plant Management Manuals and related programs, including the Radioactive Waste Management Programme and Fuel Management Programme.

IJS Reactor Centre

QA of IJS Reactor Centre is part of the Jožef Stefan Institute 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 of reactor operation are subject to internal (Jožef Stefan Institute QA management and audit team) and external (SNSA) audits and inspections.

ARAO

A QA system has been implemented in the ARAO for several years. It is documented by a quality manual including administrative and working procedures, covering all aspects of waste management in the Central Interim Storage for Radioactive Waste in Brinje and radiation protection dealing with waste. The introduction of the ISO 14001 standard for the Central Interim Storage for Radioactive Waste in Brinje is foreseen for the year 2004 with the corresponding preparatory procedure starting in 2003.

SNSA

Based on the programme of the Government on Management for Excellence in State Administration, supported by 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, Vienna, 1996; ISO 9001, "Quality Management Systems - Requirements", Third Edition, 2000 and IAEA-TECDOC-1090 "Quality assurance within regulatory bodies", IAEA, June 1999, the SNSA is establishing its QA programme. A quality management system that clearly defines organisation, responsibilities and authorities, resource management, processes and measurement, analysis and improvement is being prepared. The SNSA quality management system is built around processes and is defined in quality management documentation in the form of a process approach. The quality management documentation that is under preparation consists of a mission statement and policy, a quality manual, management procedures, working procedures and records. In its mission statement, the SNSA clearly states among other things its goal and its policy to reach the goal: "the SNSA shall function, regulate and supervise using clearly defined rules, giving an overriding priority to safety, being friendly towards customers and open to the public".

The organisational structure of the SNSA has also been adjusted by adding the function of a quality manager who reports directly to the director. A project team and quality board were also appointed. The role of the project team is to establish, document and introduce the quality management system. The role of the quality board is to ensure the development and the implementation of the quality management system and continuous improvement of its effectiveness.

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 is regulated by the 2002 Act which is based on EU Directive 96/29/Euratom. The subsidiary regulations concerning the system of radiation protection of workers and the public are still based on the previous Acts from 1980 and 1984. They form a comprehensive system of Regulations Z-1, Z-2, Z-3, Z-4, Z-5, Z-6, Z-8, Z-9, Z-10, E-1 etc. (see Section L, Annex f) which is under revision procedure with the aim to modernise regulations and also to harmonise the legislation with the EU directives.

The set of regulations prescribes control of discharges, monitoring of radioactivity in the environment, categorisation of sources and radioactive waste, radiation protection of workers together with medical surveillance, training and education programmes etc. Some new issues regarding radiation protection of workers and public are already a part of the 2002 Act, such as for example intervention criteria and levels.

Two regulatory authorities are responsible for radiation protection issues: the Ministry of Environment, Spatial Planning and Energy, and the Ministry of Health. According to the 2002 Act the Ministry of Environment, Spatial Planning and Energy is responsible for licensing and inspections in industry, research and education (including nuclear facilities) while Ministry of Health has adequate responsibilities for sources used in medicine and veterinary medicine. The licensing process of the 2002 Act prescribes the handling and use of a specific source. The facilities with radiation sources and nuclear facilities are categorised in the 2002 Act as well.

According to this, the design, planning, subsequent use and operation of sources, and handling shall be performed in a way to ensure that exposure is as low as reasonably achievable (ALARA), taking into account economic and social factors. In order to implement the radiation protection standards through licensing, the authorised technical support institutions were established to perform radiological surveillance based on the procedures given in the previous Acts from 1980 and 1984. This institution supports regulatory authorities and users of radiation sources such as for example by performing safety assessment plans, dose calculations, monitoring of radioactivity of the environment etc. Two technical support organisations were authorised to perform specific tasks regarding radiation protection measurements. Five medical institutions were authorised for health surveillance of workers.

The prescribed annual effective equivalent dose limit for workers is formally still 50 mSv, the annual equivalent dose limit for individual organs or tissue of workers is 500 mSv except in the case of eye lenses and blood forming organs, 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 nuclear fuel cycle in the country, also including contractors. In total, about 5000 workers, (together with contractors) in the nuclear fuel cycle have been registered, with an average of 1000 workers per year.

The limit for the annual effective equivalent 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. For a limited period of a few years the limit for the annual effective dose equivalent for a member of the public can be 5 mSv, if the average lifetime effective dose equivalent does not exceed the general limit.

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, structures and spent fuel storage have already been 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 must 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 include special attention to the protection of pregnant women, breastfeeding women, students, workers employed by contractors etc. A person carrying out a practice involving radiation who manages a radiation or a nuclear facility must ensure the establishment of a special organisational unit for radiation protection, which is responsible for planning and implementing the measures for protection against radiation. In all other cases the person responsible for radiation protection should be nominated by the licensee. The dose measurements of workers are based on the TL dosimetry or monitoring of workplaces, as appropriate. The dosimetry services are authorised by the Ministry of Health.

According to Regulations Z-2, Z-9 and Article 124 of the 2002 Act, operational monitoring of radioactivity must be ensured by the manager of a radiation or nuclear facility to protect the public. Operational monitoring of radioactivity shall entail:

- emission monitoring of the radioactivity of a radiation facility or nuclear installation, including the monitoring of permitted releases of radioactive substances into the environment,
- monitoring of environmental radioactivity and the monitoring of the radioactivity of foodstuffs and animal feed as the result of radioactive releases.

Radioactive discharges are monitored at regular intervals and annual public exposure has been estimated. The operator must carry out also the monitoring of the effects of remediation works in case 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 which have due regard to internationally endorsed standards on radiation protection

The legal basis for control of discharges in normal operation is Regulation Z-2 and the 2002 Act, Article 124 (Operational monitoring of radioactivity).

According to the 2002 Act two levels of the radiation monitoring insure that no individual is exposed in the normal situations above the dose limits:

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

Regular control of radioactive discharges into the environment from nuclear installations has been performed regularly during the period of their operation. The discharge limits for nuclear facilities were set by the SNSA related to the dose constraints of population exposure. Monitoring of radioactive discharges from nuclear facilities in the Republic of Slovenia started in the early eighties with the extant programmes: at the Krško NPP (1981), at the Žirovski Vrh Uranium Mine (1985), at the IJS Reactor Centre (1986) and at the Central Interim Storage for Radioactive Waste in Brinje (1986). Discharges from nuclear medicine departments are not regularly monitored and only some rough estimates have been made.

In 2002 the SNSA started a simplified database in electronic form. The annual data on gaseous and liquid radioactive discharges are the input data for a dispersion model and further for radiation exposure assessment of the members of critical groups.

b) Environmental monitoring of radioactivity

1. Monitoring of radioactive contamination in the surrounding of the nuclear facilities has been performed by technical support organisations. Population exposures to the critical groups have been estimated based on measured data and modelling.

The monitoring of radioactivity in the environment is performed in accordance with the regulations Z-1 and Z-2. The samples are taken and collected from the environment, air, water and soil, as well as drinking water, some products, foodstuffs and animal feed. The exposure to the public is estimated as a result of the environmental contamination due to nuclear tests and operation of facilities in the nuclear fuel cycle.

2. The automatic radiation monitoring system on the territory of the Republic of Slovenia has been developed since the Chernobyl accident. All the data from different networks are currently collected at the SNSA. At the moment the entire system (named CROSS) comprises on-line data of dose-rate measurements (44 stations), aerosol radioactivity measurements (3 stations) and radioactive deposition (1 station). The control of airborne activity was realised through an IAEA technical co-operation project and also with the support of the Austrian Government. The station for radioactive deposition was developed and installed by the SNSA.

3. 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

See Article 25: Emergency Preparedness.

Measures Taken by the License Holders

Krško NPP

a) Radiation Protection

In accordance with the Act from 1984 and the 2002 Act, all nuclear installations shall have a special Radiological Protection Unit. The radiological protection unit at the Krško NPP was organised in order to implement radiation protection measures including measurements, assessment and 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 and visitors. Radiation protection related to the management of radioactive waste at the plant site is one of the tasks of the radiological protection unit. This task must be in compliance with 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 area under constant radiological surveillance (controlled area) comprises: 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, a part of the building for decontamination and areas for processing and storage of radioactive wastes.

In the controlled area - where irradiation and contamination is highly probable - the Krško NPP staff and contractors must be equipped with thermoluminiscent personal dosimeters (TLD) in addition to regular protection equipment. Internal radiation is measured by a whole-body counter. Measurements of internal contamination are carried out before and after work for all workers working in the radiological controlled areas where there is a risk of internal contamination (annual outages or major maintenance works). For daily records, alarm personal dosimeters are used. However, TLD are used officially.

Administrative procedures and installed systems provide effective protection of individuals, society and the environment. ALARA planning is a common approach to work in radiological controlled areas. 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 accidental conditions. The committee is responsible for adopting and review of ALARA programmes. The reduction of personal and collective doses is the primary guideline when preparing procedures for spent fuel management. During ALARA planning procedure, radiological conditions are analysed, personal protection equipment is defined, radiological control determined, all key elements are taken into account (minimising work time, distances from sources, shielding, removing of sources, contamination control and work analysis).

Based on the 1984 Act and Regulation Z-2, the SNSA issues two decisions to the Krško NPP to demonstrate compliance with the requirements on protection of the public due to radioactive discharges. The decisions are issued on a yearly basis and define the scope of monitoring and frequency of reporting. The Radiological Monitoring Programme comprises environmental measurements, measurements of liquid and gaseous discharges, measurements of activity in plant systems, inventory of the onsite radioactive waste storage facility and preparedness for radiation measurements in case of emergency. Measurements are defined as the monitoring programme and requirements regarding the maintenance of the meteorological database and data transfer to the SNSA. The operator is obliged to announce in advance all gaseous discharges into the atmosphere and also to update the modelling of dispersion of radioactive contamination in an accident situation.

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

The Krško NPP has its own service for external personal dosimetry, which was approved by the Ministry of Health. In addition, internal contamination is controlled by whole body measurements. The exposures of workers to ionising radiation in the NPP are relatively low.

In the year 2001 the collective effective dose of workers involved in the processing of the radioactive waste in the Krško NPP was 14.53 man mSv, which represents about 1% of the total collective dose. In the year 2002 the total collective dose was 582.04 man mSv and 4.45 man mSv was related to the processing of the radioactive waste. Just two workers involved in the processing of the radioactive waste received an annual dose of more than 5 mSv in the years 2001-2002.

In 2001 the average individual effective dose of the workers was 1.27 mSv, and 0.71 mSv in 2002, which is about 6.35 % and 3.55 % respectively of the annual dose limit for occupational exposure according to the latest ICRP-60 (1991) and IAEA-BSS (Safety Standards No. 115) recommendations. In the recent years up to 2000 the average individual and collective doses of workers showed a rising trend as a consequence of plant modification work, plant upgrade and the modernisation programme, but from 2000 onwards these doses are significantly lower.

b) Liquid and Gaseous Discharges

The limits of radioactive discharges into the environment are authorised by the license for operation of the Krško NPP No. 31-04/83-5, issued on 6 February 1984 by the former Energy Inspectorate of the Republic of Slovenia.

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 as well as radioactivity in the air are measured on site. The competent authorities are regularly informed about discharges of radioactive materials into the environment by the Krško NPP on a daily, weekly, monthly, quarterly and yearly basis.

The liquid radioactive discharges are discharged into the Sava river through the main water outlet in front of the dam. The dominant radionuclides in liquid discharges are: H-3, Xe-133, Xe-135, Xe-131m, Xe-133m, Kr-85, Co-60, Fe-59. Even though the activity of tritium is high compared with other radionuclides, due to its low radiotoxicity its radiological impact is insignificant. The activities of Cs-134, Cs-137, Co-58 and Sb-125 are two to three orders of magnitude lower. The main contribution to the dose is made by the radionuclides of cesium and cobalt.

Radioactive gases from the Krško NPP were released into the atmosphere mainly from the reactor building stack and through the vent of the condenser in the secondary coolant loop. The radiation monitoring system continuously measures and monitors the concentrations of individual radioactive elements at both discharge points.

Table 6: Radioactive liquid and gaseous discharges from the Krško NPP in 1999-2001.

Liquid discharges	**Authorised limit** [Bq]	**Released activity** [Bq]		
		1999	2000	2001
Total released activity (without H-3, noble gases)	200 E+09	4.74 E+08	5.76 E+08	1.13 E+09
H-3	20 E+12	1.08 E+13	1.07 E+13	7.75 E+12
Noble gases	-	5.33 E+09	7.12 E+09	7.76 E+08

Gaseous discharges	**Authorised limit** [Bq]	**Released activity** [Bq]		
		1999	2000	2001
Noble gases (Xe-133 equiv.)	110 E+12	1.44 E +12	2.29 E +12	2.11 E +12
Iodines (I-131 equiv.)	18.5 E+09	5.46 E+06	52.3 E+06	0.13 E+06
Aerosols	18.5 E+09	16.7 E+03	1.06 E+06	2.83 E+06
H-3	-	1.16 E+12	1.2 E+12	0.86 E+12
C-14	-	0.12 E+12	0.12 E+12	0.11 E+12

Conservatively estimated individual exposures for member of the public dose are based on the directly measured values in the environment and on model calculations, and amount to a value of the effective dose usually in the range of a few μSv/year for an adult. Dose assessment showed that exposures to members of critical groups have been well below the regulatory limit of 50 μSv/year.

Central Interim Storage for Radioactive Waste in Brinje

a) Radiation Protection

Radiation protection in the Central Interim Storage for Radioactive Waste in Brinje covers workers and the public and includes:

- occupational radiation protection,
- monitoring the radioactivity in the vicinity of the storage site (protection of the public).

Radioactive waste management and other activities in the storage are performed according to the procedures. For non-regular tasks the radiation exposure of workers is estimated in advance and optimised according to ALARA procedures. All workers are included in monthly dosimetric monitoring performed by the approved dosimetry service. The effective collective dose was 0.92 man mSv in the year 1999, 2.21 man mSv in the year 2000 and 2.74 man mSv in the year 2001. The average dose per worker was 0.46 mSv/year in the year 2001. The reported doses result from the summation of measuring equipment's lowest measurable values, so they reflect equipment sensitivity rather than the actual radiation and clearly overestimate the exposure.

Monitoring of work places is performed regularly. The measurements include: measurements of gamma dose-rate, determination of the gamma radiation field, neutron dose-rate, surface and air contamination, radon concentration and gamma emitters in the samples.

Conservatively estimated radiation exposure of the public due to the operation of the Central Interim Storage for Radioactive Waste in Brinje is far below the general prescribed limit of 1 mSv/year. The annual effective dose (radon inhalation and direct exposure) for the most exposed non-radiation worker working in the vicinity of the storage site for a part of his routine job does not exceed 10 μSv/year.

b) Liquid and Gaseous Discharges

The radioactivity monitoring programme in the environment of the Central Interim Storage for Radioactive Waste in Brinje was conceived in accordance with Regulation Z-2. The scope of monitoring covers emissions (measurements of gaseous discharges, liquid discharges) and environmental concentrations of radioactivity. During normal operation there were no liquid discharges from the storage. The results of these measurements showed that the storage has negligible impact on the environment. The steady state emission of radon into the environment is approximately 70 Bq/s. This amounts to a yearly release of 2.2 GBq.

In June 2001 the ARAO was authorised by the SNSA to carry out a project related to the radium sources repackaging. After carrying our the repackaging the level of external radiation was lowered substantially.

In dose assessment of the public, only radon progeny inhalation as well as external exposure were considered. The annual effective dose received by a farmer who occasionally works in the field near the site is estimated to be around 0.3 μSv.

IJS Reactor Centre

a) Radiation Protection

At the IJS Reactor Centre radiation protection is implemented and performed by the Radiation protection service of the Institute. Altogether, 43 persons from this service, from the Radiochemical Laboratory and the Reactor Department were exposed to ionising radiation with an average annual dose of 0.05 mSv in 2001 (not taking into account the neutron dose). The collective annual dose was 1.96 man mSv in 2001.

b) Liquid and Gaseous Discharges

The radioactivity monitoring programme in the environment of the IJS Reactor Centre was carried out in accordance with Regulation Z-2 and was approved by an SNSA Decision. The liquid discharges originated mostly from the radiochemical laboratory using reactor activation products. The annual reactor emission of Ar-41 is proportional to the time of reactor operation and is estimated to be typically about 1 TBq.

For exposure evaluation of the population only two exposure pathways were considered: external exposure due to Ar-41 immersion and ingestion of contaminated water. In the year 2001 the total dose received by the public was estimated to be 0.3 μSv/y. There are no authorised dose limits for the operation of the research reactor; thus the general limit for members of the public is applied (1mSv/year).

Table 7: Discharges from the IJS Reactor Centre.

Liquid emissions	**Released activity** [Bq]		
	1999	2000	2001
Total released activity	2.5 E+06	8.7 E+06	0.51 E+06

Gaseous emissions	**Released activity** [Bq]		
	1999	2000	2001
Ar-41	0.9 E+12	0.9 E+12	1.0 E+12

Žirovski Vrh Uranium Mine

a) Radiation Protection

Within the scope of decommissioning, the Radiological Protection Unit of the Žirovski Vrh Uranium Mine is responsible for performing tasks related to radiation protection of workers concerning all activities of Žirovski Vrh Uranium Mine. In this phase most tasks related to radiation protection originate from radioactive waste related to the previous exploitation of the uranium ore.

Exposure of workers to ionising radiation is assessed by the radiological protection unit based on the following measurements:

- measurements of radon and potential alpha energy of radon progeny in the air,
- measurements of long lived alpha activity in the air,
- external radiation is measured with TLDs on a quarterly basis except the doses of the workers in the laboratory where TLDs are replaced monthly.

Dose assessments are based on these data and on the time records for individual worker relating to his/her work at different workplaces.

The highest contribution to occupational exposure comes from the Potential Alpha Energy of radon progeny.

Table 8: Radiation exposure of workers of the Žirovski Vrh Uranium Mine.

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

** in the period of regular operation*

b) Liquid and Gaseous Discharges

The regular monitoring programme of environmental radioactivity has been running continuously for a decade and a half. The programme is based mainly on the U.S. Regulatory Guide 4.14 (1980) and was approved by the competent regulatory authority. After the cessation of mining and milling, during the current closedown period, the surveillance programme has been running continuously and only some minor changes in the programme scope have been made.

Monitoring of radioactive discharges to the environment was currently performed during all the operational phase (1985-1990) and in the post-operational phase as well.

Table 9: Radioactive discharges at the Žirovski Vrh Uranium Mine.

Liquid emissions	Released activity [Bq]		
	1999	2000	2001
U-238	2.9 E+09	3.0 E+09	3.1 E+09
Ra-226	0.084 E+09	0.074 E+09	0.056 E+09

Gaseous emissions	Released activity [Bq]		
	1999	2000	2001
Rn-222	11.9 E+12	11.7 E+12	9.4 E+12

The impact of the mine discharges extends over an area inhabited by about 250-300 people. The dose assessment was made for adults in this population group. Inhalation of radon and its progeny from the mine is the main contributing factor to exposure. In 2001, the exposure of a member of the public was estimated to be 0.23 mSv/year.

Isotope Laboratory of the Institute of Oncology

a) Radiation Protection

Occupational exposure at the Institute of Oncology is monitored through regular dosimetric monitoring of the TLDs. It was reported that no worker has exceeded 20 mSv/year during the past 10 years. The annual dose of the majority of workers from the Institute of Oncology did not exceed 1 mSv in the year 2001. The maximum annual personal dose of 8.8 mSv was received by a medical nurse from the Brachyradiotherapeutic department in the year 2001. The above mentioned values also include exposures received during handling sources from and in the storage. No special tasks regarding radioactive waste are performed and no separated doses are recorded.

b) Liquid and Gaseous Discharges

Discharges from the nuclear medicine departments are not regularly monitored and only some rough estimates were made. The faecal sludge is collected in a two-vessel container (in use since 1997) and released into the hospital sewage system only after a defined period (about half a year), required for the activity of the radionuclides to decrease below the prescribed limit for drinking water activity.

For other departments of nuclear medicine in the country no special decay containers for these kinds of releases are in place so discharges are estimated regarding the administered activities.

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

According to the Act on Organisation and Field of Activities of the Ministries, 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 in nuclear installations. The SNSA is responsible for regulatory control over on-site procedures and measures related to the on-site emergency plan.

The national concept of civil protection and disaster relief is regulated by the Act on Protection against Natural and Other Disasters (Off. Gaz. RS, No. 64/94). The Act requires that the enterprises, institutions and other organisations (including nuclear facilities), which in their working process use, produce, transport and store dangerous materials or perform activities which pose some danger to the public and the environment, provide the basis for emergency planning and have an emergency response plan. The Act also requires that the state and the municipalities also provide the basis for emergency planning and have an emergency response plan.

Concerning safety, the most important Act is the 2002 Act, which stipulates that every applicant must submit, together with the application for a construction permit for a nuclear facility, a Radiological Emergency Response Plan in the event of a nuclear accident. During trial operation and operation of the nuclear facility, the radiological emergency plan must 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 SAR.

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 the nuclear facility are specified on three levels: plant, local and state. The state is responsible for the regional and state radiological emergency response planning and the maintenance of the radiological response plan. In April 1999, the updated National Protection and Rescue Plan in the Event of a Nuclear Accident (henceforth referred to as the Plan) was adopted by the Slovenian Government. In the Plan, the emergency organisation response scheme is determined for all classes of emergency. The Plan comprises: notification, activation of state civil protection units, responsibilities of state administration and support organisations, radioactivity measurements, protective actions, rescuing activities, recovery operations, training and exercises. The interfaces with the regional and local radiological emergency plans are given in the Plan as well. The main objective of the regional emergency response planning is to co-ordinate the activities between the state level and the local level, and to support and co-ordinate the emergency managing efforts between municipalities.

The two most important institutions in nuclear or radiological emergency preparedness at the national level are the Administration for Civil Protection and Disaster Relief at the Ministry of Defence and SNSA at the Ministry of Environment, Spatial Planning and Energy.

There is also the Ecological Laboratory with Mobile Unit which is a special unit for radiological and emergency response on a state level. It would assist in any radiological emergency providing radiation measurements and intervention in case of lost or dispersed radioactive material.

On-site Emergency Plan

Krško NPP

The Krško NPP has competency and all responsibility for on-site emergency preparedness and response. The principles and requirements of the legislation on protection against natural and other disasters as well as on nuclear safety in the Republic of Slovenia are being incorporated into the Krško NPP on-site emergency preparedness and response plan.

The Krško NPP has a Radiological Emergency Response Plan which meets the requirements of 10 CFR 47 NUREG-0654, therefore the radiological emergency response plan satisfies all the requirements for on-site emergency planning of spent fuel pool and radwaste facilities as well.

The objectives of the Krško NPP Radiological Emergency Response Plan are:

- identification and evaluation of the type and classification of an emergency,
- 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 in case of emergency required from off-site support organisation, Civil Protection Headquarters of Slovenia and other competent authorities,
- identification of emergency response facilities, equipment, communications, protective and other means of managing emergencies,
- establishing the Krško NPP emergency measures and procedures to assure protection of health and safety of plant personnel and members of the public in the surroundings,
- establishing on-site recovery measures to manage or mitigate consequences of an emergency and to assure conditions for recovery,
- provide a basis for maintaining on-site emergency preparedness,
- co-ordination between the Krško NPP and off-site local, regional and state authorities to assure on-site emergency preparedness including public information about protective actions.

IJS Reactor Centre

The TRIGA Mark II research reactor has an on-site Radiological Emergency Response Plan. There is no off-site Radiological Emergency Response Plan, because short term protection actions for the off-site population are not envisaged for operational accidents. In the SAR the most severe accident (total loss of all reactor coolant) would not cause a core meltdown, therefore no significant radioactive release to the environment is expected.

Emergency response plans for the TRIGA Mark II research reactor are specified in the SAR according to appropriate IAEA format. Procedures are prepared in the form of special written documents for practical use in emergency situations. The procedures are subject to internal and external verification and approval. The procedures include: reactor status data, identification of emergency situation, description of the actions, alarming, 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 controlled area) ,
- non-radiological accidents (fire in the reactor building, earthquake, sabotage and unauthorised access, riots and demonstrations, chemical emergency from the outside due to a chemical plant in the vicinity of the reactor centre).

The spent fuel of the TRIGA Mark II research reactor is to be stored in the reactor pools which are empty. The most severe operational accident (loss of coolant in the pool) would not significantly affect the spent fuel, which is stored in the reactor pool only. The off-site consequences of the gap release from damaged spent fuel elements are negligible. Since 1993, when the emergency procedures were introduced, there have been no events that would require their application.

Central Interim Storage for Radioactive Waste in Brinje

The emergency response plan for the Central Interim Storage for Radioactive Waste in Brinje, prepared by ARAO, covers all anticipated abnormal events and emergency situations related to the operation of the facility and handling the radioactive waste. The plan defines the competencies and responsibilities of personnel responsible for emergency preparedness and anticipates the response to the emergency situation.

The following abnormal events and emergency situations in the Central Interim Storage for Radioactive Waste in Brinje are included in the ARAO emergency response plan:

- fire in the storage,
- loss or theft of spent sealed sources,
- accident during handling the radioactive waste,
- other similar emergency situations.

Žirovski Vrh Uranium Mine

Radiological emergency situations at both of the disposal sites, Jazbec and Boršt, are not expected. As part of the monitoring programme, the surface of the Jazbec mine waste pile and Boršt mill tailings site is inspected regularly, and after heavy rain additional inspections are conducted. The rate of sliding of the base of the Boršt mill tailings site is measured once a year.

SNSA

The SNSA emergency plan is an integral part of the National Radiological Emergency Response Plan. The SNSA Emergency Plan contains information which is needed to support the SNSA staff when performing specific activities which are required during an emergency at a nuclear facility.

The SNSA Emergency Response Plan is oriented to accidents in an NPP (mostly the Krško NPP and partially to a foreign one). For emergencies due to spent fuel and radioactive waste, the SNSA will assist in the emergency response by providing expert groups, inspection division and measuring equipment.

The SNSA provides the neighbouring countries and the IAEA with information on the emergency, according to the Convention on Early Notification in Case of a Nuclear or Radiological Accident. In November 2000, the SNSA changed the frequency of sending data from the Automatic Early Warning System to the Ispra Joint Research Centre in Italy from a weekly to a daily basis. Bilateral exchange of monitoring data also exists with Austria, Croatia and Hungary.

In 1999, an SNSA on-duty officer was introduced around-the-clock. He is equipped with a mobile phone. In case of an event, his primary duty is verification if the message is true and activation of the SNSA staff. In 2000, a radiological monitoring officer was introduced as an additional on-duty officer. He/she daily

checks the operation of the automatic radiological monitoring system and writes a report. In case of elevated levels detected by the automatic monitoring system, he/she receives an automatic message on the wireless communicator.

Exercises

The Krško NPP radiological emergency response plan is tested through the "NPP Krško Annual and Five-year Drill and Exercise Plan". The exercises take place every year while the scope and the involvement of participants follow the plan.

The first emergency preparedness exercise was conducted at the Krško NPP in 1982, with the participation of observers from the IAEA.

The adequacy of the new concept of emergency preparedness was tested in exercises in 1993 (national exercise), 1994, 1995, 1997 (table-top exercise), 1998, 1999, 2000 and 2001. A national Nuclear Emergency Exercise was organised in November 2002 to test the harmonisation of the new regional emergency plan with the state nuclear emergency plan and other emergency plans.

In October 1995, the Republic of Slovenia was invited to take part in the second cycle of the four INEX-2 exercises, which were promoted by the OECD/NEA. The Republic of Slovenia participated in all four exercises. The SNSA also participated in the joint IAEA/WMO exercise in 2000. The Republic of Slovenia also took part in the JINEX-2000 exercise in 2001.

The training of protection and rescue forces is conducted by the Republic of Slovenia Protection and Rescue Training Centre, under the jurisdiction of the Administration for Civil Protection and Disaster Relief. The training covers introductory, basic and supplementary training courses.

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 under decommissioning, excluding the remediation of the Žirovski Vrh Uranium Mine. In order to assess the contribution to the decommissioning fund, the decommissioning plan for the Krško NPP was studied.

Krško NPP

The document "Development of a Site Specific Decommissioning Plan for the Krško NPP" provides a comprehensive analysis for accomplishment of this task. As the closure of the Krško NPP is planned after 2023, the decommission plan will be reviewed and updated every 3-5 years.

(i) Staff and Financial Resources

Based on the document Development of Site Specific Plan for the Krško NPP, a levy of 0.61 Slovenian tolar per kWh produced is paid to the Fund for the Decommission of the Krško NPP. The levy is subject to change due to revision of the decommissioning plan. As the decommissioning of the Krško NPP will occur after 2023 it is assumed that 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/dismantling of nuclear facilities. All legal requirements and limitations that are applicable to operating facilities are applicable to the facilities in the overall decommissioning process.

(iii) Emergency Preparedness

The Krško NPP has an Emergency Preparedness Department. It is responsible for conducting all activities regarding emergency preparedness required by regulations.

(iv) Records of Information

There is also an Engineering Support Department that is in charge of record keeping and of maintaining the database required by regulations.

IJS Reactor Centre

A research project estimating the quantity and composition of LILW material resulting from dismantling has been performed. It is estimated that not more than 10 tons of LILW would be produced in decommissioning. However, complete dismantling is not the most economical option after the closing of the reactor. Converting the reactor structures and the building for other research or commercial activities (e.g. gamma irradiation facility) or sealing it for an intermediate period prove to be more economical solutions than immediate dismantling after its closing.

Žirovski Vrh Uranium Mine

The proper qualified staff is available to perform all tasks of decommissioning of the Žirovski Vrh Uranium Mine. The adequate financial resources are available to support the safety of radioactive waste management during the decommissioning. For this purpose the Ministry of the Environment, Spatial Planning and Energy assures financial means from the state budget and also through a loan from the European Investment Bank.

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

The safety of decommissioning of the Jazbec mine waste pile and Boršt mill tailings site were ensured by taking into consideration all international recommendations from competent authorities, experiences from other mines in similar environments, geographical positions and in connection with this meteorological conditions as well. The public limited company Žirovski Vrh Uranium Mine, d.o.o is in charge of record keeping.

Central Interim Storage for Radioactive Waste in Brinje

Currently, no plans have been adopted for decommissioning and dismantling of the Central Interim Storage for Radioactive Waste in Brinje.

Section 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 particular requirements regarding the type of activity are stipulated in separate articles of the Act. For this reason, in order to avoid redundancy in the report and to assure fluency of 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 management and spent fuel are adequately addressed in the 2002 Act through the approval of Safety Analysis Report (SAR) by the SNSA. The Minister of the Environment, Spatial Planning and Energy shall determine the detailed content of the SAR.

The requirement that the 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. Provision (2) of Article 93 stipulates that the person responsible for the occurrence of radioactive waste and spent fuel must ensure that the radioactive substances occur in the smallest possible quantities.

The interdependencies among the different steps in spent fuel management and radioactive waste management shall be addressed through the national programme of radioactive waste and spent fuel management. The provisions of Article 98 of the 2002 Act prescribe the preparation of a such programme that shall be adopted by the National Assembly as a part of the national programme for the protection of the environment. However, the present practice is that the generators of the radioactive waste and spent fuel are considering the interdependency among different steps of their management through the approved SARs and operating licenses.

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, is assured through the framework of national regulation. The main pillar is the 2002 Act and its subsidiary regulation which is under preparation. The subsidiary regulation will be set through Government decrees and regulations prescribed by the Minister of the Environment, Spatial Planning and Energy and the Minister

of Health respectively. In the preparation of subsidiary regulation the internationally endorsed criteria and standards are being taken under due consideration. Until the new subsidiary regulations enter into force the 14 regulations of the old 1984 Act, prepared and adopted in the eighties shall be in force. These regulations respected the international practice and standards at the time of their adoption, and therefore need to be replaced.

The biological, chemical and other hazards that may be associated with spent fuel and radioactive waste management are taken into account through SAR for each particular nuclear facility and disposal facility. The content of documentation that is subject of licensing shall be prescribed by the Minister of the Environment, Spatial Planning and Energy (2002 Act, Article 71), while the content of SAR for facilities for disposal of spent fuel, radioactive wastes (2002 Act, Article 73) and disposal of uranium mining and ore processing waste (2002 Act, Article 76) shall be prescribed by the SNSA who also act as a licensing authority for the approval of SARs.

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. The legal and licensing requirement in the area of spent fuel management and radioactive waste management that are applied at present do not stipulate any relaxation in the future.

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 Practies

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 operation of the Krško NPP and IJS Reactor Centre (TRIGA Mark II research reactor) is managed in storage sites that are an integrated part of these nuclear facilities. Similarly LILW generated at the Krško NPP is managed and stored in storage sites under the operating license 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 of this paragraph are the Central Interim Storage for Radioactive Waste in Brinje and the Boršt mill tailings site and the Jazbec mine waste pile at the Žirovski Vrh Uranium Mine.

The Central Interim Storage 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 got a license for use of this facility on the basis of the Act on Construction. In 1998 the SNSA required by decree that the operator apply for an operating license under the 1984 Act and prohibited the further operation of this facility, except for emergency cases.

When the management and operation was transferred to the national waste management ARAO in 1999 the SNSA required that the new operator meets the requirements of the above decree. By the end of 2002 plans for reconstruction and modernisation of the facility had already been prepared. It is expected that the ARAO shall meet the licensing requirements in 2003. The following works will be performed:

- refurbishment and renewal of the facility and its installations to meet the highest safety requirements,
- re-packing and re-arrangement of the inventory with the aim of improving the utilisation of the storage and to provide sufficient storage capacity for future storing of waste,
- modernisation of the storage aimed at providing missing reprocessing waste capacities.

The refurbishment of the Central Interim Storage for Radioactive Waste in Brinje and the licensing will be performed in compliance with the 2002 Act.

The remediation of the Žirovski Vrh Uranium Mine has been in progress since the termination of operation in 1990. From the legal perspective the uranium mine, ore processing facilities and disposal sites for mining and ore processing waste were not nuclear facilities. The principal Act governing their operation was the Act on Mining. This situation has been changed by the 2002 Act. According to Article 76 of 2002 Act, the construction of mining or ore processing waste repositories is approved on basis of SNSA consent. The key document is the SAR.

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 in the Republic of Slovenia is the siting and construction of the facility for management and disposal of LILW. According to the current plans the facility should become operational by the year 2013. The decision on siting and construction of the facility for management and disposal of spent fuel has been deferred. At present, spent fuel management is part of operation of the Krško NPP and TRIGA Mark II research reactor at the IJS Reactor Centre.

The evaluation of all relevant site-related factors likely to affect the safety of such a facility during its operating lifetime and evaluation of 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 is assured through various legally binding documents further discussed in this text.

The Act on Environmental Protection forms the basis for the Environmental Impact Assessment (EIA). The Decree on Environmental Interventions that require an Environmental Impact Assessment determines that an EIA is mandatory for spent fuel management facilities and radioactive waste management facilities, and for the disposal of mining tailings and hydro-metallurgical tailings.

The particulars regarding environmental assessment and public participation/review of new sites in the licensing procedure for nuclear installation can be found in the Act on Environmental Protection (Off. Gaz., RS, No. 32/93, 1/96) and in its subsidiary regulation, the Decree on Environmental Interventions that require an EIA (Off. Gaz., RS, No. 66/96, 12/00, 83/02) and in the Guideline on Preparation of Environmental Impact Assessments (Off. Gaz., RS, No. 70/96).

Information on the safety of such a facility is available to members of the public through the licensing process (issued environmental protection approval). The Act on Environmental Protection, Article 7, stipulates that participation in the process of environmental protection shall involve: the State, local communities, citizens and other inhabitants either individually or joined in associations, non-governmental environmental protection organisations and their associations, and polluters.
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 an the effects of the operation of the facility on the population and the environment.

Article 67 (preliminary approval of radiation and nuclear safety) of the 2002 Act determines that for the siting of a nuclear or radiation facility, preliminary consent of the SNSA is a condition for the land use approval by the body that is responsible for the issuing of environmental protection approvals.

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 is intensely involved in the re-initiated site selection process for an LILW repository.

The following two main criteria were taken into consideration when deciding on the site selection approach:

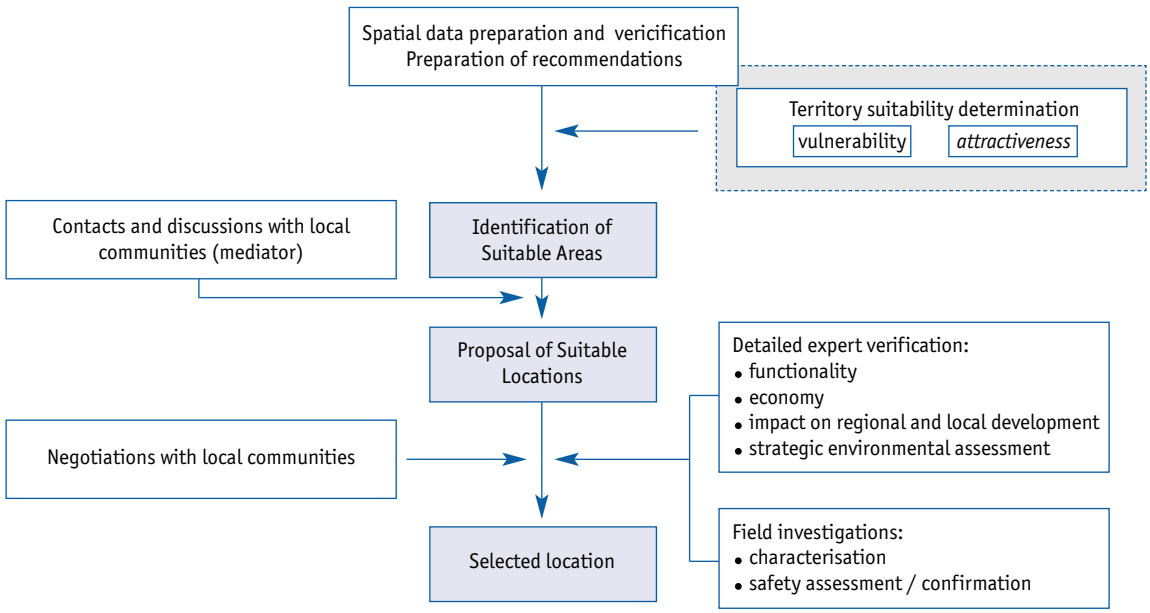
- the location together with the repository should provide a safe disposal solution which must be proven by the safety assessment,
- the site selection must be performed in agreement with the local community.

The ARAO decided on the mixed mode site selection process. According to the IAEA recommendations it is divided into four stages:

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

The mixed mode site selection process is presented schematically in Figure 2. It is in practice a combination of technical screening and proposed siting. It is flexible, transparent and it guarantees high public involvement.

Figure 2: Schematic presentation of mixed mode site selection process.



Special attention was devoted to the inclusion of the local community in the site selection process which was recognised as essential for the process. For communication with the local community(ies) an independent mediator was chosen to conduct the negotiations between the community and the investor. The mediator represents the link between the two parties and facilitates the communication and negotiations between the investor and the local community.

In 2001 an important phase of the area survey stage was completed. In the geological suitability assessment, the required natural predisposition of Slovene territory was assessed in order to locate geologically suitable formations. The assessment of natural conditions of the system was based on consideration of the main geological, hydro-geological and seismotectonic conditions. The results are compiled in a map which shows potential areas for underground and surface disposal of LILW in the Republic of Slovenia.

The final confirmation of site suitability will be gained through detailed field investigations during the site characterisation and site confirmation stages. The progress of this phase of the site selection process will strongly depend on the response of local communities where potentially suitable areas are identified, and on the successfulness and efficiency of the mediator in conducting the negotiations with local communities.

According to an amendment of the 2002 Act, the final site will be selected by 2008 and will obtain an operating license not later than 2013.

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 license for the construction of a nuclear facility is issued by the Ministry of the Environment, Spatial Planning and Energy on the basis of the Act on Construction (Off. Gaz., RS, No. 110/92); among other subconditions is the consent of the SNSA (2002 Act, Article 68). In issuing a consent the SNSA evaluates technologies incorporated in the design and construction of the spent fuel management or radioactive waste management facility from aspects related to nuclear and radiation safety and environmental protection.

According to Article 68 of the 2002 Act, the application for a construction license for a nuclear facility shall include project documentation, an SAR including relevant evaluations and the opinion of an appointed expert for radiation and nuclear safety. The contents of the project documentation and other conditions shall be prescribed by the Government. The key document governing the technical and safety measures for the construction and operation of the nuclear facility is the SAR. The content of the SAR for the disposal of uranium mining and ore processing tailings and mines is prescribed by the SNSA.

Chapter III of Regulation E-1 “Conditions for the Construction of a Nuclear Facility” sets requirements for analyses and input data for the preparation of the design documentation, equipment and facilities necessary for the physical protection of the nuclear facility and materials, the design of process, safety, protection, containment and other systems and radiation protection criteria.

Article 8: Assesment 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: Assesment 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 license shall contain project documentation, an SAR and the opinion of an appointed expert for radiation and nuclear safety.

The SAR must present the following information:

- the basic safety and design approaches,
- the location of the facility including an analysis of the location,
- the technical characteristics of the facility including a description of radioactive substances or nuclear materials and other radiation sources,
- protection against ionising radiation, including the evaluation of the protection of exposed workers against radiation,

- an assessment of the exposure of the population and the environment,
- the organisation of work, including programmes of technical training and the organisation of radiation protection,
- the radioactive waste and spent fuel management,
- physical protection of the facility,
- the plan of protection and rescuing of the facility in accordance with the regulations on the protection against natural and other accidents, or a special plan of protection and rescuing of the facility in the case of a facility for which pursuant to the regulations on the protection against natural and other accidents, it is not necessary to draw up a plan of protection and rescuing of a facility,
- in the case of the construction of a facility, programmes of trial operation,
- in the case of a nuclear facility, a safety analysis,
- operational conditions and limitations for safe operation during the period of trial operation and during regular operation,
- quality assurance,
- the anticipated discharge of radioactive substances into the environment,
- the programme of meteorological measurements and operational monitoring of radioactivity,
- in the case of a repository, the long-term supervision plan.

The SAR must be amended when changes of the situation referred to by the SAR arise during the construction or decommissioning of the facility or during the period of trial operation.

Assessment of Safety Before Operation

After construction work is completed, every nuclear facility must first undergo a period of trial operation. Prior to the start of the trial operation of a nuclear facility it is mandatory to obtain the consent of the SNSA. An application for the consent for the start of trial operation shall contain an SAR updated with the changes which occur during construction, an opinion from an authorised expert or authorised organisation for radiation and nuclear safety and other prescribed documentation.

Chapter IV of Regulation E-1 "Conditions for the Commissioning of a Nuclear Facility" sets detailed requirements for the trial operation of a 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 negative consent for the start of a trial operation.

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 license is issued by the SNSA only after the Ministry of Environment, Spatial Planning and Energy issues, in accordance with the Act on the Construction of Facilities, a license for use of a facility.

The application for the operating license shall contain an updated SAR, an opinion from an approved expert for radiation and nuclear safety and other prescribed documentation. The SAR must be updated with the changes that occur during trial operation.

A license shall be issued by the SNSA within ninety 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 34 of Regulation E-1 and Article 71 of the 2002 Act, the proposed operational limits and conditions (Technical Specifications as a part of the SAR) have to be submitted to the regulatory body as a part of the application for an operating license.

Article 35 of Regulation E-1 and Appendix 1 of Regulation E-2 define the contents of the Technical Specifications. Operational limits and conditions for the operation of a nuclear facility include:

- safety limits,
- limiting settings for safety systems,
- limiting conditions for normal operations,
- surveillance requirements,
- requirements for the operator of a nuclear facility related to reporting.

It is also a required that the operating staff should be familiar with the contents and objectives of the Technical Specifications.

Article 83 and Article 84 of the 2002 Act outline the procedure for approval of the changes to the SAR. The procedure defines three classes of changes depending on the safety relevance:

1. changes for which it shall be necessary to notify only the competent ministry,
2. changes for which the intention of their implementation must be reported to the ministry competent for the environment,
3. changes of significance for radiation or nuclear safety and for the implementation of which a license from the SNSA must be obtained.

The Minister of Environment, Spatial Planning and Energy shall define the methodology to determine the class of changes to the SAR and the method of notification and application for acknowledgement and approval of changes.

Operation, Maintenance, Monitoring, Inspection and Testing

In accordance with Article 34 of Regulation E-1, the documentation submitted for application for an operating license shall also contain a list of prepared operating procedures and rules together with the plant start-up report, the QA programme report, the Technical Specifications, the SAR, etc. In the process of reviewing the SAR for licensing purposes, operating procedures are used as additional referenced documentation (Article 16 of Regulation E-2).

Periodic safety review

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

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

In case that a report on a periodic safety review indicates the need to change the conditions of operation or the limitations from the SAR with the aim of improving radiation or nuclear safety, the operator must draw up a proposal for the respective changes.

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

Exceptional review of SAR

According to Article 86 of the 2002 Act, the operator must evaluate and verify the safety of the facility and ensure a review of the concordance of the SAR with the conclusions of the evaluation and verification of safety: directly after an emergency at the facility and after the completion of work relating to the mitigation of the consequences of an emergency.

Engineering and Technical Support

In-house capabilities have been developed to perform engineering and technical support at the existing nuclear facilities. The Krško NPP, IJS Reactor Centre, ARAO and Žirovski Vrh Uranium Mine are capable of processing minor design changes in-house. The capability of preparing purchase specification, reviewing bids and bidder selection, QA, Quality Control and engineering follow-up of the projects and review and/or acceptance testing of the product are available to a certain extent at the above facilities. Other engineering and technical support is assured through outsourcing at Slovenian research and engineering organisations or from 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 Article 8 of Regulation Z-3, the license holder shall collect radioactive wastes, classify them by categories, groups and compressibility, keep records accounting for the wastes, label the wastes, provide for processing, transport and storing of wastes, as well as perform activities in such a manner that the lowest possible quantities of radioactive wastes 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 2002 Act stipulates that an operator must submit exceptional reports to Ministry of Environment, Spatial Planning and Energy containing information on:

- equipment defects which could cause an emergency, emergencies and measures taken for the mitigation of the consequences of the defects or emergencies,
- errors made by workers while handling or operating a facility which could cause an emergency,
- deviations from operational limitations and conditions,
- all other events or operational circumstances which significantly affect the radiation or nuclear safety of the facility.

The regulations on the method and frequencies for keeping records, for reporting to the regulatory body by the authorised technical support organisations and by the organisations operating nuclear facilities (Off. Gaz. RS, No. 12/81), prescribe 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 case 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 license holder is required to report to the ministry which issued the operating license and to other competent agencies about the accidental condition 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 experiences gained during operational events) the operator of a radiation or nuclear facility must ensure that programmes of recording and analysing operational experience at nuclear facilities are implemented.

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

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 2002 Act. Decommissioning includes both decontamination and dismantling procedures, as well as the removal of radioactive waste and spent fuel from the facility.

The legal requirements for approval of the decommissioning of a nuclear facility are similar to those for licensing of siting and construction and are defined in Article 71 of the 2002 Act which prescribes that an investor intending to construct or decommission a radiation or nuclear facility must attach to an application for the approval and to the project documentation an SAR and the opinion of an authorised expert for radiation and nuclear safety (the content of documentation and content of the SAR are described hereinabove).

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

Two special acts have been approved by Slovenian Parliament for the decommissioning of nuclear facilities. The Act on the Fund for Financing the Decommissioning of the Krško NPP and Disposal of Radioactive Waste from the Krško NPP (Off. Gaz., RS, No. 75/94) and Act on Cessation of Exploitation of the Uranium Mine (Off. Gaz., RS, No. 36/92, 28/00). Through the legal provisions of these 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 SAR on the repository facilities relating to the time period following the closure thereof all the possible risks due to the spent fuel or radioactive waste shall be assessed, as well as 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 after the closure (Article 73 of the 2002 Act).

The plan of long-term supervision of the repository of radioactive waste and the repository of mining or hydro-metallurgical tailings must 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,
- the criteria on the basis of which decisions on the carrying out of maintenance work at the repository shall be made 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 that facility required by the regulatory body are preserved through provision of Article 80 (application for a permit) requiring that it shall be necessary to attach to the application for closure permit an SAR, an opinion from an approved 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 must ensure the maintenance and supervision of the disposal in line with the conditions laid down in the SAR.

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

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

In the strategy of long-term spent fuel management, a deferred final decision has been is adopted as a reasonable solution in the present situation. The final decision will be adopted before the end of the lifetime of the Krško NPP in 2023.

IJS Reactor Centre

At present no spent fuel from the TRIGA Mark II research reactor is planned for disposal. The IJS has the possibility for shipment and permanent disposal of spent fuel within the framework of the U.S. government programme. In case that the return of spent fuel from the IJS Reactor Centre to the U.S.A. does not occur, the spent fuel management will be solved 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.

Through new regulation, the Republic of Slovenia has substantially improved the area of transboundary movement of nuclear and radioactive substances, including waste. This issue is covered in the following articles of the 2002 Act:

Subparagraph 4.9 “Import, export and transit of nuclear and radioactive substances and radioactive waste”:

- Article 101 - approval for the import, export or transit of nuclear waste and spent fuel,
- Article 102 - issuing an approval,
- Article 103 - financial warranties and other conditions.

To summarise the main requirements:

It is necessary to obtain SNSA approval for the import, export or transit of radioactive waste and spent fuel. Issuing the approval, the SNSA evaluates the measures related to radiation and nuclear safety throughout duration of the transport of radioactive waste and spent fuel from the place of origin to the place of final destination.

The export (A), import (B) or transit (C) approvals are issued by SNSA if:

- (A) a consent to the consignment has been given by the competent body in the destination country of the radioactive waste or spent fuel, as well as by the competent bodies in the countries the consignment is supposed to travel across, and if all the conditions pertaining to the exporter of radioactive waste with regard to receiving the radioactive waste or spent fuel in case of the consignment being refused, have been fulfilled.
- (B) the importer proves that the radioactive waste or spent fuel is guaranteed to be handled in line with the regulations, and if the importer has the approval from the country of origin for returning the consignment to the place of origin in case the consignment is refused, and when the SNSA has obtained all the consents from the competent bodies in the country of origin and the countries across which the consignment is supposed to travel.
- (C) all the consents from the competent bodies in the country of origin and in the destination country as well as the countries through which the consignment is supposed to travel have been given and if the sender of radioactive waste or spent fuel has an approval from the country of origin for the return of the consignment to the place of origin in case the consignment is refused by the consignee.

When the SNSA has issued an approval for the export, import or transit of a consignment of radioactive waste or spent fuel, it must give the competent bodies in the countries of origin or the destination country a notification of this, and obtain the consent of the competent bodies in the countries the consignment is supposed to travel through.

An exporter of radioactive waste or spent fuel must report to the SNSA the delivery of a consignment at the latest within two weeks of the arrival of the consignment at the point of delivery.

An approval for the import, export or transit of radioactive waste or spent fuel and approvals for the import or export of nuclear and radioactive substances is issued for one or more consignments for a maximum of three years.

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.

The issue of an approval for the import, export or transit of radioactive waste or spent fuel and the issue of an approval for the import or export of nuclear and radioactive substances shall not affect any other responsibility regarding radiation or nuclear safety in line with this Act on the part of the holder, carrier, owner or consignee or any other person involved in the transport of a consignment.

The shipment of radioactive waste and spent fuel with the intention of disposing it at a location south of longitude 60° South is prohibited.

In addition to the insurance stipulated by customs regulations, an exporter, importer or the person carrying out the transit of radioactive waste, spent fuel, nuclear or radioactive substances must ensure for each consignment thereof financial warranties to a level which guarantees the payment of the expenses of:

- the refusal of the consignment by the competent body in the destination country,
- the handling ordered by the SNSA if it has concluded that there is no assurance for the imported radioactive waste or radioactive substances being handled in the manner pursuant to this Act.

The conditions for transport of radioactive waste are set in Act on Transport of Dangerous Goods.

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. Licensing is required for all activities dealing with radioactive sources: for purchase and use, for import or export, for transport or transit. The competent authorities (SNSA and Slovenian Radiation Protection Administration) keep records on radioactive sources in use.

In accordance with Article 130 (records) of the 2002 Act, a register of radiation practices, register of radiation sources and register of radiation and nuclear facilities 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 ministry competent for health. The content of the registers are described in Article 131 of the 2002 Act.

When the radioactive sources are no longer in use, they become radioactive waste. Since 1986, disused radioactive sources from small producers are stored in the Central Interim Storage for Radioactive Waste in Brinje. In 1999 the national public service for managing the waste from small producers was established by Governmental Decree (Off. Gaz., RS, No. 32/99). The ARAO, being assigned to perform this public service, became responsible for operating the storage and managing the waste from small producers including spent sealed sources.

Until 2000 the acceptance of waste for storing was free of charge. Since then according to the "polluter pays" principle, each waste producer pays for the acceptance of waste by the Central Interim Storage 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 the future disposal of the waste.

It is also the ARAO's responsibility to accept and provide proper further management of waste when its producer is not known (historical waste) or incapable of paying the fee for storing and managing the source. The expenses in such cases are covered from the state budget.

The Republic of Slovenia is not a significant producer of sealed sources. The IJS occasionally produces sources for domestic market, therefore the return of exported sources is only a hypothetical question.

Section K: Planned Activities to Improve Safety

Krško NPP

In the near future high density spent fuel racks with a total of 1694 spent fuel locations will be installed into the Spent Fuel Pool. In order to improve safety, the highest standards will be implemented in the reracking project as seen in Section B, Article 32. This project has already been started.

With the new racks, additional cooling capacities will be brought into operation. A third heat exchanger will remove decay heat after core unloading and keep the temperature of spent fuel pool water low as required and therefore contribute to improved safety.

IJS Reactor Centre

At present, the Republic of Slovenia has no facility for classifying and processing radioactive waste and spent sealed radioactive sources from small producers. The hot cell at IJS Reactor Centre could be used for the characterisation, treatment, and conditioning of radioactive waste. However, this complex needs complete refurbishing. The determination of a renovation plan for this hot cell, the purchase and installation of the relevant equipment (e.g. compactor, cutting devices, measurement of the contamination level in air and liquid effluents) constitute the main content of the PHARE project. The refurbishment will be implemented in the year 2003/2004.

The Central Interim Storage for Radioactive Waste in Brinje

Characterisation of radioactive waste

The objective of the project is to improve the safety of the existing Central Interim Storage for Radioactive Waste in Brinje. The storage facility is in the phase of refurbishment, aimed at improving the facility's ventilation and at performing some minor construction maintenance works. The first reconstruction works, aimed at improving the facility's hydroisolation, were started in 2001 and ended in 2002. Some of the inventory needs to be classified and repacked in order to achieve better utilisation of the storage. There are 60 - 70 m^3 of radioactive waste stored in the facility. A significant part of this waste is historical waste, in the sense that very few data exist concerning their chemical and radiochemical characteristics. The Slovenian authorities, through the ARAO, started to fund a programme aiming to categorise the waste packages. Some reconstruction jobs were started in 2001. The project features three main components:

- Logistical activities (transfer of waste packages from one zone to another),
- Preparatory works for waste characterisation,
- Radiation protection measures.

The project will be partially financed through the PHARE programme and will be implemented in the year 2003/2004.

Siting and Construction of the LILW Repository

One of the major task in the area of the radioactive waste management in the Republic of Slovenia is the siting and construction of the LILW repository. The Slovene Government made a decision to have an operational LILW repository by the year 2013. The organisation authorised to perform this task is the ARAO. In the past years of research and development in this area, the ARAO has collected comprehensive information on possible sites for the repository. The main obstacle to the faster development of this project is public acceptance. It is hoped that with a more active role of the Slovene Government and eventually the Slovene Parliament the goals will be achieved by the year 2013. The funds for the project are sufficient and will be available through the Fund for Decommissioning of the Krško NPP.

Žirovski Vrh Uranium Mine

The Government of the Republic of Slovenia approved the Programme for Permanent Closeout of Exploitation of Uranium Ore and Preventing the Consequences of Exploitation in April 1994. This programme discussed three basic possible solutions:

- relocation of a part of the mill tailings into the mine slopes and suitable revitalisation of the mill tailings site,
- removal of all of the mill tailings from the location, in connection with the planned closeout of the mine and the waste rock piles (tailings relocation in the mine rooms) as well as rehabilitation of the former tailing piles location,
- relocation of complete tailing and its disposal to another site (Jazbec mine waste pile), rehabilitation of the former tailing pile.

According to the results of the studies the first basic possible solution was included in the Programme on Permanent Closeout of Exploitation of Uranium Ore the Žirovski Vrh Uranium Mine and Preventing the Consequences of Exploitation. It was decided later that no mill tailings would be used to backfill the mine. The mill tailings will remain at the site with a valid location permit.

The basic objectives of the programme of permanent closeout of exploitation of the Žirovski Vrh Uranium Mine (Figure 3) and the prevention of consequences in the mine are as follows:

- managing of the performance of permanent closeout of the facilities: the mine and accompanying surface facilities, Jazbec mine waste pile (Figure 4) and Boršt mill tailings site (Figure 5), taking into consideration acts and regulations,
- protection of health of people, inhabitants of surrounding settlements and employees against consequences in the mine,
- permanent protection of the environment against the consequences of exploitation of the uranium mine,

- long-term assurance of supervision and protection of the environment and
- assurance of social security to all employees and maintenance of the economic vitality of the location in co-operation with the entities responsible for environmental development.

Figure 3: Žirovski Vrh Uranium Mine.

Figure 4: Jazbec Mine Waste Pile.

Figure 5: Boršt Mill Tailings Site.

Section L: Annexes

a) List of Spent Fuel Management Facilities

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

b) List of Radioactive Waste Management Facilities

The Central Interim Storage 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 10: The number, the average burn-up and total mass of heavy metal (uranium plus plutonium) 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	16335.0
2	40	24.3	15788.4
3	40	30.9	15613.2
4A	25	30.7	9767.4
4B	16	34.3	6258.0
5A	40	32.6	15666.8
5B	2	30.2	780.1
6A	4	38.7	1563.6
6B	1	36.7	390.6
6C	36	39.5	14036.0
7A	24	35.9	9463.0
7B	2	36.4	785.5
7C	20	33.7	7913.3
8A	15	44.7	5856.9
8B	6	43.5	2346.2
KWU	40	34.8	14980.1
9	12	41.7	4694.9
10A	8	40.5	3119.2
10B	12	43.3	4656.6
10C	8	47.3	3090.3
11	40	40.1	15646.9
11B	20	40.2	7832.8
12	24	44.4	9317.3
12B	6	43.8	2333.5
13	38	42.9	14818.3
14	28	42.3	10913.9
14B	4	44.5	1554.2
15	24	46.4	9290.9
15B	12	37.1	4702.6
16	12	45.5	4662.0
16B	4	40.7	1564.5

Spent Fuel Pools at the IJS Reactor Centre

There are no spent fuel elements.

e) Inventory of Radioactive Waste

Radioactive Waste Storage Sites at the Krško NPP

Table 11: Radioactive waste inventory in the Krško NPP SRSF on 31 December 2002.

Type of waste	No. of drum	Volume [m^3]	Netto mass [kg]	Total activity [Bq]	Specific activity [Bq/m^3]	LLRW*	ILRW*
A	33	6.9	8508	4.12E+08	6.00E+07	15	18
BR	33	6.6	5158	1.61E+09	2.44E+08	5	28
CW	438	91.1	50513	2.71E+10	2.97E+08	107	331
EB	251	52.2	50684	3.81E+10	7.30E+08	7	244
F	112	23.1	43047	5.19E+11	2.25E+10	1	111
O	603	125.4	64621	2.36E+10	1.88E+08	385	218
SC	617	197.4	181763	3.11E+10	1.58E+08	286	331
SR	689	143.3	197886	3.60E+12	2.51E+10	7	682
ST	1765	1525	1881537	1.13E+13	7.41E+09	245	1520
TI	43	37.4	23678	3.02E+12	8.08E+10	3	40
Total	**4584**	**2208.4**	**2507395**	**1.86E+13**	**8.42E+09**	**1061**	**3523**

** ILRW and LLRW mean Intermediate and Low Level Radioactive Waste according to the classification described in the Article 32, Paragraph 1(v).*

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

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

- EB (Evaporator Bottom) - the residue from evaporating waste water, containing boric acid, solidified in vermiculite cement packed in 208 l drum,
- F (Filters) - spent filters from the primary water purification and liquid waste processing system, packaged in standard 208 l steel drum with inner concrete biological shield,
- SR (Spent Resins) - spent ion exchange resins from purification systems, embedded in 208 l drum with vermiculite cement,
- CW (Compressible Waste) - waste arising mostly from using personal protective clothes, coveralls, shoe covers, plastics etc, packed into 208 l drum,
- O (Other) - miscellaneous waste arising during operation and maintenance activities like contaminated used parts, cables, hoses, valves, concrete, wood etc., packed in 208 l drum,

- SC (Supercompacted waste) radioactive waste of type CW supercompacted and packed in 320 l carbon steel overpack,
- ST (Supercompacted waste), radioactive waste of type CW and EB, supercompacted, SR inserted and packed in tube-type container,
- A (Ashes) - ashes, dust and other residues from incineration of combustible waste,
- PR (Primary Resins) spent ion exchange resins from primary water purification systems dried and packed in stainless steel drums with 3 cm thick walls as biological shield,
- BR (Blowdown Resins) - resins arising from purification system of secondary system, packed in stainless steel drum,
- TI package as PR, BR and DC additionally inserted in tube-type container (3 PR/BR/DC in 1 tube-type container).

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

- 208 l standard drum, designed in accordance to ANSI DOT-17H standard, appropriate for the following solid wastes: CW, O, F, SR and EB,
- 320 l overpack, used solely for packaging of compressed standard 208 l drums from the first supercompaction campaign,
- 200 l SS heavy drum with biological shield (150 l of usable volume), used for dried primary spent resins (PR) tested as Type A Package in accordance to IAEA SS No. 6 Regulation for the Safe Transport of Radioactive Material, 1985 Edition,
- 200 l SS heavy drum without biological shield, used for secondary spent resins (BR) 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 drums were filled with secondary spent resins (BR) 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 SS No 6,
- tube-type container, usable volume 864 l with a flanged lid used for in-drum drying system products and the other types of radioactive waste as a preferred final package for interim storage in a solid radwaste storage facility (SRSF), awaiting transport to off-site disposal area. Tested as IP 2 container.

Table 12: Radioactive waste inventory in the Krško NPP Decontamination Building - Decontamination area, on 31 December 2002.

Type of radioactive waste	Number of pieces	Volume [m^3]	Mass [kg]	Contamination [Bq/dm^2]	Packaging
Old cranes for de-mounting of screws of RX	3	1	300	400	N/A
Scrap iron		1.5	800	400	N/A

Table 13: Radioactive waste inventory in the NPP Krško Decontamination Building - Old steam generators area, on 31 December 2002.

Type of radioactive	Number of pieces	Volume [m^3]	Mass [kg]	Activity/Contamination/ Dose Rate	Packaging
Steam generators	2	600	6.46E+05	< 3.00E+12 Bq	N/A
Insulation of the steam generators	4	156	2.00E+04	100-1000 Bq/dm^2	Container
Insulation and platform	1	36	4.00E+03	100 Bq/dm^2	Container
Insulation valves, scrap iron, pipes etc.	1	36	4.00E+03	600 Bq/dm^2	Container
Regenerative exchanger	1	4	4.50E+03	3.5 mSv/h	Container
Bulk items	22	20	9.80E+03	300-4000 Bq/dm^2	N/A

Note: Activity of the steam generators was calculated on 31 December 2000.

Central Interim Storage for Radioactive Waste in Brinje

Table 14: Quantity of stored radioactive sources at the end of the year 2002.

Waste type	Stored in 2002	Main radionuclides	Estimated activity [GBq]
Drums	254	Co-60, Cs-137, Ra-226, Eu-152	30-47
Special bulky items	139	Co-60	100
Disused sealed sources	358	Co-60, Cs-137, Kr-85, Sr-90	2689
Historical waste *	34	no data	no data
Total	**785**	**-**	**app. 2900**

**Sources with poor or no data.*

Jazbec Mine Waste Pile at Žirovski Vrh Uranium Mine

Table 15: Mine waste and other debris at the Jazbec mine waste pile site, situation at the end of the year 2002.

Deposited	mine waste and red mud 1982-1990 (mine ore production), contaminated material, technological equipment 1991-2005 (decontamination, demolition)
Final arrangement	2005 (planned)
Surface, total	51,400 m^2 (17,000 m^2 slopes, 32,000 m^2 plateau, 2,400 m^2 roads)
Altitude	bottom 460 m, top 505 m (above sea level)
Volume of disposed waste	885,000 m^3 of mine waste, 34,000 m^3 of red mud, 2,100 m^3 of filter cake from mine water treatment station, 83,000 m^3 of contaminated soil and rubble from uranium ore processing facilities and crash station demolition, **total volume of storage material is 1,004,100 m^3**
Amount of disposed waste	1,415,000 t of mine waste (<70 g U_3O_8/t), 48,000 t of red mud, 3,800 t of filter cake from mine water treatment station, 134,000 t of contaminated soil and rubble from uranium ore processing facilities and crash station demolition, 1,200 t of technological equipment from uranium ore processing facilities and crash station, **total amount of storage material is 1,602,000 t**
Average specific activity of disposed material	10.2 kBq/kg mine waste, 60-70 kBq/kg red mud (Th-230 97 %), 34.4 kBq/kg filter cake, < 2 kBq/kg contaminated soil and ruins
Total activity of disposed material	**18.0 TBq**
Dose rate, average	0.4 µGy/h (mine waste), 0.1 µGy/h (ruins, soil)

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

Boršt Mill Tailings Site at the Žirovski Vrh Uranium Mine

Table 16: Boršt mill tailings site with basic data, situation at the end of the year 2002.

Deposited	mill tailings and mine waste 1984-1990
Final arrangement	2006 (planned)
Surface, total	41,000 m^2 (15,000 m^2 slopes, 26,000 m^2 plateau, 10,000 m^2 roads)
Altitude	bottom 535 m, top 570 m (above sea level)
Volume of storage waste	333,000 m^3 of mill tailings, 46,000 m^3 of mine waste
Amount of storage waste	600,000 t of mill tailings, 73,000 t of mine waste
Average specific activity of storage material	112.3 kBq/kg mill tailings, 10.2 kBq/kg mine waste
Total activity of storage material	**7.6 TBq**
Dose rate, average	4 µGy/h (new mill tailings), 2.5 µGy/h (temporary mill tailings)

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 Radiological Safety, Physical Protection, Safeguards, Quality Assurance

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

- On siting, construction, commissioning, start-up and exploitation of nuclear facilities (with appendix on QA), (Off. Gaz., SFRY, No. 52/88), **Regulation E-1**,
- On preparation and content of safety analysis reports and other documentation relevant for the assessment of safety of nuclear facilities (Off. Gaz., SFRY, No. 68/88), **Regulation E-2**,
- On education, experience, examination and certification of personnel conducting specific work at nuclear installations (Off. Gaz., SFRY, No. 86/87), **Regulation E-3**,
- On material balance areas and the method of keeping records of nuclear raw materials and nuclear materials as well as to the submission of data contained in such records (Off. Gaz., SFRY, No. 9/88), **Regulation E-4**,
- On places, methods and frequencies of monitoring of the contamination with radioactive materials (Off. Gaz., SFRY, No. 40/86), **Regulation Z-1**,
- On the method, extent, and frequencies of monitoring of radioactive contamination in the surroundings of nuclear facilities (Off. Gaz., SFRY, No. 51/86), **Regulation Z-2**,
- On the method of collecting, accounting, processing, storing, final disposal and release of radioactive waste into the environment (Off. Gaz., SFRY, 40/86), **Regulation Z-3**,
- On trading and utilisation of radioactive materials exceeding certain limits, X-ray machines and other apparatus producing ionising radiation as well as measures for the protection from radiation of such sources (Off. Gaz., SFRY, No. 40/86, 45/89), **Regulation Z-4**,
- On education, health condition and medical examination for the personnel working with ionising radiation sources (Off. Gaz., SFRY, No. 40/86), **Regulation Z-5**,
- On dose limits for members of the public and for occupational exposure, on measurements of occupational exposure and on monitoring of the working environment (Off. Gaz., SFRY, No. 31/89, 63/89), **Regulation Z-6**,
- On conditions for the application of sources of ionising radiation for medical purposes (Off. Gaz., SFRY, No. 40/86, 10/87), **Regulation Z-7**,
- On terms under which drinking water, foodstuffs and articles in mass consumption may be traded if they contain radioactive materials exceeding the prescribed limits of activity (Off. Gaz., SFRY, No. 23/86), **Regulation Z-8**,
- On maximum established limits for radioactive contamination of the environment and on decontamination (Off. Gaz., SFRY, No. 8/87, 27/90), **Regulation Z-9**,
- On the method of keeping records accounting for sources of ionising radiation and irradiation of the population and workers (Off. Gaz., SFRY, No. 40/86), **Regulation Z-10**,
- On the trade of fodder (Off . Gaz., SFRY, No. 6/88).

Based on the **1980 Act** the following Regulations are in force:

- On the method and frequencies for keeping records and for reporting to the regulatory body by the authorised Technical Support Organisations and by the organisations operating nuclear facilities (Off. Gaz., RS, No. 12/81),
- On education, experience and compulsory qualification and training of personnel working with ionising radiation sources or in radiation protection services and on the procedure of verifying their qualification (Off. Gaz., RS, No. 9/81).

Third Party Nuclear Liability

- Act on Third Party Liability for Nuclear Damage (Off. Gaz., SFRY, No. 22/78, 34/79),
- Act on Insurance of Liability for Nuclear Damage (Off. Gaz., RS, No. 12/80),
- Decree on Establishment of the Amount of Limited Operator's Liability for Nuclear Damage and on Establishment of the Amount of Insurance for Liability for Nuclear Damage (Off. Gaz., RS, No. 84/98).

Civil Protection and Disaster Relief

- Act on Protection against Natural and Other Disasters (Off. Gaz., RS, No. 64/94),
- Ordinance on Contents and Writing the Civil Protection and Disaster Relief Plans (Off. Gaz., RS, No. 3/2002).

Administrative

- Act on Administration (Off. Gaz., RS, No. 52/2002),
- Act on Inspection (Off. Gaz., RS, No. 56/2002),
- Act on Administrative Procedures (Off. Gaz., RS, 80/99, 70/00, 52/2002),
- Act on Standardisation (Off. Gaz., RS, No. 59/99).

Energy and Environmental

- Act on Energy (Off. Gaz., RS, No. 79/99),
- Act on the Postponement of Construction of Nuclear Power Plants until the Year 2000 (Off. Gaz., RS, No. 45/87) - the Act ceased to be valid at the end of 2000,
- Decree on the Transformation of the Krško NPP, p.o. into the Public Limited Company NPP Krško, d.o.o. (Off. Gaz., RS, No. 54/98, 57/98, 59/2002),
- Act on Environmental Protection (Off. Gaz., RS, No. 32/93 and 1/96),
- Decree on Environmental Interventions that Require Environmental Impact Assessments (Off. Gaz., RS, 66/96, No. 12/2000, 83/2002),
- Guideline on Preparation of Environmental Impact Assessments (Off. Gaz., RS, No. 70/96),

- Act on Minor Offences (Off. Gaz., RS, No. 87/97, 73/98, 31/2000, 24/2001),
- Act on Land Use Planning (Off. Gaz., RS, No. 110/2002),
- Act on Construction (Off. Gaz., RS, No.110/2002),
- Ordinance on the Method and Conditions of Discharging the Public Service for Radioactive Waste Management (Off. Gaz., RS, No. 32/99),
- Decree on Establishment of a Public Agency for Radioactive Waste Management (Off. Gaz., RS, No. 5/91, 45/96, 32/99, 38/01).

Transport, Export and Import

- Act on Transport of Dangerous Goods (Off. Gaz., RS, No. 79/99, 96/2002),
- Act on Export of Dual Use Goods (Off. Gaz., RS, No. 31/2000),
- Decision on Determination of Dual Use Goods (Off. Gaz., RS, No. 45/2000),
- Decree on Export and Import Regime of Specific Goods (Off. Gaz., RS, No. 111/2001, 20/2002, 64/2002, 116/2002).

General

- Maritime Code (Off. Gaz., RS, No. 26/2001, 21/2002),
- Penal Code (Off. Gaz., RS, No. 63/94, 70/94, 23/99, 110/2002).

Multilateral and Bilateral Treaties, Conventions, Agreements/Arrangements

Based on the Slovenian Constitution all announced and ratified international treaties also constitute an integral part of the Slovenian legislation and can be applied directly. The following international instruments to which 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,
- Convention on Early Notification of a Nuclear Accident,
- Convention on Assistance in the Case of a Nuclear Accident of Radiological Emergency,
- Convention on Nuclear Safety,
- Treaty Banning Nuclear Weapon Tests in the Atmosphere in Outer Space and Under Water,
- Treaty on the Non-proliferation of Nuclear Weapons,
- Treaty on the Prohibition of the Emplacement of Nuclear Weapons and other Weapons of Mass Destruction in the Sea-Bed and the Ocean Floor,

- European Agreement Concerning the International Carriage of Dangerous goods by Road (ADR),
- Convention on International Railway Carriage (COTIF) including Appendix B (RID),
- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management,
- Comprehensive Nuclear Test Ban Treaty,
- Convention on Third Party Liability in the Field of Nuclear Energy of 29 July 1960, as Amended by the Additional Protocol of 28 January 1964 and by the Protocol of 16 November 1982,
- Convention of 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.

Bilateral Agreements

- Agreement with the IAEA for the Application of Safeguards in Connection with the Treaty on the Non-proliferation of Nuclear Weapons,
- Protocol Additional to the Agreement between the Republic of Slovenia and the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-proliferation of Nuclear Weapons,
- Agreement between the U.S. NRC and the SNSA on Exchange of Technical Information and Co-operation in the Nuclear Safety Matters,
- Agreement between the Government of the Republic of Slovenia and the Government of Canada on Co-operation in the Peaceful Uses of Nuclear Energy with an Arrangement between SNSA and AECB,
- Agreement between the Governments of the Republic of Slovenia and the Republic of Hungary on Early Exchange of Information in the Event of a Radiological Emergency,
- Agreement between the Governments of the Republic of Slovenia and the Republic of Austria on Early Exchange of Information in the Event of a Radiological Emergency and on Questions of Mutual Interest in the Field of Nuclear Safety and Radiation Protection,
- Agreement between the Governments of the Republic of Slovenia and the Republic of Croatia on Early Exchange of Information in the Event of a Radiological Emergency,
- Agreement between the Government of the Republic of Slovenia and the Government of the Slovak Republic for the Exchange of Information in the Field of Nuclear Safety,
- Arrangement between the Nuclear Safety Administration of the Republic of Slovenia and the Council for Nuclear Safety of South Africa for the Exchange of Technical Information and Co-operation in the Regulation of Nuclear Safety,
- Arrangement between the Nuclear Safety Administration of the Republic of Slovenia and the Ministry of Science and Technology of the Republic of Korea for the Exchange of Information and Co-operation in the Field of Nuclear Safety,
- Arrangement between the Nuclear Safety Administration of the Republic of Slovenia and the Nuclear Installations Safety Directorate of the Republic of France for the Exchange of Technical Information and Co-operation in the Regulation of Nuclear Safety,
- Arrangement between the State Office for Nuclear Safety in the Czech Republic and the SNSA for the Exchange of Information,
- Agreement between the Government of the Republic of Slovenia and the Government of the Republic of Croatia on Settlement of Statutory and Other Legal Relations Related to Investments into NPP Krško, its Exploitation and Decommissioning.

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,
- *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,
- *WAMAP Mission to the Socialist Federal Republic of Yugoslavia*: travel report, IAEA, April 1991.

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.

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. The generator output was 664 MW_e prior to replacing the steam generator in the year 2000. At the present, the generator output is 707 MW, however, net output is 676 MW_e. The NPP operates in twelve-month fuel cycles. The fuel is replaced, the equipment is overhauled and all the necessary maintenance work is done once a year during the time of annual outage.

Figure 6: The Krško NPP.

The Krško NPP was designed and operates in accordance with U.S. safety regulations and TS. The Krško NPP systematically observes the regulations and industrial standards of the U.S.A. which is the supplying country.

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

- The U.S. 10 CFR 50 legislative regulations applied to the design of the Krško NPP,
- Regulatory guidelines issued by the U.S. regulatory authority,
- The U.S. 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 these regulations are derived from the contract with Westinghouse, from the licenses issued and from the agreement between the IAEA and SFRY (on the Krško NPP project).

Table 17: Some technical data on the Krško NPP.

Reactor Thermal Power	MW	1994
Gross Electrical Output	MW	707
Net Electrical Output	MW	676
Engineering Minimum	MW	32
Heat Consumption	kcal/kWh	2560
Thermal Efficiency Factor	%	33
Annual Production at Rated Power and 7000 Operational Hours	TWh	4.7
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	9021
Pressure	MPa	15.51
Total Volume	m^3	182
Temperature at Reactor *(Vessel) Inlet*	°C	288.1
Temperature at reactor *(Vessel) Outlet*	°C	326.7
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	8.192
Pellet Height	mm	13.460
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	52.15
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 principle 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, Reactor Coolant System and 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, Component Cooling Building, Fuel Handling Building, Diesel Generator Building and 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 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. Demineralized 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. 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.

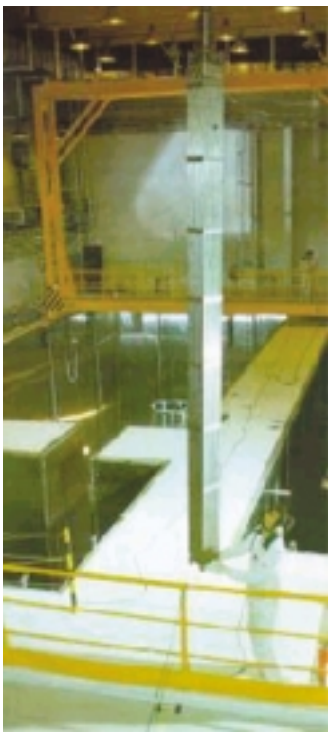
Long-term core reactivity changes and core poisoning with fission products are compensated by means of boric acid concentration change in the reactor coolant.

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 (Figure 7). 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 the U-235.

Each year one third of the fuel assemblies is 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.

Figures 7 and 8: The Krško NPP fuel transfer channel and Westinghouse PWR fuel element.



Performance Indicators of the Krško NPP

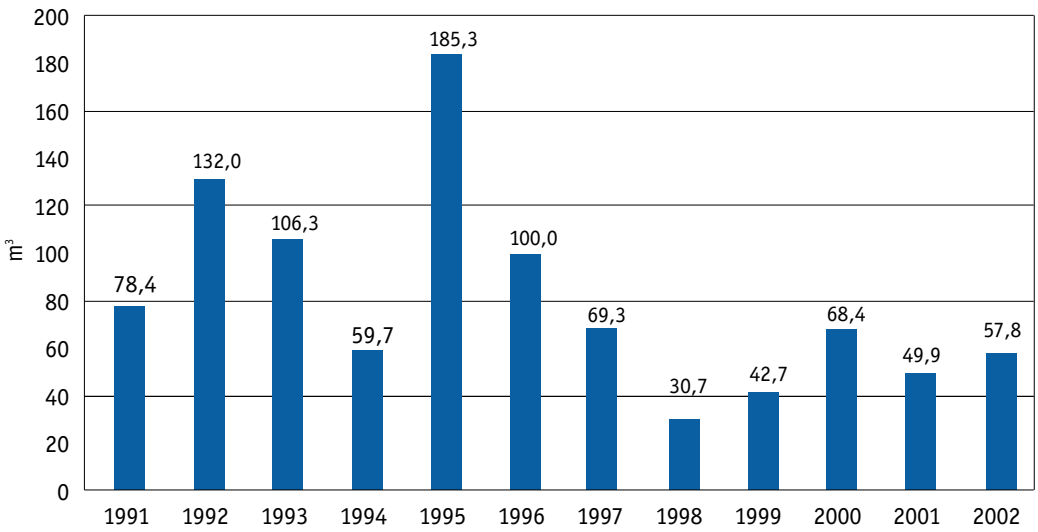
The World Association of Nuclear Operators (WANO) set ten performance indicators in the year 1991, which are regulatory monitored and analysed at the Krško NPP. The selected indicators cover the quality of operation from the aspect of safety and reliability, production of low and intermediate level waste, monitoring the quality of secondary chemistry, occupational safety and other aspects of operation.

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.

The INPO goal for this indicator for the year 2005 is not defined, while the Krško NPP goal for the year 2002 is ≤ 40 m^3. The total volume of low-level radioactive waste produced in 2002 was above goal by approximately 28% because of the increased priority of salvaging problems of solid waste produced during the replacement of steam generators. Nevertheless, 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. Systems for radioactive waste treatment were recently improved by introducing the In-drum Drying System into operation and reconstruction of the Waste and Boron Evaporator Packages.

Figure 9: Annual production of LILW at the Krško NPP.



General Description of the TRIGA Mark II Research Reactor

The TRIGA Mark II research reactor is the part of the IJS Reactor Centre. A view of the IJS Reactor Centre is shown in Figure 10.

Figure 10: View of the IJS Reactor Centre. The entrance to the Central Interim Storage for Radioactive Waste in Brinje is seen on the right side.

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

The core is placed at the bottom of the 6.25 m high open tank with 2 m diameter. 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. Elements are arranged in six concentric rings. Each location corresponds to a hole in the aluminum 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 aluminum 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.

Figures 11 and 12: The reactor body and the reactor tank of the TRIGA Mark II research reactor.

Fuel Elements

The TRIGA fuel element is a cylindrical rod with SS 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 18 and Table 19.

Table 18: Data on 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		Molybdenum	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 19: Standard TRIGA fuel element.

Total mass of uranium [g]	278
Mass of U-235 [g]	55.4
U in U-ZrH [wt.%]	11.9
Enrichment [wt.%]	19.9
H/Zr atom ratio	1.6