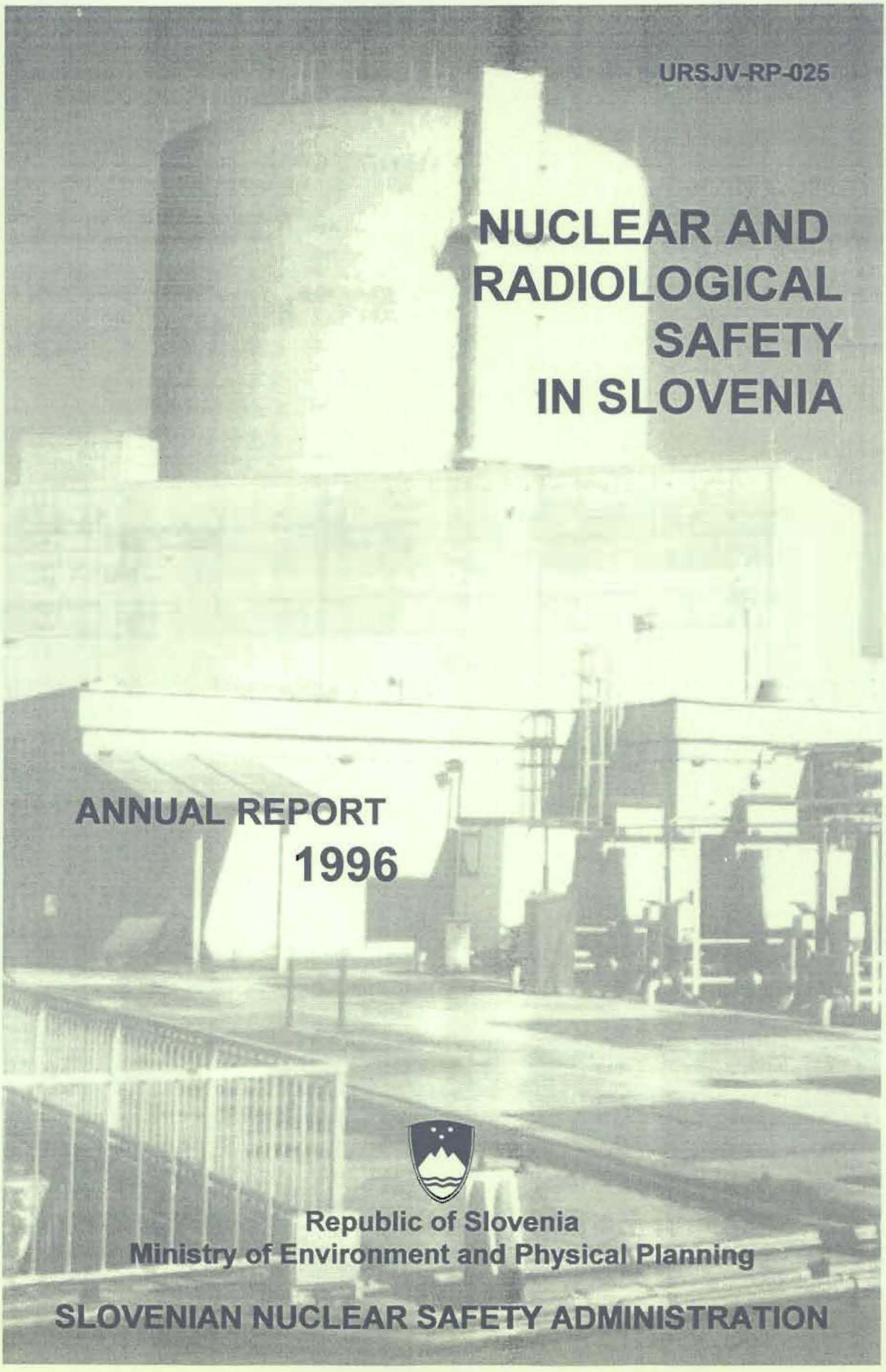

URSJV-RP-025

NUCLEAR AND RADIOLOGICAL SAFETY IN SLOVENIA

ANNUAL REPORT 1996

Republic of Slovenia
Ministry of Environment and Physical Planning

SLOVENIAN NUCLEAR SAFETY ADMINISTRATION

URSJV-RP-025

NUCLEAR AND RADIOLOGICAL SAFETY

IN SLOVENIA IN 1996

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CONTENTS

SUMMARY

The Slovenian Nuclear Safety Administration (SNSA), in cooperation with Health Inspectorate of the Republic of Slovenia, the Administration for Civil Protection and Disaster Relief and the Ministry of the Interior, has prepared a Report on Nuclear and Radiological Safety in the Republic of Slovenia for 1996. The report presents activities of the SNSA; operation of nuclear facilities; activities of the Agency for Radwaste Management; work of international missions; emergency plan; authorized organizations; monitoring of radioactivity; control of ionizing radiation and nuclear electricity generation.

In the field of legislation, the Administration continued with the preparation of the new Slovenian legislation (the new law on nuclear and radiological safety, and the new law on liability for nuclear damage). At the international level a great number of activities was carried out, which will certainly influence the further preparation of Slovenian legislation.

In the year 1996, the SNSA significantly expanded its international activities. The following agreements were ratified: the Agreement between the Republic of Slovenia and the Republic of Austria for the Early Exchange of Information in the Event of a Radiological Emergency and for the Questions Referring to the Field of Nuclear Safety and Radiation Protection and the Agreement between the Government of the Republic of Slovenia and the Government of the Republic of Hungary for the Early Exchange of Information in the Event of a Radiological Emergency. The Austrian Parliament has not ratified the Agreement yet.

In addition, the Agreement between the Government of the Republic of Slovenia and the Government of the Republic of Canada for Co-operation in the Peaceful Uses of Nuclear Energy was ratified and on its basis the Administrative Agreement between the SNSA and the Atomic Energy Control Board of Canada was ratified, as well.

On October 1, the National Assembly of the Republic of Slovenia ratified the Convention on Nuclear Safety, which represents a very important step towards the internationalization of the problem referring to nuclear safety.

The co-operation between the SNSA and the International Atomic Energy Agency was very intensive. The SNSA staff co-operated with the supreme body of the General Conference and Board of Governors. The SNSA staff and other Slovenian experts participated in a number of meetings and in the preparation of the IAEA's documents. The most intensive co-operation between the SNSA and the IAEA was in the field of technical assistance and co-operation programme and in the safeguards.

The IAEA organizes many expert courses and workshops. The SNSA and also other Slovenian experts form the field of nuclear and radiological safety took part in them.

The training of the SNSA personnel is a very important activity. Particular attention is given to training in rapidly developing information technology. The SNSA has obtained possibility to receive and to process the data needed in real time, and has modern computer programmes for safety assessments, which are available to all workers. Training and education in the field of nuclear and radiological safety are substantially supported by the SNSA.

Provision of open and authentic information forwarded to the public is a fundamental policy of the SNSA. The SNSA endeavours to provide substantial and reliable information to the interested institutions, mass media and to the citizens through press conferences, public statements, media discussions and active participation in domestic and international meetings, symposia and congresses.

In 1996, the inspectors of the SNSA carried out all together one hundred and twenty two inspections of the Krško NPP, one hundred and fourteen regular ones, two extraordinary ones and six joint inspections together with the authorized organizations. In addition, there were two inspections of the TRIGA Mark II

research reactor and two inspections of the interim storage of low and intermediate level of waste (LILW) of the Reactor Centre at Brinje, and four inspections of repacked radiological waste at an abandoned caserne at Zavratec taking place from September 2 to 15, 1996.

Based on earlier experience and facts, it is stated by inspectors that annual outage works, function and start-up tests on the systems and components of NPP Krško, meet the operational conditions and restrictions also after the 1996 annual outage, which was completed at the beginning of June 1997. This can be seen also from the reports of the authorized organizations and from the opinions, which the Krško NNP and the authorized organizations discussed during special inspections.

The inspectors also state that in the year 1996 the operation of the research reactor TRIGA Mark II at the Reactor Center Brinje, Jožef Stefan Institute, met the operational conditions and restrictions.

The radioactive waste in the temporary storage of LILW of the Krško NPP and in interim storage of radioactive waste of the Brinje Reactor Centre are stored in accordance with the legislation. The records are correctly and consistently kept.

In accordance with the Regulation on Export and Import of Specific Goods (Off. Gaz. RS, 75/95), import permits for the import of nuclear and radioactive materials are issued by the SNSA. Permits for the import of thirty-six fuel elements for NPP Krško and four hundred and twenty-eight permits for transportation of radioactive materials were issued, four of them for the export, two for a multiple import and the rest for a single import.

The safeguarding of nuclear materials pursuant to the NPT was carried out on the basis of the existing legislation and international agreements. No anomalies have been recorded.

In 1996, Slovenia produced 11.5 TWh net electric energy, that is approximately 2.5% less than a year ago. The Krško NPP produced 4.4 TWh electric energy and the production of net electric energy from the NPP decreased by approximately 1.6%, but it represents approximately 37.9% of all electric energy produced in Slovenia. NPP Krško covers 22% of need of electric energy in Slovenia. The availability factor of NPP Krško was approximately 80%. The number of forced shut-downs and unusual events in 1996 was below the annual average. Shut-downs were caused by faults and equipment damages as well as by the human errors as for example maintenance.

After some years of decreasing reliability of the nuclear fuel used in NPP Krško, in 1996, the situation improved. The indicators of fuel clodding damage show that on completion of the 12th fuel cycle, during the '96 outage, not all damaged fuel elements were removed. The increased number of fuel cladding damages was noticed also in the 13th fuel cycle causing increased contamination of primary coolant with uranium.

Due to longer fuel cycles, the spent fuel pool is being filled less intensively than foreseen (in the design of the NPP). According to analysis, the capacity of the spent fuel pool will be sufficient for the storage of used fuel elements until the year 2004. In 1996, the number of fuel elements increased by twenty-eight and, by the end of the year, the total number of used fuel elements stored in the spent fuel pool was 470.

In 1996, 476 drums were filled with low and intermediate level of radioactive waste. Since the beginning of the NPP operation, 12324 drums or 2588 m^3 of radioactive waste has been accumulated.

In 1996, the average individual effective annual dose of ionizing radiation of workers at NPP Krško was 2.26 mSv. This is approximately 4.5% of the regulatory limit for radiation workers and approximately 11.3% of the dose limit recommended in the new documents of the ICRP. The most exposed, according to the nature of the job, were the maintenance workers (90% of the total dose). The average collective effective annual dose per unit of electric energy produced was 4.00 human Sv/GWyear, which is the highest level in the last three years but lower than the world average which is 4.3 human Sv/GWyear.

The degradation of steam generators requires plugging of failed tubes. The plugging is approaching the limit of 18%, which is, according to safety analysis, the limit above which the reduction of power is necessary. The level of failed tubes is being kept under the limit with the technique of inserting sleeves. By making use of this technique, the plugging can be even decreased and in 1996, the average level of plugging after the annual outage was 13.15%. The degradation phenomenon is common to the power plants of this type and the insertion of the sleeves is a routine technological procedure. Due to a condition of the steam generators, the Krško NPP announced a notice for activities for their replacement and chose Consortium Siemens - Framatone as a supplier of the new equipment.

The probabilistic safety analysis brought up a lot of findings about the safety of NPP Krško. It showed that NPP Krško had similar safety concerns as other western nuclear power plants. Similar to other NPP, the relationships of risk factors or safeguards factors, which were slightly different from those in the early 70-ies, were identified. It goes for NPP Krško, as well that besides the so-called project incidents, there are also transitional phenomena, which are not relevant for safe operation of the NPP, but adequate and reliable response of the NPP also in these cases is a very important factor.

In order to improve the safety of the Krško NPP, about thirty modifications on equipment and systems were made in 1996.

The monitoring of the impact of NPP Krško on the environment was performed in accordance with the established programme. NPP Krško controls its liquid and gaseous radioactive waste released to the environment. In 1996, among the controlled releases of radioactivity from NPP Krško, the liquid waste represented over 46% while gaseous waste represented 11.5% of the annual marginal quantity. The main reasons were the damages of cladding of the fuel rods in the reactor during the second half of the 12th fuel cycle. The annual dose of radiation received in the surroundings of the Krško NPP was lower than 0.5% of the annual dose received by an individual from natural or other artificial sources of radiation.

The monitoring of non-radioactive NPP impacts on the quality of the Sava river and ground water has shown no negative effects of the operation of NPP Krško.

In 1996, the 250-kw thermal power research reactor TRIGA produced 400.9 MWh of heat. Out of 407 shut-downs there were seven unplanned ones, six because of a voltage cut-out and one because of a reactor coolant pump trip.

In spite of a permanent storage of additional radioactive waste in 1996, the total activity of the waste in the Reactor Centre at Brinje interim storage of radioactive waste decreased, because of the decay of short-lived radio nuclides.

In 1996, the surveillance of the radioactive releases and radioactivity in the surroundings of the Reactor Centre at Brinje was performed in accordance with the programme confirmed by the SNSA. The release of Ar-41 (due to the ventilation of the protective system of the reactor) and the release of the liquid effluents into the Sava river, mostly from the laboratory for radiochemistry, were the major releases in the environment. Conservative estimation of the annual effective dose to an individual living in the surroundings of the Reactor Centre for the year 1996 is 0.3 microSv due to inhalation and 1.0 microSv under the assumption that the individual drinks water directly from the Sava river, where waste water is discharged from the Centre.

The funds assigned from the national budget for financing the programme of closure of the uranium mine were not sufficient to carry out the majority of the activities in the 1996 programme. The preparation of all relevant documentation and analyses to carry out the programme was late, as well. Recommendations of the IAEA missions and the demands of the SNSA had not been fulfilled yet. Radioactive measurements at the Žirovski Vrh Mine and its surroundings show that the cessation of the uranium ore exploitation just partly reduced the impact of the mine on the environment even six years after its shut-down. No essential changes are expected until the whole uranium complex site is remediated. The emission of radio nuclides with liquid effluents and the annual discharge of radon from a pit and tailing at Boršt were

significantly reduced in 1996.

In 1996, the most important source of radioactive pollution in the surroundings of the Žirovski Vrh Mine still remained radon ^{222}Rn with its short-lived daughter products which contribute more than 4/5 additional exposure or, on the average, 0.26 mSv. All other carriers eg. inhalation of long-lived radionuclides, external radiation, etc. contribute less than 0.06 mSv per year. The effective dose for an adult is about one third of the regulatory dose limit 1 mSv per year, directed by Regulation on Dose Limits to Population and Radiation Workers (Off. Gaz. SFRY, No. 31/89, 63/89) and the latest international recommendations of the ICRP 60 (1991). In comparison to the total amount of radiation the Žirovski Vrh Mine represents around 6% of the average radiation exposure in this area (around 5.5 mSv per year).

The radioactive waste originating from the accident at the Institute of Oncology in 1961, with a spill of 10 mg of Ra-226, is temporarily stored in an abandoned caserne near the village Zavratec. A contract has been signed between the Jožef Stefan Institute and the Agency for Radwaste Management in May 1996 for the second phase of the reconstruction of the radioactive waste storage at Zavratec. In accordance with the contract, all the waste was measured and repacked in new drums, properly labeled and returned to the temporary storage.

The Agency for Radwaste Management used to be a public company and in 1996, turned into a public economic institution. In 1996 a great deal of their activities were dedicated to the preparation of technical bases to carry out the activities for obtaining a site for radioactive waste depository. In the field of communication with the public the Agency published a book about radioactive waste. The purpose of the book is to lessen the fear towards radioactive waste. At the end of the year the Agency presented itself also on the Internet.

At the invitation of the SNSA there were three missions of the IAEA in Slovenia: IPPAS (International Physical Protection Advisory Service) and ASSET (Assessment of Safety Significant Team). The purpose of the IPPAS mission is to examine the adjustment of domestic legislation and practice to the international conventions and recommendations referring to physical protection of nuclear facilities and materials specially to those issued by the IAEA. The ASSET mission reviewed and assessed the Self Assessment Report, in which the Krško NPP reports about operating events in last five years. In addition, the IAEA enabled a professional review and assessment of geological, tectonic and seismic researches and also probabilistic safety analyses of the Krško NPP according to external initial events. Both reviews were carried out by groups of international experts under the IAEA's programme Engineering Safety Review Service - ESRS. The reports and recensions of all missions will enable the improvement of safety studies and indirectly greater safety of NPP Krško.

The Administration for Civil Protection and Disaster Relief of the Republic of Slovenia has the authority to assess the situation in the event of a nuclear accident in Slovenia, to elaborate a national plan for protection and rescue and to take measures in the case of emergency at national level, offsite the NPP. The SNSA Emergency Plan regulates the alarming procedures and organizing of operative measures in the event of emergency. The purpose of the Emergency Plan is to regulate the activities of the SNSA in the event of emergency and supports the authorities, mostly Civil Protection Headquarter of the Republic of Slovenia. In 1996, the second revision of the Emergency Plan, which consists of thirty -one procedures, was carried out.

NPP Krško is responsible for the preparation of its own Emergency Plan in the event of emergency and for the technical and organizational execution of it, as well.

OECD/ Nuclear Energy Agency organised international exercise in order to test emergency preparedness called "INEX-2". The first exercise of the cycle "INEX-2", the Swiss National Exercise, was held on November 7, 1996 in the Swiss NPP Liebstadt. The exercise was held at both levels, national and international, the levels being communicatively separated. At the international level the purpose of the exercise was testing the responsiveness of the

neighbouring and other countries in the case of nuclear accident. Slovenia took part in this exercise, as well.

According to the Article 14 of the Act on Implementing Protection against Ionizing Radiation and Measures for the Safety of Nuclear Facilities (Off. Gaz. SRS, No. 28/80), Expert and Research Organizations were authorized by the former Republic Committee for Energy, Industry and Construction and later by the SNSA, with a decree to perform specific tasks in the field of nuclear and radiological safety in the Republic of Slovenia. Up to now there have been twelve organizations authorized from Slovenia, Croatia and Austria. Authorized Expert and Research Organizations represent a vital part of monitoring the operation, maintenance and modifications of the nuclear facilities.

The results of the general radioactivity measuring in the environment in the year 1996 show no significant changes compared to previous years. The concentration of long-lived fissiom radio nuclides was in some cases even at the pre-Chernobyal level and in 1996, an individual received additional 0.06 mSv above the background. The results of the study from 1996, about contamination of the soil with cesium-137 in Slovenia, are a good basis for evaluating the present dose of contamination in the environment. The annual dose of external radiation was measured in all bigger cities in Slovenia. In Ljubljana the measured external radiation was 844 microSv and the contribution of Chernobyl to this figure was 54 microSv for an adult.

The contribution of the Slovenian nuclear facilities to radioactivity in the environment is as follows: in the area of the Žirovski Vrh Mine the level of radiation is the highest (0.32 mSv), then follows the area of the Krško NPP (0.01 mSv) and the lowest level of radiation is in the area of the Podgorica Reactor Centre (0.001 mSv). Exposure of the local population to the radiation is lower than the annual marginal dose values.

The Health Inspectorate of the Republic of Slovenia is responsible for the control of the sources of ionizing radiation and for their safe use. In 1996, 3788 persons were registred during the regular dosimetric control; 1880 in the medical sector; 458 in the industry; 889 in the Krško NPP; 31 in the Žirovski Vrh Mine; the remaining 561 persons were monitored in other institutions (Ministry of the Interior, Customs, SNSA, etc.). 2845 workers (75%) received radiation doses lower than 1 mSv; 769 workers (20%) received doses between 1 and 4.99 mSv and 174 workers (5%) received doses higher than 5 mSv but no worker received dose higher than 30 mSv. The majority of workers were from the Krško NPP performing the annual outage works, surgeons at intervention radiology, workers at industrial radiography and employees of the Institute of Oncology. Some workers at the Institute of Oncology (thirteen persons) and at the University Medical Centre Ljubljana, the Department of Nuclear Medicine (four persons) were using also thermoluminiscence dosimeters on their hands. No one received more than the allowed annual dose of 50 mSv. X – ray examinations represent a major contribution to the dose of the population.
In 1996, the Health Inspectorate of the Republic of Slovenia issued fifty-nine licenses for the purchase and usage of sealed and open ionizing sources, and sixty-four licenses for the usage of x-ray devices or new x-ray tubes.

UNSCEAR is constantly collecting data about the exposure of the population to the radiation of all sources. In 1996, Slovenia made its contribution, as well. It proved that Slovenia, in practice, does not carry out such statistics which would enable filling the questionnaire completely. This goes especially for medical examinations.

The Ministry of the Interior pays special attention to the Krško NPP and tries to prevent any actions that could in any way endanger the security of these facilities and takes part in training and testing of the Krško NPP security guards.

In 1996, there were no anomalies found by the regulatory bodies of the Republic of Slovenia in operation of the nuclear facilities (transportation of nuclear and radioactive materials); in use of radiation at research and development; in medical care and industry that could endanger safety or have negative impact on the environment and in health of the population caused to personnel exposed to radiation.

ABBREVIATIONS

AMS	Automatic Meteorological Stations
ARAO	Agency for Radwaste Management
CVD	Cerenkov Viewing Device
EIS	Ecological Information System
ESRS	Engineering Safety Rewiew Service
HLW	High Level Radioactive Waste
IAEA	International Atomic Energy Agency
ICISA	International Commission for Independent Safety Analysis of the Krško NPP
ICRP	International Commission on Radialogical Protection
IJS	Jožef Stefan Institute
INES	International Nuclear Event Scale (IAEA)
INIS	International Nuclear Information System (IAEA)
IPPAS	International Physical Protection Advisory Service
LILW	Low and Intermediate Level Radioactive Waste
MOP	Ministry of Environment and Physical Planning
NNSR	Non Nuclear Safety Related
NPA	Nuclear Plant Analyzer
NPP	Nuclear Power Plant
NPT	Treaty on the Non-Proliferation of Nuclear Weapons
NSR	Nuclear Safety Related
NSRAO	Medium and Low Level Radioactive Waste
OECD	Organization for Economic Co-operation and Development
OSART	Operational Safety Review Team (IAEA)
PHARE	European Community Programmes for Economic Assistance to Central and Eastern European States
PP	Physical Protection
PSA	Probabilistic Safety Analyses
RAMG	Regulatory Assistance Management Group (of EU)
RAMS	Radiological Alarm Measuring System
ROS	Radiation Early Warning System
RS	Republic of Slovenia
RR	Research Reactor
RŻV	The Žirovski Vrh Mine
SEP	SNSA Emergency Plan
SFAT	Spent Fuel Attribute Device
SFR	Socialistic Federative Republic
SKJV	Nuclear Safety Expert Commission
SNSA	Slovenian Nuclear Safety Administration
TLD	Thermoluminescent Dosimetry
TSO	Technical Support Organizations
TTC	Tube Type Container
URSZR	Ministry of Defence, Administration for Rescue and Disaster Relief
US NRC	US Nuclear Regulatory Commission
WMS	Weather Monitoring System
ZVD	Institution for Occupational Safety of the Republic of Slovenia

INTRODUCTION

SLOVENIA

Slovenia is a central European country, located along the foothills of the eastern end of the Alps, at the very tip of the most northerly Mediterranean bay, open towards Hungary.

It is a natural hub of European routes from the North to the South and from the West to the East. Besides Hungary to the East it borders with Austria to the North, Italy to the West and Croatia to the South.

Basic data on Slovenia
Area: 20,256 km^2
Population (according to the Central Register of Inhabitants, 31.12.1995): 1,990,266
Number of households (1991): 640,195
Population density: 97.1 inhab./km^2
Constitutional order: Parliamentary Republic
Capital: Ljubljana
Ethnic composition (census 1991): Slovene 87.9%, Hungarian 0.43, Italian 0.16%. Others 11.6%
Official language: Slovene, in nationally mixed regions also Hungarian and Italian
Currency: Slovene tolar (1 SIT=100 stotin)
Annual population growth (1994): 0.6 per thousand
Birthrate (1995): 9.5 per thousand
Life expectancy (1994/1995): men 69.45, women 77.25
Urban population (1994): 50.1%
Major towns (1994): Ljubljana (276,119), Maribor (134,979), Celje (50,155), Kranj (51,602), Velenje (33,436), Koper (46,695), Novo mesto (51,159)
Gross domestic product (1995): 18.6 mrd USD
Per capita gross domestic product (1995): 9348 USD
Main agricultural products (1994): potato (400,909t), corn (324,442t), wheat (181,743t), hops (3,372t), apples (108.350t), wine (807,246hl), meat (163,500t), milk (577,000t)
Main industrial branches (by share of added value in industry, 1994): food industry 15.2%, textile industry 10.8%, metal industry 11.8%, electrotechnical and optics industry 10.0%, wood and furniture industry 9.9%, chemical industry 9.8%, machinery industry 7.3%, paper and graphics industry 7.5%
Exports (1995): 8316 mil. USD
Imports (1995): 9492 mil. USD
Number of tourists (1995): 1,577,000, overnight accommodation 5,883,000
Number of schools (1995/96): primary 825, secondary 152, universities 2
Number of primary and secondary school pupils and students (1995/96): primary 209,334; secondary 99,657; tertiary 43,249;
Number of books published (1994): 2906, of which 1981 original works
Number of magazines and newspapers (1994): 953, of which 6 daily and 41 weekly
Number of television subscribers (1994): 456,000
Number of telephone subscribers (1996): 663,497
Number of motor vehicles registered (1996): 871,097, of which 727,554 private cars

Ref: Statistical yearbook 1996

SLOVENIAN NUCLEAR LEGISLATION

Legislation in force

The Constitutional Law on Enforcement of the Basic Constitutional Charter on the Autonomy and Independence of the Republic of Slovenia, adopted on 23 June 1991, (Off.Gaz. RS1/91) provides that all the laws adopted by SFR of Yugoslavia remain in force in the Republic of Slovenia pending the adoption of appropriate legislation by the Slovenian Parliament.

Accordingly, legislation on nuclear energy (and safety) in Slovenia is made up of the following laws and regulation:

Liability

- Act on Third Party Liability for Nuclear Damage (Off.Gaz. SFRY, 22/78 and 34/79),
- Act on Insurance of Liability for Nuclear Damage (Off.Gaz. SRS, 18/80),
- Decree to Amend Decree on the Insurance Amount for Liability (Off.Gaz. RS, 22/91-1),
- Decree to Amend Decree on the Limitation for the Liability (Off.Gaz. RS, 22/91-1),

Nuclear and Radiological Safety

- Act on Radiation Protection and the Safe Use of Nuclear Energy (Off.Gaz. SFRY, 62/84),
- Act on Implementing Protection against Ionizing Radiation and Measures for the Safety of Nuclear Facilities (Off.Gaz. SRS, 28/80).

For the implementation of the act first mentioned in this section several regulations were adopted:

- On Siting, Construction and Operation of Nuclear Facilities (Off.Gaz. SFRY, 52/88),
- On Safety Analysis Reports (Off.Gaz. SFRY, 68/88),
- On Operator Licensing (Off.Gaz. SFRY, 86/87),
- On Safeguards (Off.Gaz. SFRY, 9/88),
- On Radioactivity Monitoring in whole country (Off.Gaz.SFRY, 40/86),
- On Radioactivity Monitoring in the Vicinity of Nuclear Facilities (Off.Gaz. SFRY, 51/86),
- On Radioactive Wastes (Off.Gaz. SFRY, 40/86),
- On Trade of Radioactive Materials or Sources (Off.Gaz. SFRY, 40/86, 45/89),
- On Conditions for Radiation Workers (Off.Gaz. SFRY, 40/86),
- On Dose Limits to Population and Radiation Workers (Off.Gaz. SFRY, 31/89, 63/89),
- On Use of Sources in Medicine (Off. Gaz. SFRY, 40/86, 10/87),
- On trade of Foodstuffs (Off. Gaz. SFRY, 23/86),
- On limits of Radioactivity of the Environmental and for Decontamination (Off.Gaz. SFRY, 8/87, 27/90),
- On Register of Sources and Doses to Population and Radiation Workers (Off.Gaz. SFRY, 40/86),
- On Trade of Fodder (Off.Gaz. SFRY, 6/88).

Radwaste

- Act on Decommissioning Fund (Off.Gaz.RS, 75/94),
- Act on Termination of Exploration of the Uranium Mine (Off.Gaz.RS, 36/92),
- Decree on Setting Up the Radwaste Agency (Off.Gaz. RS, 5/91),

Administrative

- Act on Organization and Competencies of Ministries (Off.Gaz. RS, 71/94),
- Act on Administration (Off.Gaz.RS,67/94),
- Act on Administrative Procedures (Off.Gaz.SFRY,47/86),

Energy

- Act on Energy Economy (Off.Gaz.RS,71/94),
- Act on Construction Postponement of Nuclear Power Plant until Year 2000 (Off.Gaz. SRS,45/87),

General

- Act on Environmental Protection (Off.Gaz.RS, 32/93,1/96),
- Act on Defense and Civil Protection (Off.Gaz.RS, 46/94),
- Criminal Act (Off.Gaz.RS,63/94),
- Act on Minor Offences (Off.Gaz.RS,66/93, last version),
- Act on Transport of Hazardous Substances (Off.Gaz.SFRJ, 27/90),

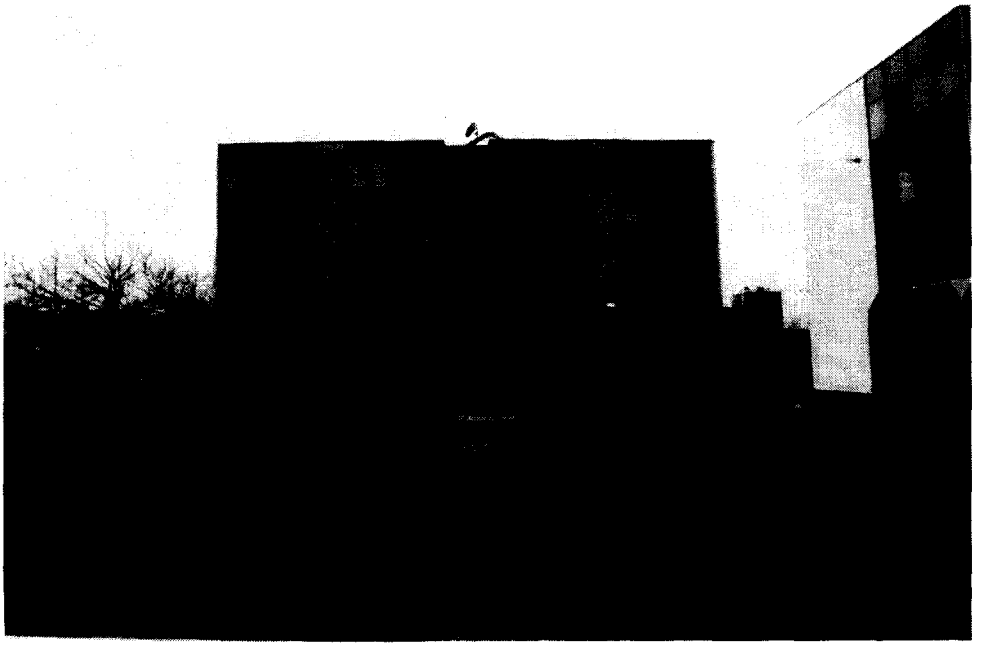
Furthermore, based on the Slovenian Constitution, all announced and ratified international treaties also constitute an integral part of our legislation and can be applied directly. The following are those international treaties which the former SFR Yugoslavia was party to and were later succeeded by Slovenia:

- Agreement between SFR of Yugoslavia and IAEA for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons (Off.Gaz.SFRJ, 67/73),
- Vienna Convention on Civil Liability for Nuclear Damage,
- 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 or Radiological Emergency,

- 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 and in the Subsoil.

Slovenia also became a party to Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention; in 1996 Slovenia ratified the Convention on Nuclear Safety.

SLOVENIAN NUCLEAR SAFETY ADMINISTRATION



LEGAL BASIS

The Slovenian Nuclear Safety Administration (SNSA) was established in 1987. Activities in this field before 1987 had been carried out by different committees and secretariats (now transformed into ministries). From 1987 to 1991 the SNSA was an independent, functionally autonomous body dealing with all matters concerning nuclear safety. It had two organizational divisions, the Safety Analysis and Legislative Division and the Division of Inspection. The SNSA was directly responsible to the Government and to the Parliament of the Republic of Slovenia. In 1991 the Parliament adopted a new Act on Organization and the Working Field of State Administration, by which the SNSA came under the Ministry of the Environment and Physical Planning and lost some of its independence and autonomy. It was also no longer responsible directly to the Government and to the Parliament but to the Ministry of the Environment and Physical Planning.

The Director of the SNSA represents the SNSA and conducts its activities. On the Governmental and the Parliamentary level the SNSA is represented by the minister. The director is responsible to the minister for the work carried out by the SNSA. He is appointed and discharged by the Government on the motion of the minister.

Senior civil servants are also appointed by the Government on the motion of the director while others are appointed by the director.

The scope of competences of the SNSA is defined in the Act on the Organization and Competences of Ministries. The SNSA deals with administrative, inspection and technical tasks, related to:

- nuclear and radiological safety in nuclear installations;
- handling, trade and transport of nuclear and radioactive materials;
- safeguards of nuclear material;
- physical protection of nuclear installations and materials;
- liability for nuclear damage;
- licensing of operators of nuclear installations;
- quality assurance;
- radiological monitoring;
- early notification in the case of a nuclear or a radiological accident;
- international cooperation in the field of the SNSA's work;
- other tasks defined in "nuclear" and other legislation.

Off-site emergency preparedness is under competance of the Ministry of Defense - Administration for Rescue and Disaster Relief. For the physical protection of nuclear material the responsibilities are divided between the SNSA and the Ministry of Internal Affairs.

In view of the markedly interdisciplinary nature of the SNSA fields of activities, cooperation with other administrative bodies in 1996 was very intensive, especially with the Ministry of Economic Affairs, the Ministry of Labor, Family and Social Affairs, the Ministry of Health, the Ministry of Foreign Affairs, the Ministry of Internal Affairs, the Ministry of Defense and the Ministry of Science and Technology. This cooperation was intense in issuing administrative decisions, in performing inspections and supervisions, in the preparation of answers to the questions and initiatives of the members of the Parliament, and in the preparation of materials for sessions of the Government and its working bodies, and in the work of interdisciplinary expert commissions.

ORGANIZATION

The SNSA is divided into five divisions:

- Nuclear Safety Inspectorate,
- Nuclear Safety Division,
- Radiation Safety Division,
- Nuclear and Radioactive Materials Division,
- Legal and International Cooperation Division.

According to the organizational chart there are 40 posts; at the end of 1996 more than half were occupied.

The main task of the Nuclear Safety Inspectorate is to perform the inspection in compliance with the regulations and to determine the scope and depth of the inspection. The inspections were organized as a single or as a planned series of inspections in order to determine whether the licensee's actions meet regulatory requirements. The inspections were (a) planned or (b) un-planned (e.g. inspections which cover reactor trips, abnormal events). Planned inspections were announced or unannounced.

The Nuclear Safety Division has to run two main functions: the subdivision for licensing is responsible for tasks which are directly related to licensing, such as: issuing decisions, performing integrated safety evaluations, cooperating with the inspectorate, participating in quality assurance, etc. The subdivision for analysis supports the licensing division in performing the analyses which are allocated to it and other, mostly continuous analyses; the priority is given to PSA application, severe accident analysis and emergency preparedness tool development. Since the manpower of the SNSA as well as this division are limited, many analyses are performed by the Technical Support Organizations (TSO).

The main technical and regulatory responsibilities of the Radiation Safety Division are in connection with radiation safety (of nuclear installations only), radiation monitoring, early notification in the case of a nuclear or radiation accident, etc. In some other areas, as for example exposure of workers (and population), strict division of responsibilities between different authorities has not been defined; therefore, the SNSA closely cooperates with the Ministry of Health (Health Inspectorate), which is responsible for all questions concerning radiation protection (apart from nuclear facilities).

Nuclear and Radioactive Materials Division has duties and responsibilities regarding the trade, transport and handling of nuclear and radioactive materials; it accounts for and controls nuclear materials (safeguards); controls physical protection of nuclear facilities and materials; etc. This division deals also with questions relating to the treatment (conditioning), intermediate storage and final disposal of radioactive waste. It also deals with siting of nuclear installations.

The Legal and International Cooperation Division has duties and responsibilities which are not necessarily always related to nuclear safety but which are in close connection with organizational matters, as for example: links with other ministries, the Government and the Parliament; the budget; the employment policy, etc. This division is also engaged in the licensing process and in the preparation of new legislation in the field of nuclear and radiological safety. Its responsibility is also the licensing of NPP's shift personnel. Regarding international cooperation the SNSA fosters and implements international relations for the purpose of gathering information on the state-of-the-art in nuclear technology worldwide and of exchanging experience. The SNSA was appointed as a liaison office for contacts with the IAEA (for technical questions); good relations have been established with the OECD/NEA and with the European Commission regarding the PHARE programme (RAMG assistance).

There are also expert Commissions attached to the SNSA:

- The Nuclear Safety Experts Commission, which has an advisory role to the SNSA for different quations related to nuclear and radiation safety.

- Expert Commission for Operators Exams, which gives exams and proposes the SNSA to grant or extend licenses to shift personnel.

LICENCING

In the licensing procedure, the SNSA has an overall control over nuclear safety in all stages. This task is, however, implemented in two main forms:

1. The form of a consent: the site licence and the construction licence are granted by other ministries; in these two stages the SNSA reviews and evaluates only questions related to nuclear safety; accordingly, and issues a consens to the licence.

2. The form of a licence: the licences for commissioning, operation and decommissioning are granted by the SNSA.

All safety-related modifications in a nuclear facility under construction or operation require a new procedure and licence of the SNSA. The operator may file a complaint against a licence issued by the SNSA; in this case the Ministry of the Environment and Physical Planning makes the decision based on an outside expert opinion. This decision can be challenged at the Supreme Court by the operator or by the attorney general.

The SNSA has a nuclear safety inspectorate which is responsible for inspecting nuclear facilities during construction and operation. In discharging their responsibilities, the SNSA inspectors may require to halt the operation of a nuclear facility if all prescribed conditions from the licence have not been met and if there is an eminent threat to nuclear safety. The SNSA can at any time suspend or revoke a licence.

INSPECTION AND ENFORCEMENT

The Nuclear safety Inspection Section within the SNSA consists of the section head and four inspectors for nuclear safety. The entry qualifications of the inspectors are university degree in engineering or science and eight years of relevant experience. Additionally, inspectors are trained in Slovenian legislature and administrative procedures, nuclear technology, nuclear and radiological safety, simulator training, and on-the-job training with a foreign inspector.

The main task of a nuclear safety inspector is to perform inspections in compliance with the regulations and to determine the scope and depth of the inspection. The legislation gives the inspectors full power to perform inspections. He can stop the operation of the plant in case safety is jeopardized. There are no resident inspectors having an office on-site, but continuous monitoring of the nuclear power plant performance was performed through planned inspections of two inspectors once or twice a week. On the same day the inspection report is written on the site and a master copy of this report is handed over to the plant staff.

The inspections were planned in accordance with the general annual programme of inspections, which was divided into four three-month periods. More detailed plans were prepared at the beginning of each three-month period and, after the end of each three-month period, the inspection reports were reviewed and the compliance of the objectives and the scope of the inspections with the general annual program was established. The new three-month plan was then amended according to the findings given in the review of the inspection reports.

In 1996, the inspectors of the SNSA carried out one hundred and fourteen regular inspections, two unplaned inspections and six joint inspections with other inspections of the Krško NPP. In addition, there were two inspections of the TRIGA Mark II research reactor and two inspections of the interim storage of low and intermediate level of waste (LILW) of the Reactor Centre at Brinje, and four inspections of radiological waste at an abandoned caserne at Zavratec taking place from September 2 to 15, 1996, during the repacking activity.
Inspection of the Krško NPP found no problems compromising safety of the plant operation. The licensee adhered to the regulations, license and internal procedures.

The radioactive waste in the temporary storage of LILW of the Krško NPP and in interim storage of radioactive waste of the Brinje Reactor Centre were determinated by the inspectors to be stored in accordance with the legislation. The records were correctly and consistently kept.

SAFEGUARDS

The safeguard of nuclear material in Slovenia is currently regulated by Agreement Between the SFR of Yugoslavia and the International Atomic Energy Agency for the Application of Safeguards in Connection With the Treaty on the Non-Proliferation of Nuclear Weapons (Safeguards Agreement). In order to establish appropriate legislation in this field, the Safeguards Agreement between the Republic of Slovenia and the International Atomic Energy Agency (Agency) was signed, September 29, 1995. It is expected that the agreement will be ratified by the Parliament in 1997.

In Slovenia there are two nuclear facilities subject to the safeguard inspections, the NPP Krško and the Research Reactor (RR) TRIGA at the Institute Jozef Stefan. In both facilities the nuclear material, subject to the safeguards, is contained in nuclear fuel elements: in NPP Krško in PWR fuel assemblies and at the Institute Jozef Stefan in TRIGA fuel rods. For this reason the safeguard procedures are relatively simple. The inspection consists of item counting and verification of the item identity. In the NPP Krško the verification of spent fuel assemblies with low burnup and long cooling time using the Cerenkov Viewing Device (CVD) became problematic. For this reason the Agency is planning to verify the older fuel elements with low burnup with the Spent Fuel Attribute Tester (SFAT). It is expected that some difficulties in implementing SFAT, which are related to the safety procedures in practice in NPP Krško, will be solved in 1997.

The cooperation between Slovenia and the Agency in the area of Safeguards is efficient. In 1997 seven regular inspections were carried out by the Agency´s inspectors in the NPP Krško. No anomalies were reported. In the RR TRIGA there were no Agency´s inspections in 1996. The physical inventory of nuclear material was carried out by ad-hoc commission of the Institute Josef Stefan. No anomalies were reported.

P H Y S I C A L **PROTECTION** (PP)

The nuclear facilities in Slovenija, the research reactor TRIGA Mark II and the power reactor Krško with corresponding PP systems were build according to the US standards. For this reason it is believed that PP measures in Slovenia meet the best international practice in this field. However, because of ageing of equipment it was recently decided to modernize the PP systems. In the RR TRIGA the PP system was modernized in 1991 and 1992. In the NPP Krško the modernization of PP equipment will be carried out gradually without change of the original design.

The inspections being carried out by the SNSA are identifying some minor deficiencies of the PP systems which were improved by operators in a due time. Regardless, it is the SNSA opinion that the quality of implemented PP measures in Slovenia is comparable with the measures implemented in similar facilities in the other countries. Similar conclusions were reported by the IPPAS mission which visited Slovenia in December 1996.

In Slovenia the regulatory power over PP is given to two organizations, to SNSA and to the Ministry of Interior. In order to define the division of responsibilities a mixed commission was established. So far the cooperation in this field is successful.
experts.

TRADE, TRANSPORT AND MANAGEMENT OF NUCLEAR AND RADIOACTIVE MATERIALS

Trade of nuclear and radioactive materials is regulated by the Act on Radiation and the Safe Use of Nuclear Energy (Off. Gaz. SFRY No. 62/1984), by the regulations based on the above mentioned Act. Recommendations of International Atomic Energy Agency - IAEA (Safety Standards Series No. 6, No. St -1, Regulations for the Safe Transport of Radioactive Material) are also taken into account.

Trade in nuclear materials may be carried out by enterprises that fulfil legally prescribed requirements and are given a special licence by the competent authority. These requirements are: organization and continuous control of the compliance with the prescribed conditions and application of measures; nuclear materials in trade can only be handled by adults who are professionally qualified for that purpose; providing special repositories and containers for protection of the environment; nuclear materials may only be sold or assigned to firms or other legal persons, being licensed for that.

At the end of 1995 Regulation on Export and Import of Specific Goods was issued (Off. Gaz. RS No. 75/95). According to the above-mentioned regulation which entered into force on January 1, 1996, 428 licences were issued in 1996, 4 of them for the export of specific goods (to SANOLABOR which exported close source Ir-192), two for a multiple import and 422 for a single import. At the table 2.1 you can see the Status of import . Import licence was also issued to NPP Krsko for importing thirty-six fresh fuels assemblies (package 9239/AF types A) and thirty-three control rod assemblies. Slovenian Nuclear Safety Administration also prescribed special security measures and carried out inspections of The Trade activities.

The transport of radioactive material in Slovenia was performed for the following end users: NPP Krsko, research reactor TRIGA, hospitals, research organisations, industry, and the Zirovski vrh Uranium Mine.

Import of radioactive and other specific materials in 1996

	IMPORTER				
LICENSEE	GENOS	KRKA	KARANTA	OTHERS	TOTAL
No. of Licenses	169	107	68	84	428

Users of isotopes: Status of the Import of radinuclides (MBq) by the end users

End user	J-125	J-131	Tc-99m	P-32	S-35	H-3	Cr-51	Ga-67	Tl-201	Xe-133	Co-57/58	Ba-133	In-111	Y-90	Sr-89	Rb-86	Ir-192	C-14	Pb-210	Ra-226	Cs-137	Co-60	Cd-109	Mn-54	Fe-55
H. Sl. Grad.	81,67	16280	50000																						
Hosp. Facul.						18,5												218							
Hosp. Celje	107,71		519835																						
Hosp. Derganc			127500																						
Hosp. Drzaja																		0,15							
Hosp. Izola	15,34																								
Hosp. Maribor	88,9	51282	770000				5809		55870		0,05		122		148										
Hosp. Šemp			51060																						
Cinkarna Celje																					740				
Fac. Veterino	2,03																								
Industry																	16930000								
IJS	74				111	9,25					3700	14										0,1	1,8	0,03	3700
IKKKB	52,28					3,05																			
Inst. anato					37																				
Inst. biok.	111			148	481	18,5																			
Inst. farma						18,5																			
Inst. mikro				9,25	37	259	74																		
Inst. pato				74																					
Kefo				37	74																				
Lek	2738																								
Med. Fak.	20,35																								
Metal Ravne																						370			
nukl. med.	517,71	359529	676160	888			1850			192400	0,72		4375	7770	37										
Onko. inst		465756	634000			185,59		17060			14,8	7,4			592	111	11000				7280				
Sava Kranj																									
MO						113220000																			
ZVD Lj.		0,04													0,02				0,02	0,2					
ZZTK Lj.						111	74																		
Total	3809	892847,04	2828555	1156,25	740	113220623,38	7807	17060	55870	192400	3715,57	2140	4497	7770	777,02	111	16941000	218,15	0,02	0,2	8020	370,1	1,8	0,03	3700

NEW LEGISLATION

Nuclear and radiological safety and the measures for their assurance are defined in the Act on Radiation Protection and the Safe Use of Nuclear Energy (Off. Gaz. SFRY, 62/84) and in the Act on Implementing Protection against Ionizing Radiation and Measures for the Safety of Nuclear Facilities (Off. Gaz. SRS, 28/80). The liability for nuclear damage and its insurance is defined in the Act on Third Party Liability for Nuclear Damage (Off. Gaz. SFRY, 22/78 and 34/79), the Act on Insurance of Liability for Nuclear Damage (Off. Gaz. SRS, 18/80) and in the decrees on defining the liability and its insurance. The preparation of a new Slovenian legislation on nuclear energy will be influenced by:

- the adoption of the revised Vienna Convention (Protocol to Amend the Vienna Convention on Civil liability for Nuclear damage;

- the adoption of Convention on Supplementary Funding;

- the adoption of the Convention on Safety of Spent Fuel Management and on safety of radioactive Waste Management.

Furthermore in 1996 the Parliament ratified the Convention on Nuclear Safety ; the SNSA was engaged in preparation of several year programme with the PHARE - RAMG activities.

INTERNATIONAL AGREEMENTS

Bilateral Agreements

The Agreement between the Republic of Slovenia and the Republic of Austria on Early Exchange of Information in the Event of a Radiological Emergency and on Questions Related to Common Concern in the Field of Nuclear Safety and Radiation Protection.

The Parlament ratified the Agreement on October 1, 1996 and it was announced in the Official Gazette of the Republic of Slovenia, International Agreements, No. 15/96.
The Agreement represents a basis for a qualitative relationship between the countries in the field of early notification and exchange of information in the event of a radiological emergency.
The major items of the Agreement are: harmonized activities of both countries in the field of notification and exchange of information in the event of a radiological emergency; establishment of contact points, available twenty-four hours a day and establishment of a radiological warning system.
Until the end of the year 1996, the Republic of Austria has not ratified the Agreement yet.

Agreement between the Government of the Republic of Slovenia and the Government of the Republic of Hungary for the Early Exchange of Information in the Event of a Radiological Emergency.

The Agreement was ratified by the Parlament on January 26, 1996 and it was notified in the Official Gazette of the Republic of Slovenia, International Agreements, No. 2/96.
The Agreement with Hungary establishes two contact points, which are available twenty-four hours a day. It also enables that the systems for the exchange of information are examined yearly. Beside the information in the event of a radiological emergency, the parties will exchange also all relevant data in the field of nuclear and radiological safety, as well as the results of measurements of the radioactivity in the environment.

Agreement between the Government of the Republic of Slovenia and the Government of Canada for Co-operation in the Peaceful Uses of Nuclear Energy.

The Agreement was ratified on January 30, 1996 by the National Assembly and it was notified in the Official Gazette of the Republic of Slovenia, International Agreements, No. 3/96.
Fundamental items of the Agreement are:

- peaceful uses of nuclear energy and nuclear and radiological safety
- exchange of information
- implementation of research studies and industrial co-operation
- technical training and offering technical assistance
- supply of nuclear materials and equipment.

The main stress of the Agreement is laid to the conditions of physical protection, to the system of nuclear material monitoring and to the prohibition of use of nuclear materials, equipment and technology, supplied under this Agreement, in order to elaborate all kinds of nuclear explosive devices.

On the basis of the above mentioned Agreement the **Administrative Arrangement between the SNSA and Atomic Energy Control Board of Canada** has been concluded for the execution of the above mentioned agreement.

Agreement between the Republic of Slovenia and the International Atomic Energy Agency on Safeguards in Connection with Treaty on the Non-proliferation of Nuclear Weapons.
(See Safeguards)

Multilateral Agreements

In 1996, in the framework of the IAEA there was a continuity of preparations to accept some important conventions in the field of nuclear safety.

Representatives of the SNSA took part in the work of the Standing Committee on liability for Nuclear Damage (to prepare draft Protocol to amend Vienna Convention on Civil liability for Nuclear Damage and to prepared draft Convention on Supplementary Funding) and in the work of Group of Joint Convention on the Safety of Spent Fuel Management and on the safety of Radioactive Waste Management).

The SNSA has also closely followed the progress on the preparation of the draft of the Model Protocol additional to the Agreements between the Member States and the IAEA for the Application of Safeguards.

INTERNATIONAL CO-OPERATION

Co-operation with the International Atomic Energy Agency

The IAEA is an independant international orgnization, founded in 1957 on the basis of the conclusion of the UN General Assembly. According to the IAEA's Statute its functions are as follows: to promote and to intensify the contribution of nuclear energy to peace, health and progress in the world. Forthermore the Agency wants to promote research and development in the field of peaceful use of nuclear energy and the exchange of scientific and technical information; to establish and maintain the monitoring system of nuclear materials, and to prepare and accept health and safety standards related to the use of nuclear energy.

In 1996 the most extensive co-operation between Slovenia and IAEA was in the field of technical assistance and co-operation .

In 1996 the SNSA staff members successfully participated in more than seventeen seminars, courses and workshops.
Other Slovenian experts from institutions such as: the Jozef Stefan Institute, the Krsko Nuclear Power Plant, the University Medical Centre Ljubljana, the Zirovski Vrh Uranium Mine, the Agency for Radwaste Management, the Institute of Occupational Safety, etc. also took part in training courses, workshops, seminars and meetings organized by the IAEA.

Some SNSA employees and other Slovenian experts also participated in the following four meetings, jointly organized by the IAEA and the Jozef Stefan Institute and the Department for Nuclear Medicine of the University Medical Centre Ljubljana. Meetings and courses took place in Slovenia:

- Training Course on Source Term Determination and Emergency Planning, Ljubljana, September 30 - October 4, 1996,
- Advisory group Meeting on Elemental Analysis of Extremely Small Samples, Ljubljana, July 5 - 7, 1996,
- First Research Co-ordination Meeting of the CRP on Validation of PC/Gamma Camera Interface and Software for Data Processing of Clinical Studies, Ljubljana, May 13 - 17, 1996,
- International Training Course on Nuclear Electronics, Ljubljana, June 24 - September 20, 1996.

The increased number of jointly organized international meetings bears out the close co-operation between the IAEA and the SNSA.

Fellowships and Scientific Visits

Another area of the SNSA-IAEA collaboration within the sphere of technical assistance and co-operation covers fellowships and scientific visits. In 1995, we received fourteen applications for training of foreign experts in Slovenia. Four applications out of fourteen were implemented in 1996. The following countries sent their applications for the following fields of training:

- Iraq, for a three-month fellowship in the field of nuclear medicine,
- Macedonia, for a three-week scientific visit in the field of nuclear medicine,
- Tunisia, for a one-week scientific visit in the field of nuclear instrumentation, electronics and reactor control,
- Brazil, for a three-month fellowship in the field of nutritional and health related environmental studies,
- Bangladesh, for a four-month fellowship in the field of nuclear instrumentation, electronics and reactor control,
- Pakistan, for a one-month scientific visit in the field of analytical nuclear physics.

There were eight fellowships completed, their applications were received already in 1995 and 1994. The countries sending the applications and the areas of training are:

- Marroco, for a four-month fellowship in the field of analytical nuclear

physics,

- Vietnam, for a three-month fellowship in the field of chemical physics,
- Iran, for a four-month fellowship in the field of radiation protection,
- Pakistan, for a three-month fellowship in the field of environmental protection,
- Ghana, for a two-week scientific visit in the field of radiation protection,
- Iran, for a one-month fellowship in the field of analysis of nuclear materials,
- Sudan, for a four-month fellowship in the field of nuclear instrumentation, electronics and reactor control,
- Pakistan, for a one-month fellowship in the field of nuclear instrumentation, electronics and reactor control.

The applications were addressed to the Jozef Stefan Institute, the Faculty of Mathematics and Physics and to the University Medical Centre Ljubljana, Department for Nuclear Medicine.

In 1996, within the scope of this programme, Slovenia sent three applications to the IAEA , two for a fellowship and one for a scientific visit. The IAEA approved all three applications; the fellowships were realized the same year together with another fellowship - its application was approved already in 1995 - but the scientific visit was not realized at that time. One of the applications was from the University Medical Centre Ljubljana, one from the Institute of Occupational Safety and the rest from the Jozef Stefan Institute. Trainings through fellowships and scientific visits are usually parts of technical co-operation projects and that was also the case with the Slovenian applications.

Research Contracts

Within the scope of the programme of assistance and technical co-operation, the SNSA and the IAEA cover also the field of research contracts and financing of major national projects.

In 1996, sixteen research contract proposals were sent to the IAEA, typical value of each was approximately US $ 5.000, seven of them being renewals and nine new ones. The majority of research contracts renewals were prepared by the Jozef Stefan Institute, the University Medical Centre Ljubljana - Department for Nuclear Medicine and the Institute for Biomedical Informatics. It is also worth mentioning that in 1996, two research projects, carried out by the Jozef Stefan Institute and the University Medical Centre Ljubljana, Department for Nuclear Medicine, were brought to an end.

Projects of Technical Assistance

Technical assistance projects are the most extensive and the most demanding form of co-operation between the Republic of Slovenia and the IAEA. This is due to a large amount of resources, engagement of experts and due to the fact that projects of this type last several years. In 1996 (for the 1997-98 budgetary year) Slovenia applied for three projects prepared by the experts from the SNSA, the Zirovski Vrh Uranium Mine and the Jozef Stefan Institute:

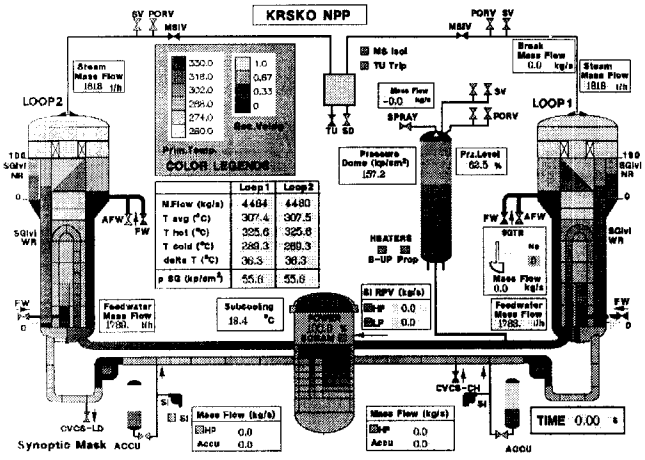
- Licensing the NPP Krško S/G Replacement
- Radiation Safety after Uranium Mine Remediation
- Nuclear Safety Enhancement through Staff Training and Expert Missions

In 1996 the first two projects were approved and beside them there were another three projects continuing from the past: the University Medical Centre project Radiological Accident Preparadness Management, the IJS project Beam Transport System for the Van de Graff Accelerator, approved for the first time in 1995 and the SNSA project Early Worning system for Radiological Emergencies.

EXPERTISE AND RESEARCH

During 1996, the SNSA financed the following studies:

- Stress mechanical analysis of the main reactor coolant pump casing (Part II) - Report of Laboratory for modeling and numerical simulation in mechanics, University of Ljubljana
- Inicialization, Melt-through and Nodilization Study of NPP Krško Model for the Use in Programming Package MELCOR - Report of the Faculty of Engineering, Maribor.
- Nuclear Plant Analyzer for Krško NPP - TIERSDI/4DG/1854/01
- Measurement of neutrons in the vicinity NPP Krško - Report of the Jožef Stefan Institute Ljubljana.
- Expert Review of the PSA of NPP Krško in Shutdown Mode - report of ENCONET, Consulting Ges.m.b.H.
- Measurement of radioactivity in Thermal baths. Report of the Institute for Occupational Safety from Ljubljana
- Data base of neotectonics and seismic research at the Krško area - Report of the Institute for geology, geotechnics and geophysics., Ljubljana.
- Neotectonic research of the Krško NPP site - Second phase report, Institute for geology, geotechnics and geophysics., Ljubljana.
- Map of Chernobil contamination in Slovenia - Report of the Jožef Stefan Institute Ljubljana.



One of the NPA Analyser Mask for Krško NPP

STAFFING

On January 1, 1996, in the Slovenian Nuclear Safety Administration, there were twenty-six persons employed. During the year six new workers employed.

On December 31, 1996, in the Administration, there were thirty staff members, the increase is due to four new trainees.

The degree of proficiency of the thirty persons employed is as follows: twelve experts with Master of Science degree, fifteen employees with a engineering degree, one person with a college degree and two staff with a secondary education.

The structure of the staff engaged on the last day of the year was: the director, twenty-one senior civil servants, three civil servants, two expert officers, three trainees – civil servants and one trainee for an expert officer.

According to the capabilities and budgetary funds the SNSA tried to employ more experts. A favourable trend of employment has been observed in the past few years, but a lot of resources is needed to train experts and to enable them to participate in training courses, workshops and seminars.

In spite of a favourable trend the fact of the insufficient number of occupied working places remains; international recommendations are much more demanding (eighty to one hundred experts). In 1993, the EU mission RAMG recommended the employment of forty experts.

Total Number of SNSA Staff Members (Status December)

Year	1988	1989	1990	1991	1992	1993	1994	1995	1996
Staff members	5	7	9	11	16	18	20	26	30

BUDGET AND ITS REALIZATION

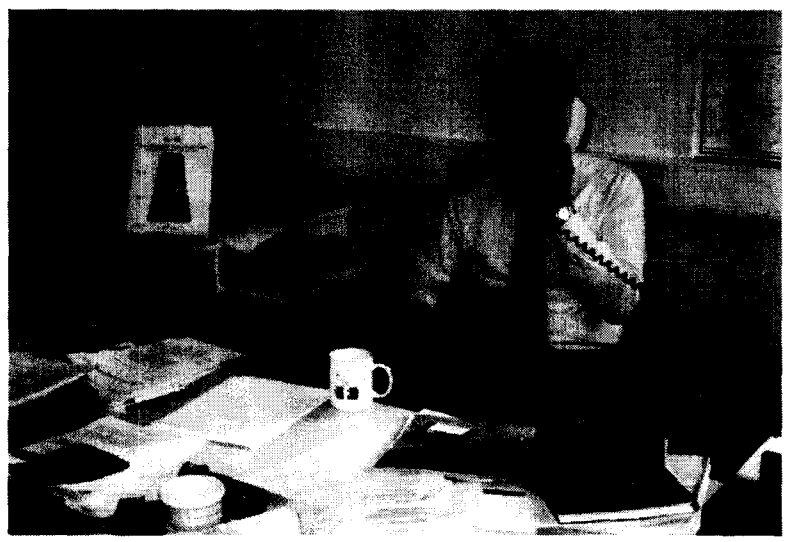
The table below represents the budget of the SNSA for 1996 according to economic purposes and its realization.

The overall budget of the SNSA represented in 1996 only approximately 1,4 % of the budget of the Ministry of Environment and Physical Planning.

The Budget of the SNSA for 1996		
Economic Purpose	Budget 1000 SIT	Budget Including Amendments 1000 SIT
Wages- Government Officials	80.380	94.313
Material Expenses	21.030	22.730
Payments of Services	41.272	39.272
Investments	13.877	12.777
Total	156.559	169.092

INFORMATION MANAGEMENT

Provision of open and authentic information forwarded to the public is a fundamental policy of the SNSA. The SNSA endeavours to provide substantial and reliable information to the interested institutions, mass media and to the citizens through press conferences, public statements, media discussions and active participations in domestic and international meetings, symposia and congresses.



E M E R G E N C Y PREPAREDNESS

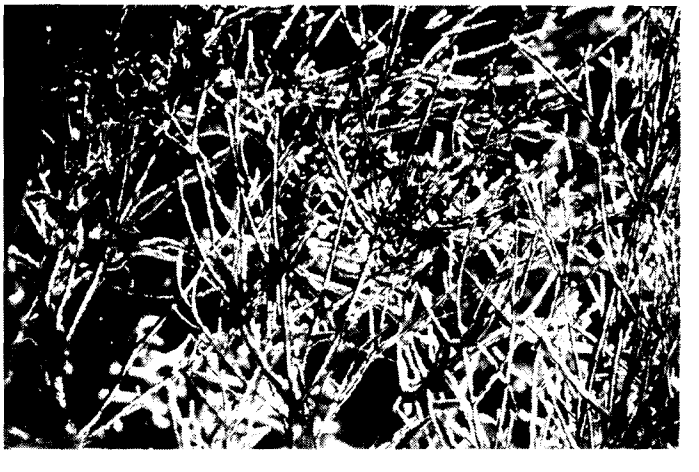
The Administration for Civil Protection and Disaster Relief of the Republic of Slovenia has the authority to declare the emergency, prepare the national emergency plans, perform the training of national rescue teams, coordinate the civil protection and other forces, implement the countermeasures to protect the population in case of emergency.

The SNSA emergency plan contains a set o 31 procedures, which have been written to give instructions, how the SNSA staff shall cope with the nuclear emergency. The SNSA emergency plan comprises of six sections:

- organisation and responsibilities,
- notification and activation of emergency staff,
- accident assessment and dose prediction,
- information of the public,
- instructions for the use of communication equipment,
- maintainance of the nuclear preparedness (training and exercises).

The Krško NPP is responsible for maintaining its own emergency plan. In 1996 the Radiological Emergency response plan was revised (20 th revision), the premises of technical support centre were partially refurbished (refurbishment is still in progress) and the rooms for emergency off-site facility were obtained in Ljubljana. In 1996 no major nuclear emergency exercises was organised in the Krško NPP.

OECD/Nuclear Energy Agency designed a set of exercises under the name of "INEX-2" to test the international response on a nuclear accident in a foreign country. The first exercise in this cycle was "INEX-2-CH" which was originally designed as a Swiss national exercise. For this exercise the basic assumption for the scenario was an explosion and the fire in the turbine building of Leibstadt NPP (1000 MWe boiling water reactor), which is situated on the Rhine river close to Swiss-German border. Explosion damaged the turbine and caused major generator fault. There was minor radioactive steam release during the accident. Radiological impact on the environment was minimal, what was proven by the field measurements. Therefore the Swiss exercise was predominantly the communication and public relations exercise for the foreign countries participating in this exercise.



EXPERT COMMISSIONS

Nuclear Safety Expert Commission (SKJV)

This expert commission held two meetings in 1996. The Commission has 22 members, ten of them are selected from ministries, while 12 are experts in individual fields of nuclear safety and radioation protection. The work of the SKJV is defined in the Act on Ionizing Radiation Protection and the Safe Use of Nuclear Energy (SRS Official Gazette, NO.28/80) and in the Rules of Procedure (as amended at 45th session of the SKJV on 22 March 1991).

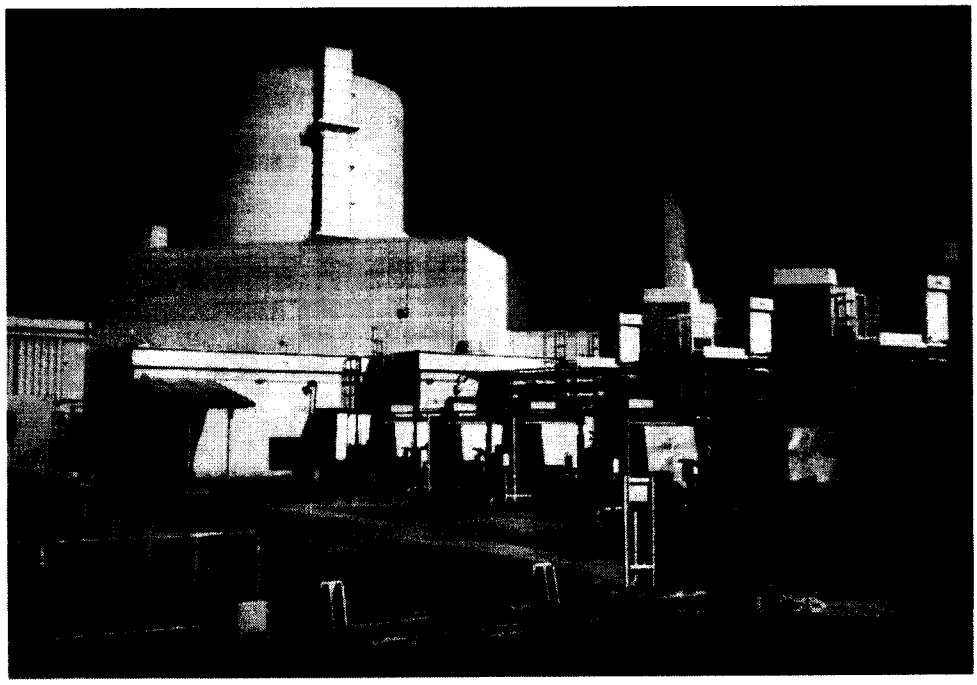
In addition to the standard item, i.e., operational safety of nuclear facilities in the period since the last meeting, the SKJV in 1996 also dealt with:

- The report on the outage of the Krško NPP,
- Updating physical protection of NPP Krško,
- Activities conected to 10 years of Chernobil accident
- Anual report on nuclear and radiological safety in 1995
- The report on the status of activities of planed replacement of steam generators,
- The preparation of criteria for assesing the of competance of optimization that apply for authorisation a new authorized organization (technical support Organisation)
- The report on repacking program of radwaste in temporary storage
- The report on INEX 2-CH exercise
- The report of the IAEA IPERS mission on PSA - external events.

Expert Commission for Operators Exam

In 1996, the Commission for Testing the Qualifications of the Krško Operators organized two examination periods for 12 candidates. 11 candidates for senior operators took the exam, 4 to renew their licenses and 7 first time to become senior operators. In addition one candidate took the exam for renewal of reactor operators license.
All the candidates successfully passed the exam and on the proposal of the Commission, the SNSA granted the licence for one or four years or extended their licences for four years.

OPERATION OF NUCLEAR FACILITIES



KRŠKO NUCLEAR POWER PLANT

Main operational data

In 1996 the Krško NPP generated 4.561.900 MWh of electrical energy at the output of the generator, or 4.368.700 MWh net.The generator was connected to the electrical grid for 7143.9 hours or 81.32 % of the total number of hours in the year. The electrical production was 7.6 % higher than planned.

In 1996, the generation of thermal energy amounted to 13.121.306 MWh. The whole production of the electrical energy in Slovenia was 11,510 GWh, the share of the nuclear energy production being 37.9 %. Slovenia used 9,963 GWh of produced electrical energy and the nuclear share was 23%, as half the production of NPP Krško was transmitted to Croatia.

Important performance indicators of the power plant	Year 1996	Average
Availability Factor (%)	81.32	81.02
Capacity factor (Load Factor) (%)	80.22	76.58
Forced Outage Factor(%)	0.07	1.66
Net Electrical Energy Production (GWh)	4368.7	4152
Reactor Shutdown - Manual (Number)	1	4.57
Reactor Shutdown- Avtomatic (Number)	2	2.73
Incident Reports (Number)	2	4.3
Outage Duration (day)	41.17	64.63
RCS Contamination, 13 cycle, (g Uranium)	18.80	
Fuel realibility Indicator (FRI) (GBq/m^3)	0.08	
Volume ILLW (m^3)	185	172
Collective Effective Dose (manSv)	2.01	2.09
H-3 Activity in Liquid Relese (TBq)	9.3	11.7
Activity in Liquid Relese, no H-3 (GBq)	7.9	4.1
14.Co-60 Activity in Liquid Relese(GBq)	0.25	0.82
Cs-137 Activity in Liquid Relese (GBq)	0.05	0.53
J-131Activity in Liquid Relese (MBq)	13.2	34.23
Atmospheric Discharges of Noble Gases (TBq)	12.6	4.6
Atmospheric Discharges of C-14 (TBq)	0.05	0.18
Atmospheric Discharges of H-3(TBq)	1.2	1.53
External Radiation (mikroSv)	800	

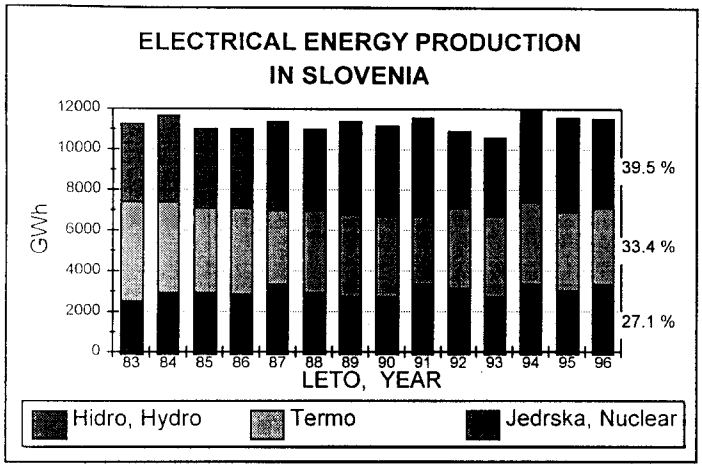
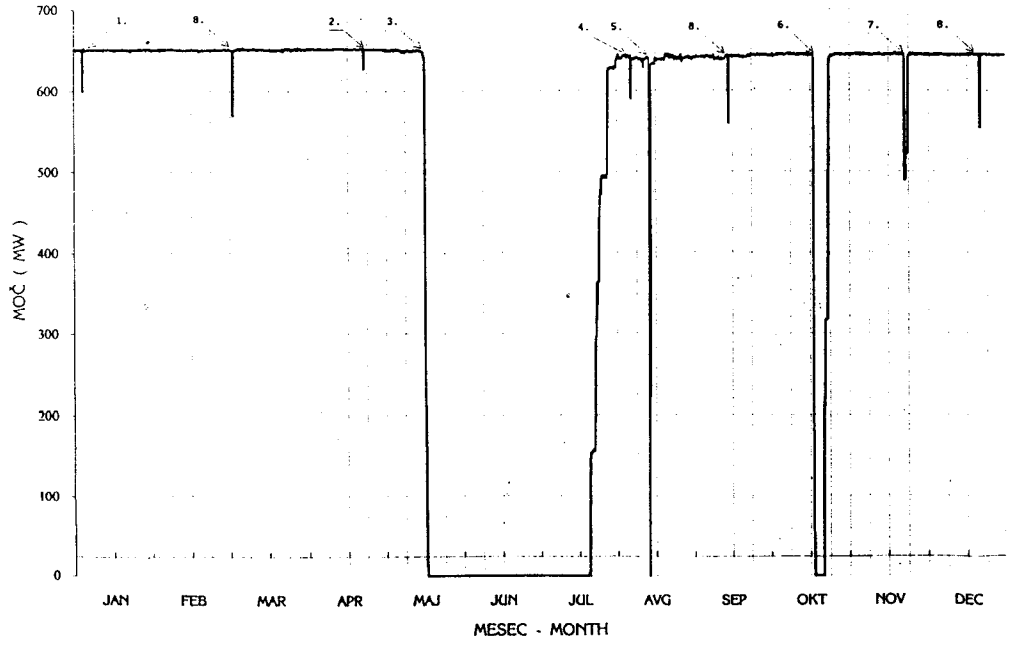


DIAGRAM OBRATOVANJA NE KRŠKO ZA LETO 1996
NPP KRŠKO OPERATING DIAGRAM FOR 1996

Proizvedena energija na generatorju: 4.561.900 MWh
Proizvedena energija na pragu: 4.368.700 MWh
Razpoložljivost: 81.32 %
Izkoriščenost : 80.22 %

Gross energy produced: 4.561.900 MWh
Net energy produced: 4.368.700 MWh
Availability factor: 81.32 %
Capacity factor: 80.22 %



1. Nezaželjeno odpiranje drenaž HD sistema
- Inadvertant HD system drain valves opening

2. Menjava HD črpalk
- HD pumps switchover

3. Menjava goriva
- Refueling

4. Sanacija FW kontrolnih ventilov
- FW control valves repairation

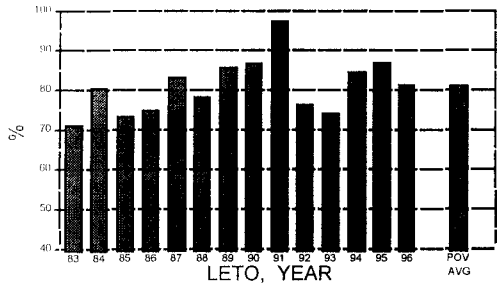
5. Izpad elektrarne zaradi nezaželjenega zaprtja FW izolacijskega ventila
- Unit trip because of inadvertent FW isolation valve closure

6. Zaustavitev elektrarne zaradi puščanja sekundarne strani uparjalnika št. 2
- Plant shutdown because of SG #2 steam leak

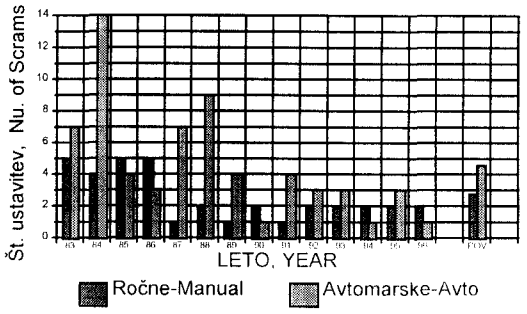
7. Zamenjava varnostnih zatičev na Taprogge filtrih
- Safety pins replacement on Taprogge filters

8. Test turbinskih ventilov
- turbilne valves test

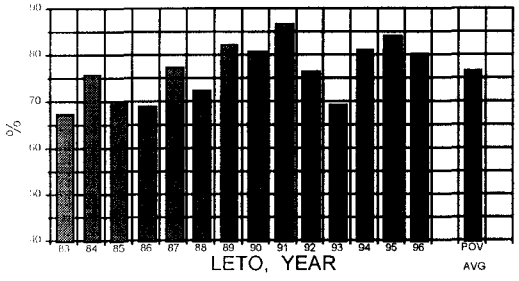
RAZPOLOŽLJIVOST
AVIABILITY FACTOR



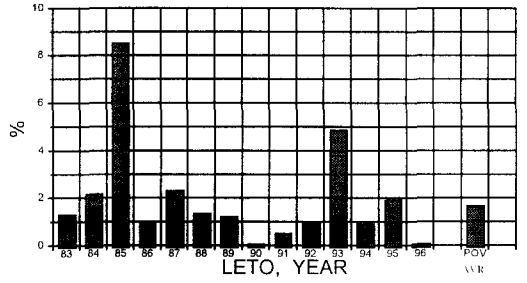
USTAVITVE
REACTOR SHUTDOWN



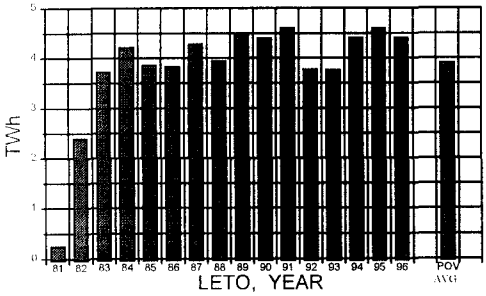
IZKORIŠČENOST
LOAD FACTOR



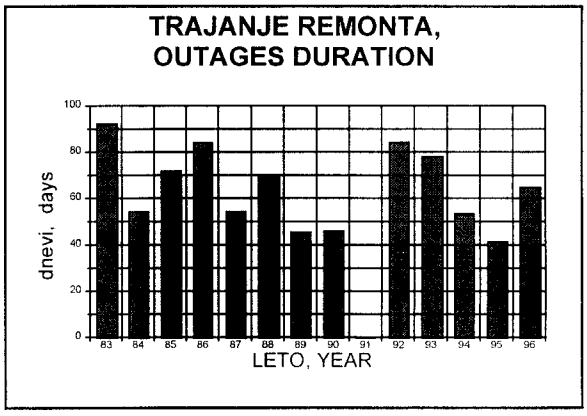
FAKTOR PRISILNE USTAVITVE
FORCED OUTAGE FACTOR



REALIZIRANA PROIZVODNJA,
ELECTRICAL ENERGY PRODUCTION



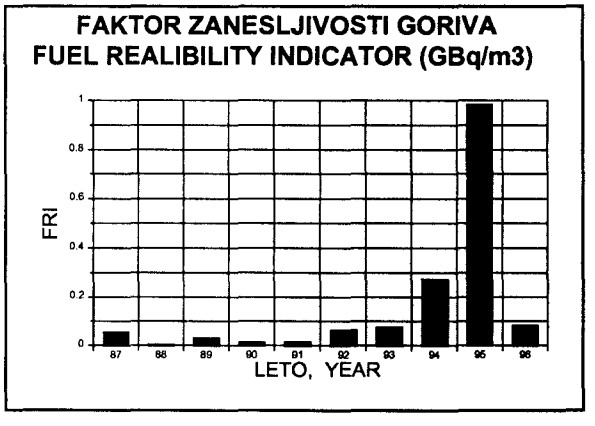
Shutdowns and reductions of power in 1996			
Date	Hours	Outage type	Short description
4.1.	3	Unplanned Automatic	Shutdown due to short circuit during fuse replacement in HD regulation system
3.3.	10.5	Planned, Manual	Operating at reduced power (89%) due to testing of the turbine valves..
18.5.	1551.1	Planned, Manual	**OUTAGE 96**
7.8.	6	Planned, Manual	Operating at **reduced power** (92%) due to maintenance works on the control valve of main feed water
14.8.	6.1	Unplanned Automatic	Shutdown due to main feed water isolation valve closure
15.9.	4.5	Planned, Manual	Operating at **reduced power** (90%) due to testing of the turbine valves.
19.10.	83.9	Planned, Manual	Operating at **reduced power** (76%) due to testing of the turbine valves.
23.11.	35.5	Planned, Manual	Operating at **reduced power** (90%)due to maintenance works on the condenser.
22.12.	5.5	Planned, Manual	Operating at **reduced power** (88%) due to testing of the turbine valves.

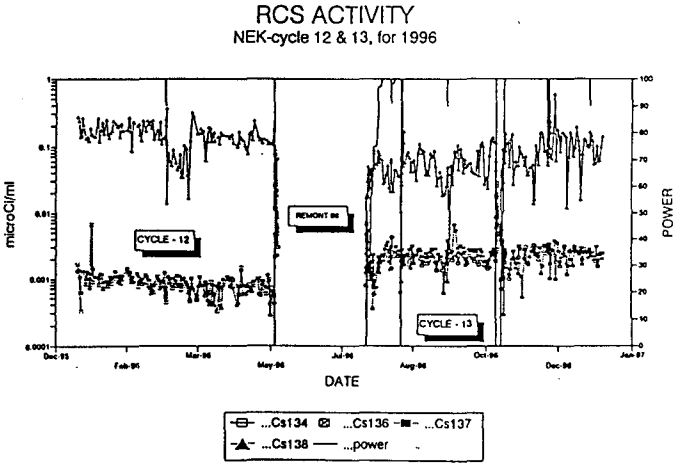


After some years of decreasing reliability of the nuclear fuel used in NPP Krško, in 1996, the situation improved. The indicators of fuel damage show that on completion of the 12th fuel cycle, during the '96 outage, not all damaged fuel elements were removed as fuel damage was noticed also in the 13th fuel cycle causing increased contamination of primary coolant with uranium.

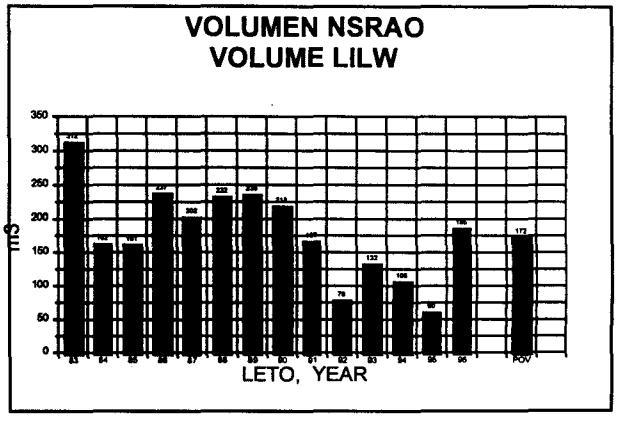
Due to longer fuel cycles, the spent fuel pool is being filled less intensively than foreseen (in the design of the NPP). According to the analysis, the capacity of the spent fuel pool will be sufficient for the storage of used fuel elements until the year 2004. In 1996, the number of fuel elements increased for 28 and, by the end of the year, the total number of used fuel elements stored in the spent fuel pool was 470.

Average activity of the primary coolant for 7th, 8th, 9th, 10th, 11th, 12th and 13th cycles										
ISOTOPE	AVERAGE ACTIVITY (GBq/m^3)									
	cycle 7	cycle 8	cyclel 9	cycle 10	cycle 11		cycle 12 1.6.95 - 18.5. 96		cycle 13 20.7. - 31.12. 96	
					stable conditions	all measures	stable conditions	all measures	stable conditions	all measures
J - 131	0.08	0.03	0.10	0.11	0.78	7.44	0.44	0.66	0.17	0.31
J - 133	0.55	0.34	0.25	1.09	3.99	9.14	2.22	2.12	1.51	1.76
J - 134	2.22	1.22	0.68	0.62	5.40	5.40	5.81	6.03	7.14	5.73
Xe - 133	23.3	7.40	16.83	6.10	19.72	20.35	12.62	18.61	5.11	4.22
Xe - 135	2.96	0.89	5.81	3.20	16.24	16.68	13.65	17.39	5.03	4.55
Xe - 138	0.93	0.52	0.91	0.41	3.09	3.63	5.92	7.03	5.55	5.14
Kr - 85	1.11	0.26	1.54	0.73	2.33	2.39	2.11	2.623	0.63	5.81
Kr - 87	0.48	0.19	0.93	0.47	2.69	2.82	3.53	3.85	1.18	1.10
Kr - 88	1.11	0.32	2.36	1.12	6.88	6.33	4.92	5.51	1.54	1.42
cycle length days	308	396	485	513	469 d		351		164	
Length EFPD d	275.5	365.5	437.9	394.5	406.5		336.7		158.1	
Max. burn up (MWD/TU)	37515	40048	46508	48352	48037		46129		38780	





In 1996, 476 drums were filled with low and intermediate level radioactive waste. Since the beginning of the NPP operation, 12324 drums or 2588 m3 of radioactive waste has been accumulated.

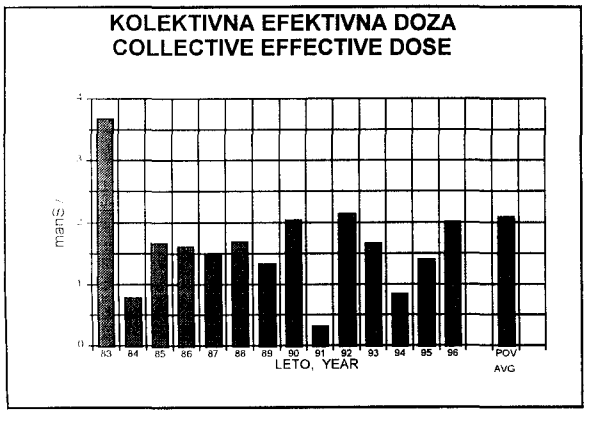


Doses Received by Personnel

The exposure data in 1996 indicate that the doses received by workers remained at the very low levels achieved over recent years. The average individual dose was 2.26 mSv and the total collective dose was 1.33 manSv.

Belowe is showen the distribution of effective doses for workers of NPP Krško for the period 1981 - 1996. Besides the power plant personnel exposure, the doses of subcontractors are also included in the table. The table shows that no employee received an annual dose exceeding 20 mSv. Workers are mostly exposed during the outage period due to refueling and maintenance.

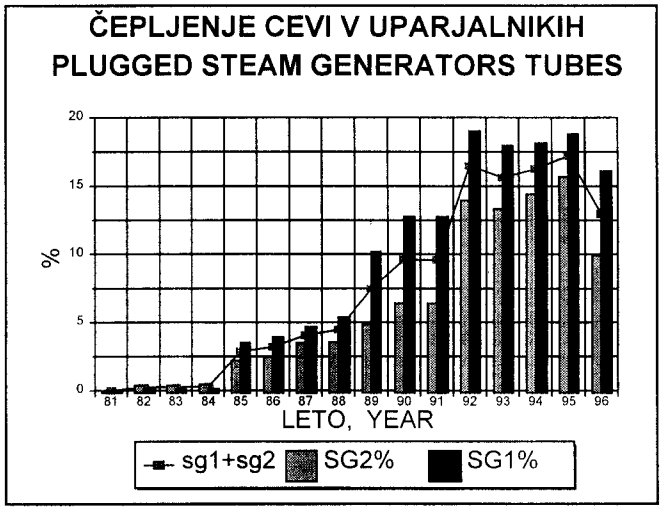
Year	**Distribution of effective doses for all workers at the Krško NPP during the operational period from 1981 to 1996.** Range of annual doses mSv							Total number of workers
	0 - 1	1 - 5	5 - 10	10-15	15-20	20-25	over 25	
1981	475	45	0	0	0	0	0	520
1982	275	313	9	13	10	1	1	622
1983	462	206	53	45	34	27	4	831
1984	375	205	15	3	2	0	0	600
1985	517	277	79	17	2	0	0	892
1986	524	301	79	3	4	1	0	912
1987	486	242	65	16	6	1	0	816
1988	506	298	60	21	3	1	0	889
1989	443	200	66	19	3	0	0	731
1990	390	265	92	38	5	2	0	792
1991	257	89	8	0	0	0	0	354
1992	448	219	0	127	22	1	0	817
1993	401	183	87	26	9	1	0	707
1994	536	187	32	2	0	0	0	757
1995	521	248	62	16	3	0	0	850
1996	489	258	114	25	3	0	0	889



Steam Generators

The degradation of steam generator tubes required plugging of failed tubes. The plugging is approaching the limit of 18%, which is, according to safety analysis, the limit above which the reduction of power is necessary. The level of failed tubes is being kept under the limit with the technique of inserting sleeves. With the use of this technique, the plugging can be even decreased and in 1996, the average level of plugging after the annual outage was 13.15%. The degradation phenomenon is common to the power plants of this type and the insertion of the sleevs is a routine technological procedure.

In 1996, NPP Krško decided to replace steam generators and out of international tender selected Siemens-Framatome as new steam generators suppliers. They will be replaced during the outage in the year 2000.

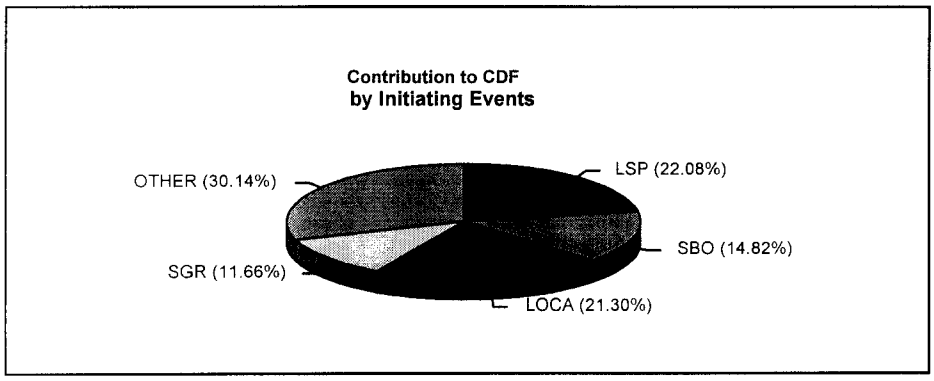


Probabilistic Safety Analysis

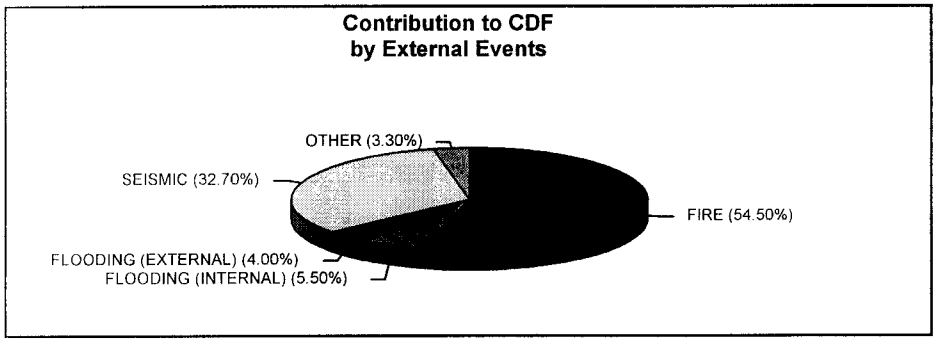
The probabilistic safety analysis Level 1 and Level 2 brought up a lot of findings about the safety of NPP Krško. It showed that NPP Krško has the same safety problems known also to other western nuclear power plants. PSA application and Living PSA are main objectives.

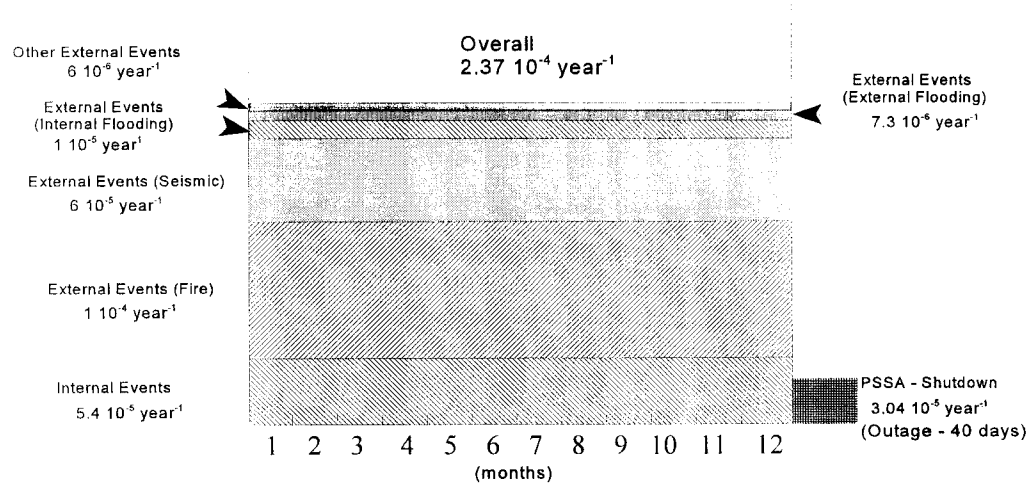
The major charateristics of average annual hazardous operation of NPP Krsko are:

- considerable high level of fire risk,
- the loss of electric supply and NPP's ability to respond to such events as a dominating risk factor,
- human agent as an inevitable risk factor, possible to influence the degradation of safety.



CDF - Core Damage Frequency
SBO - Station Blackout Initiating Event
SGR - Steam Generator Tube Rupture Initiating Event
LSP - Loss of Offsite Power Initiating Event
LOCA - Loss of Coolant Accident





Contribution to Core Damage Frequency

Plant Modifications

An extensive programme of Steam Generators replacement, upgrading NPP Krško and increasing the safety of the plant is in progress.

Modification in accordance with the license issued by the SNSA, which was completed in 1996 was "Modification 046-HC-L, "Containment H_2 Monitoring" .

Thirty modifications on equipment and systems were made in 1996 among them:

- Diesel Generator (DG) pre-lube oil system,
- Blow down - Floor drain system connection,
- In Drum Drying System - connection to CC system,
- DG alarming system modification,
- Condenser pressure measurement change.

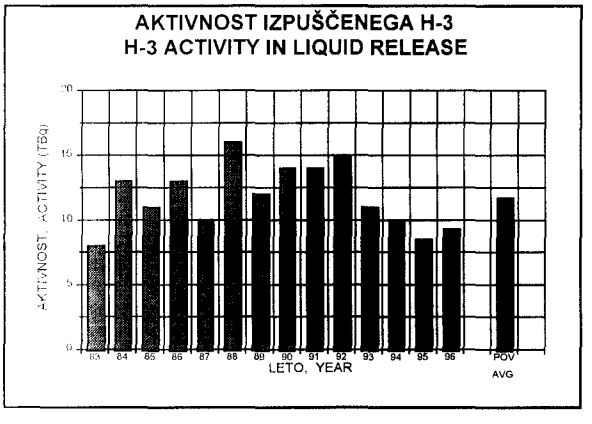
Radioactive Releases to the Environment from NPP Krško

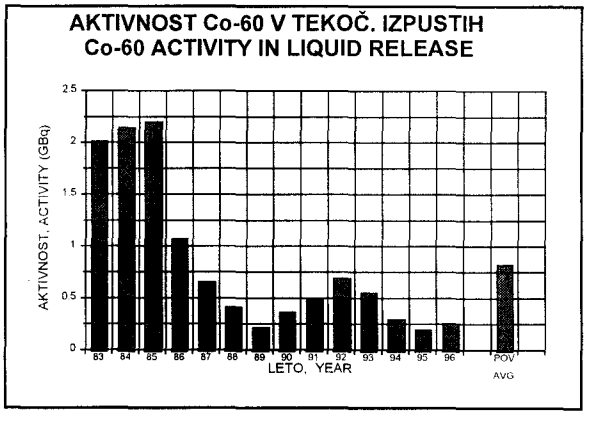
The limits of radioactive releases into environment are stipulated by the licence to start operations of NPP Krško No. 31-04/83-5 issued on February 6, 1984 by the Energy Inspection Authority of the Republic of Slovenia.

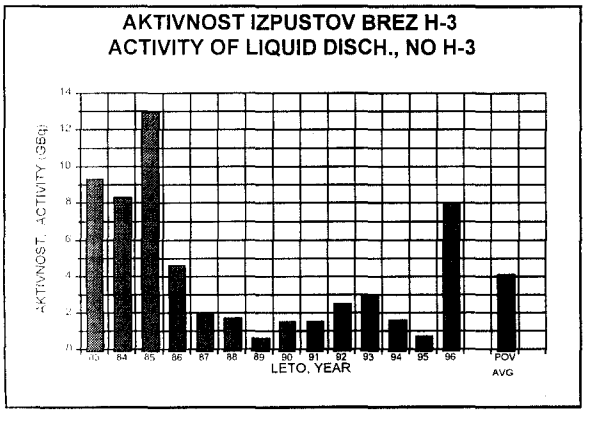
Competent administrative authorities were regularly informed about the releases in regular and special reports by NPP Krško. Regular reports were made on a daily, weekly, monthly and yearly basis. In daily reports, NPP Krško was informing competent regulative bodies in regular operation reports about the type and activity of releases into the atmosphere and the Sava river. Special reports were mostly relevant to planned gas releases from the gas storage tanks and for the containment before its venting.

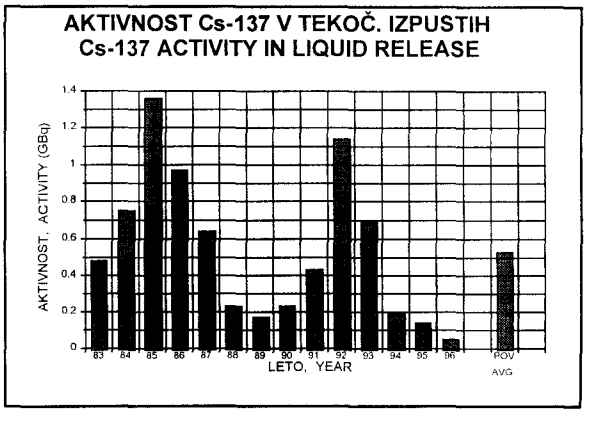
In liquid releases into the Sava river, the dominating radionuclide was tritium. The annual released activity of this radionuclide was 9.3 TBq, which was approximately 46.5 % of the limiting value 20 TBq stated in the licence. The activity of all other radionuclides was about 10,000 times lower and was at the level of a few percent of the limiting values of the licence.

Radioactive gases were released to the atmosphere mainly from the reactor building stack. Noble gases represented the majority of radioactivity released to the atmosphere, i.e., about 95% of all activity. In 1996 total released activity was 12.6 TBq, which was approximately 11% of the limiting value 110 TBq which increased considerably compared to previous year, due to the lower fuel cladding integrity.

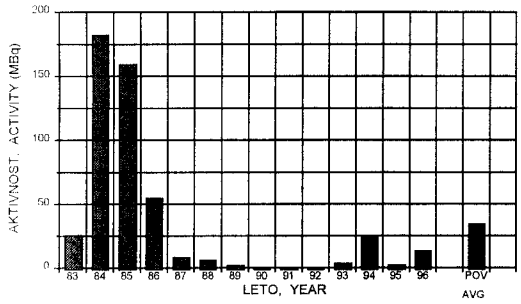




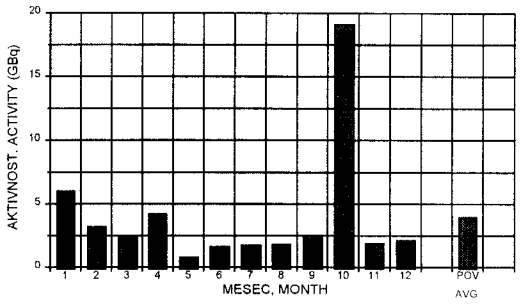




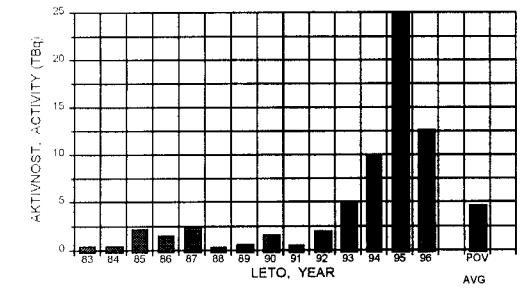
AKTIVNOST J-131 V TEKOČ. IZPUSTIH
J-131 ACTIVITY IN LIQUID RELEASE



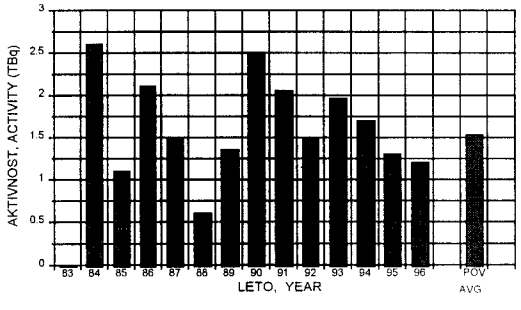
C-14 V PLINSKIH IZPUSTIH V 1996
DISCHARGES OF C-14 IN 1996



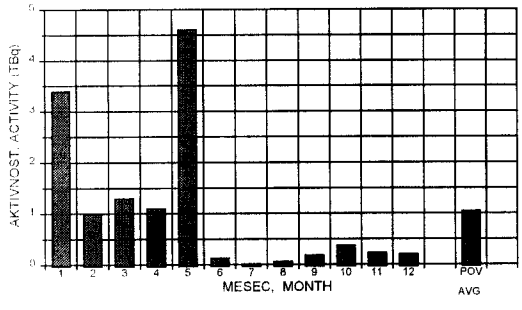
AKTIVNOST IZPUSTOV ŹLAHTNIH PLINOV
ATMOSPH. DISCHARGES OF NOBLE GASES



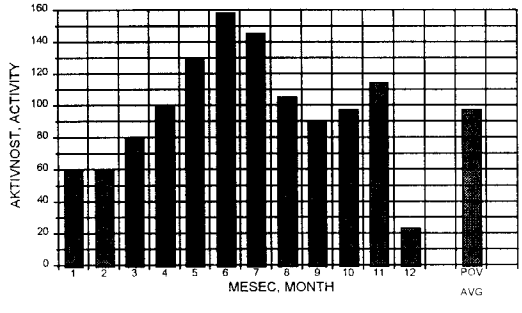
AKTIVNOST H-3 V PLINSKIH IZPUSTIH
ATMOSPHERIC DISCHARGES OF H-3



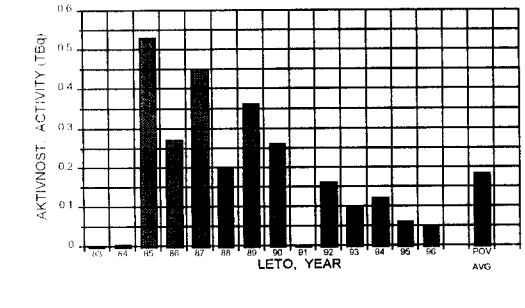
IZPUSTI ŹLAHTNIH PLINOV V 1996
DISCHARGES OF NOBLE GASES IN 1996



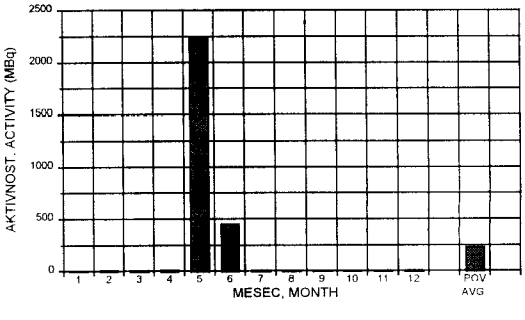
H-3 V PLINSKIH IZPUSTIH V 1996
DISCHARGES OF H-3 IN 1996



AKTIVNOST C-14 V PLINSKIH EMISIJAH
ATMOSPHERIC DISCHARGES OF C-14



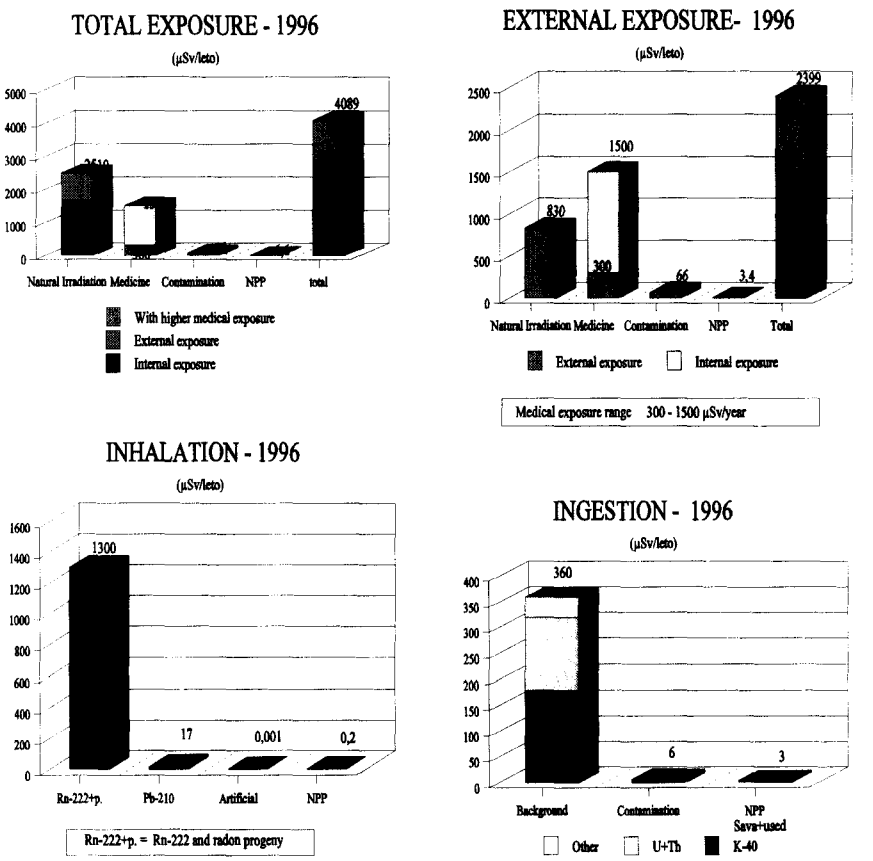
AKTIVNOST IZOTOPOV JODA V 1996
IODINE ACTIVITY IN 1996



Radiation Monitoring Programme

The monitoring programme of radioactivity in the environment of NPP Krško had been approved by the SNSA and has regularly been performed by the Jožef Stefan Institute and the Institution for Occupational Safety from Ljubljana, and by the Rudjer Bošković Institute and the Institute for Medical Research and Occupational Health from Zagreb. Radionuclide concentrations in all elements of biosphere were determined, covering all important pathways. The area monitored lies within the radius of 12 km around NPP Krško and reference measurements were taken up to the distance of 45 km.

Members of the public were exposed to radiation originating from liquid and atmospheric discharges from NPP Krško, including direct radiation. The dose evaluation was made on the basis of results of the environmental monitoring programme, including activities of liquid and gaseous releases; meteorological data were also taken into account. In 1996, the additional annual effective dose of the members of the critical group was estimated to be below 6.6 microSv. The annual individual exposure of population around NPP Krško should not exceed the prescribed limits: 0.25 mSv for total exposure (0.05 mSv due to releases and 0.20 mSv due to direct radiation) so that all doses of members of the public were - as before - well within the regulatory limits.



Radioactivity Monitoring in the Environment of NPP Krško - results of the dose assessment

TRIGA RESEARCH REACTOR

The TRIGA Mark II research reactor at Brinje near Ljubljana with the power of 250 kW is operating since May 31. Therefore, in 1966, it has celebrated 30th anniversaries. In 1996, research reactor TRIGA produced 400.9 MWh of thermal energy. Seven unplanned shut-downs occurred, six because of loss of external power and one because of a reactor coolant pump trip.

The reactor was utilized for neutron activation analyses, development of new analytical techniques, real time neutron radiography and tomography, research in field of boron cancer treatment, nondestructive material examination and in other related research.

The maintenance in 1996 consisted of replacement of the primary pump with two pumps (redundancy) and of the refurbishment of piping of the primary circuit. Because of the sheduled return of spent fuel to the USA several interventions were made in the spent fuel pools.

Radioactive Discharges and Environmental Monitoring

In 1996, the surveillance measures of the radioactive releases and radioactivity in the surroundings of the Podgorica Reactor Centre were performed in accordance with the programme confirmed by the SNSA.

Conservative estimation of the annual effective dose to an individual living in the surroundings of the Reactor Centre for the year 1996 was 0.3 microSv due to inhalation and 1.0 microSv for ingestion under the assumption that the individual has been drinking water directly from the Sava river.

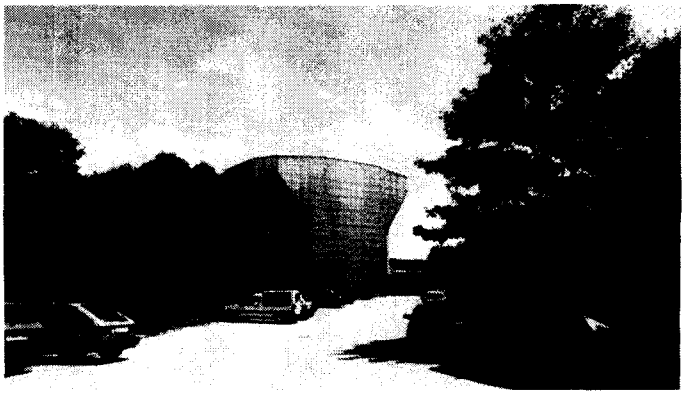
Interim Storage of Radioactive Waste in the Reactor Center Podgorica

Interim storage for low - and intermediate-level radioactive wastes for users in Slovenia (except for NPP Krško and Žirovski Vrh Uranium Mine) has been in operation since 1987.

There were three types of radioactive waste in the storage:

- -closed drums with contaminated items (paper, plastics, glassware, etc.) and materials with induced radioactivity due to irradiation in the TRIGA reactor,
- -other waste - contaminated or radioactive items which, due to their big size, could not be stored in barrels and were therefore stored separately,
- -sealed sources out of use, which were stored in original protected containers.

In spite of receiving for storage additional radioactive waste in 1996, the total activity of the waste in the Podgorica interim storage decreased, because of the decay of short-lived radio nuclides.



ŽIROVSKI VRH MINE

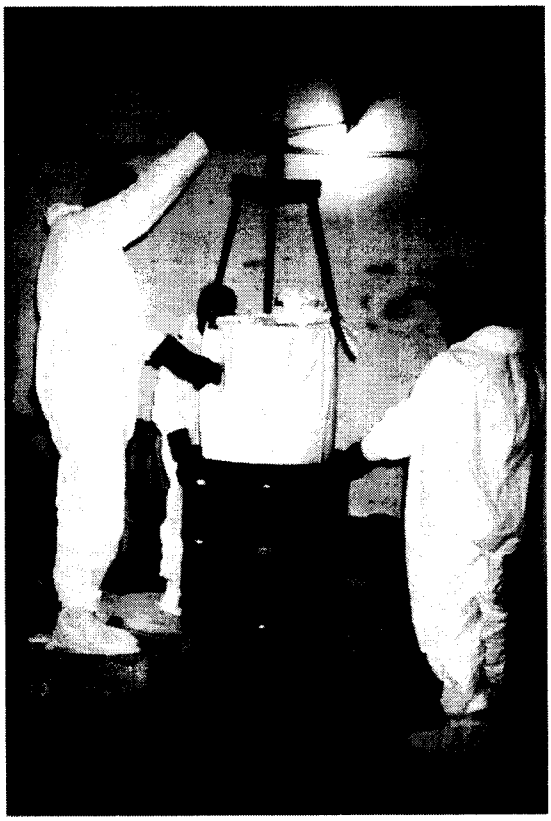
The funds assigned from the national budget for financing the programme of closure of the uranium mine were not sufficient to carry out the majority of planed activities in the 1996 programme. The preparation of relevant documentation and analyses needed to carry out the programme, was late as well. Recommendations of the IAEA missions and the demands of the SNSA has not been fulfilled yet. Radioactive measurements at the Žirovski Vrh Mine and its surroundings showed that the cessation of the uranium ore exploitation just partly reduced the impact of the mine to the environment even six years after its shut-down. No essential changes are expected until the whole uranium complex site is remediated. The emission of radionuclides with liquid effluents and the annual discharge of radon from the mine and tailings pile at Boršt were significantly reduced in 1996.

In 1996, the most important source of radioactive pollution in the surroundings of the Žirovski Vrh Mine still remained radon ^{222}Rn with its short-lived daughter products contributing more than 4/5 of exposure or, on the average, 0.26 mSv. All other exposure pathways eg. inhalation of long-lived radionuclides, external radiation, etc. contribute less than 0.06 mSv per year. The effective dose for an adult is about one third of the primary limit dose 1 mSv per year, directed by still in force Regulation on Dose Limits to Population and Radiation Workers (Off. Gaz. SFRY, No. 31/89, 63/89) and the latest international recommendations of the ICRP 60 (1991). In comparison to the total amount of radiation, the Žirovski Vrh Mine represents around 6% of the average radiation exposure in this area (around 5.5 mSv per year).

View on the tailings pile at the Boršt site

RADWASTE STORAGE AT ZAVRATEC

The radioactive waste originating from the accident at the Institute of Oncology in 1961, with a spill of 10 mg of Ra-226, is temporarily stored in an abandoned caserne near the village Zavratec. A contract has been signed between the Jožef Stefan Institute and the Agency for Radwaste Management in May 1996 for the second phase of reconstruction of the radioactive waste storage at Zavratec. In accordance with the contract, all the waste was measured and repacked in new drums, properly labeled and returned to the temporary storage.



TECHNICAL SUPPORT ORGANIZATIONS

According to the Article 14 of the Act on Implementing Protection against Ionizing Radiation and Measures for the Safety of Nuclear Facilities (Off. Gaz. SRS, No. 28/80), Technical support organizations were authorized by the Republic Committee for Energy, Industry and Construction (succeded by SNSA), with a decree to perform specific tasks in the field of nuclear and radiological safety in the Republic of Slovenia. In the year 1996 one Tecnical support organization was authorized by the SNSA (ENCONET). Technical support organizations represent a vital part of monitoring of operating, backfitting, improvements and monitoring of maintenance work on nuclear facilities.

In 1996 Technical support organizations performed tasks as follows:

- review of "NPP Krško 1996 outage plan,"
- quality assurance/control activities,
- review of "Design modification packages,"
- review of NPP Krško documentation (QA procedures, Maintenance procedures, Testing procedures, Inspection procedures, Work orders),
- review of "In service inspection and testing" results,
- review of "Non destructive testing and examination" results,
- review of maintenance activities (electrical equipment, mechanical equipment, instrumentation & control equipment),
- verification of performance/operability and acceptance of test results.

Electric Institute "Milan Vidmar",

Ljubljana is autorised for:

- quality assurance, performance of measurements and quality control of electrical equipment during construction, trial operation and operation of nuclear power plants,
- verification of operability, reliability and quality of the systems for control and automation of nuclear installations,
- training of technical staff in the area of expertise of the Institute,
- performance of acceptance tests on the electrical equipment.

IBE Consulting Engineers, Ljubljana

is autorised for:

- preparation of investment and technical documentation for nuclear facilities,
- organizing construction of nuclear facilities and installations and surveillance during construction, preoperational tests and trial operation, including organization of quality assurance in nuclear facilities and installations during construction,
- control of investment and technical documentation for nuclear facilities and installations,
- preparation of physical plans and siting documentation.

Institute for Metal Constructions,

Ljubljana is autorised for:

- quality assurance activities, carrying out measurements and control of quality and functioning, including nondestructive testing and quality assurance for bearing metal constructions and metal parts of equipment, pressure piping and vessels during construction, trial operation and operation of nuclear facilities and installations,
- training of technical staff in the area of expertise of the Institute.

Faculty of Mechanical Engineering, University of Ljubljana is autorised for:

- quality assurance and control of mechanical equipment in nuclear facilities and installations during production, installation, preoperational tests, trial operation and operation of a nuclear facility,
- training of technical staff in the area of expertise of the Institute,

Welding Institute, Ljubljana is autorised for:

- quality assurance activities related to welding,
- quality control of welding,
- evaluation of welding procedures, base metal and filler material,
- verification of welders qualification, suitability of welding equipment and instruments,
- verification of welding-engineering concepts for welded constructions, design and statistics,
- inspection of welds, including nondestructive testing,
- consulting in the use of welding technology at new installations and in maintenance.

High Voltage and Energetics Department, Faculty of Electrical Engineering, University of Zagreb is autorised for:

- safety analysis of installations, components and systems of nuclear facilities,
- safety analysis for qualification of safety class electrical equipment.

EKONERG, Zagreb for

- quality assurance and quality control of mechanical equipment in nuclear facilities during production, installation, preoperational tests, trial operation and operation,
- performance of acceptance and functional tests of a mechanical equipment in nuclear facilities,
- verification of base line condition of the mechanical equipment which is specially important for the safety of a nuclear facility, in-service inspection and impact of aging on its availability,

Energy Institute Ltd., Zagreb is autorised for:

- quality assurance and quality control of instrumentation and control systems and verification of its operability and reliability during construction, preoperational tests, trial operation and operation of a nuclear facility.

Institute of Metals and Technologies, Ljubljana is autorised for:

- quality assurance and control of metals based on investigations of their chemical, mechanical, microstructural and corrosion properties, assurance of quality and adequacy of metals used for metal constructions, piping and pressure vessels during constructions, trial operation and operation of nuclear facilities and installations.

ENCONET Consulting Ges.m.b.H. Vienna, Austria is autorised for:

- Probabilistic safety analysis of NPPs, reliability analysis,
- Regulatory regimes, regulatory guides and standards, regulatory and risk based inspection,
- Maintenance of NPPs, preventive maintenance, maintenance optimization, Realibility Centered Maintenance (RCM),
- Operational safety of nuclear facilities, operational safety reviews,
- Research reactor safety and probabilistic analysis,
- Plant modification planning and assessment,

- Research reactor safety and probabilistic analysis,
- Plant modification planning and assessment,
- Engineering activities related to safety upgrades,
- Significant event analysis, root cause analysis, feedback of operational experience,
- Technical specification development and optimization.

Institute of RS for Occupational Health, Ljubljana is authorised for:

- preparation and execution of measures related to the radiation protection,
- systematic research of radioactive contamination,
- radiological food and water control,
- occupational, environmental and toxicological expertises in the field of radiological safety.

Jožef Stefan Institute, Ljubljana is autorised for:

- analysis of events in nuclear facilities,
- reviewing the results of siting investigations for nuclear facilities,
- analysis of abnormal events in nuclear facilities,
- verification of operational status of the safety systems in a nuclear facility and of physical security,
- testing and verification of operability of nuclear, in-core and radiological instrumentation as well as reactor control system,
- nostrification and review of safety report,
- verification of test results of the safety systems during trial operation,
- preparation and execution of emergency measures during an accident related to radiation protection, labelling of radioactive contamination and decontamination and risk assessment to the environment,
- training of workers in basics of reactor technology, nuclear power plant systems descriptions, and radiation protection.

Nuclear Training Centre Milan Čopič (Jožef Stefan Institute, Ljubljana)

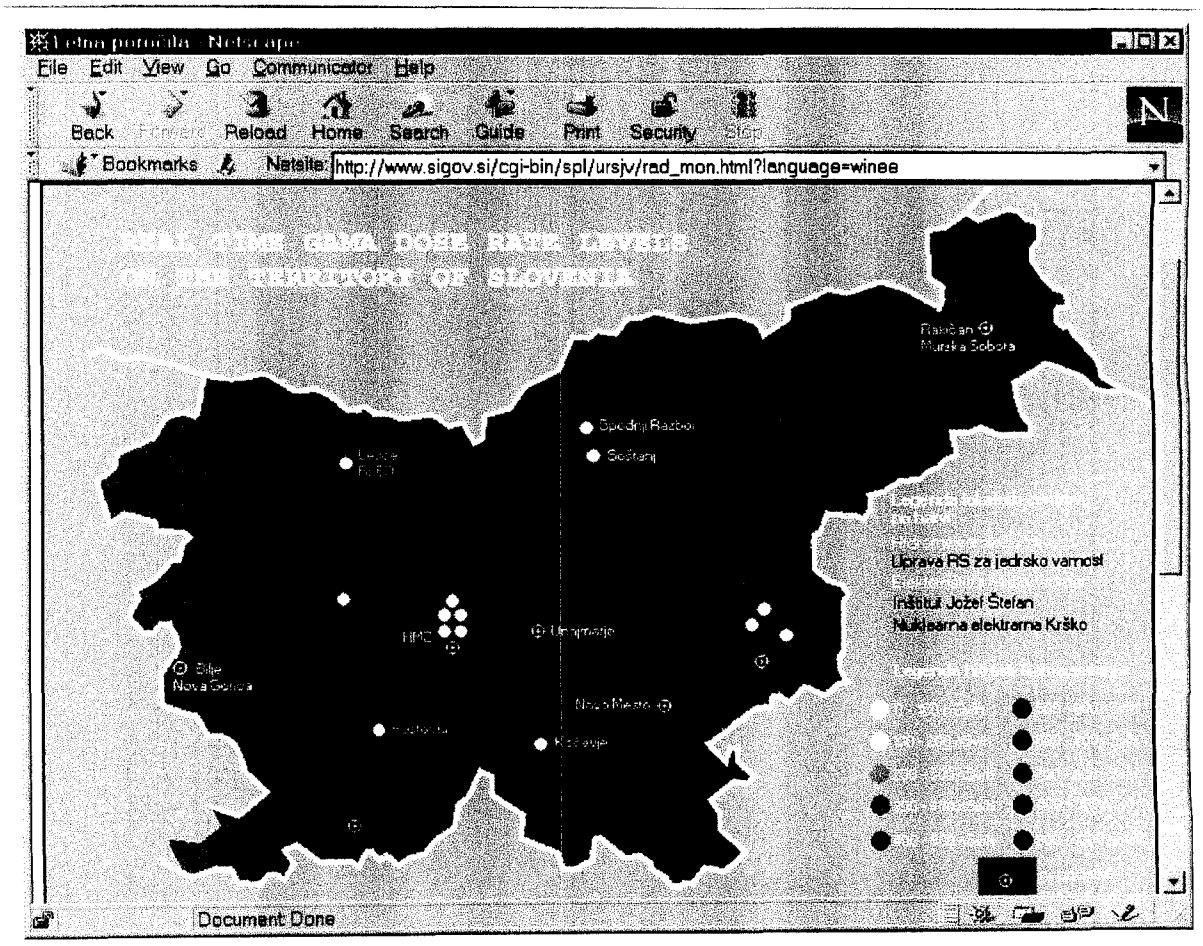
Nuclear Training Center Milan Čopič continued with its activities as:

- training of NPP Krško personnel,
- organizing shorter courses *like Basics of nuclear technology*,
- public information, (In the school year 1995/96 there were altogether 7234 students visited the centre),
- training activities in the field of radiological protection.
- IAEA sponsored courses

Courses in the year 1996

DATE	TITLE	No. of Participants	No. of Weeks	No. of Lecturers	Participant/ week
27.11.95-19.1.96	Basics of Nuclear Technology - Systems OTJE (9)	15	5	15	75
22.1.-16.2.96	Basics of Nuclear Technology - Theory OTJE (10)	13	4	9	52
8.3.95	Radiological protection for industrial sources of ionizing radiation, Refresher Course - OTIND-01	12	0.2	3	2.4
18., 21. 3.96	Exercises in Radiological Protection for Medical School	11	0.5	1	5.5
18.3.-22.3.96	Operator Retraining	7	2	3	14
1.4.-29.4.96	Basics of Nuclear Technology - Systems OTJE (10)	13	4	6	52
10.-12.4.96	Radiological protection for activities with open sources of ionizing radiation - RZOVIR-02	18	0.6	7	10.8
15.-18.4.96	Exercises in Radiological Protection for Medical School	10	0.5	1	5
23.-24.4.96	Radiological protection - RZCC-01	31	0.5	3	15.5
25.4.96	Radiological protection - RZCC-02	28	0.2	3	5.6
26.4.96	Radiological protection - RZCC-02	23	0.2	3	4.6
19.2.-28.6.96	Power Reactor Technology - Systems, TJE-S (5)	18	18	12	324
26.-28.6.96	Radiological protection for activities with open sources of ionizing radiation - RZIJS-02	6	0.3	6	1.8
24.6.-20.9.96	Interregional Course on Nuclear Electronics, IAEA	22	13	6	286
30.9.96-4.10.96	Source Term Determination and Emergency Planning, IAEA	27	1	4	27
7.10.-15.11.96	Basics of Nuclear Technology - Theory OTJE (11)	15	5	6	75
18.11.-27.11.96	Operator Retraining	5	1.6	3	8
2.12.-17.1.97	Basics of Nuclear Technology - Systems OTJE (11)	15	5	?	75
10.12.96	Public Information About Nuclear Energy	13	0.2	0	2.6
		302	**61.8**	**91**	**1041.8**

RADIOACTIVITY MONITORING IN SLOVENIA



RADIOACTIVITY IN THE LIVING ENVIRONMENT

Monitoring of the Global Radioactive Contamination in Slovenia

The radioactivity monitoring programme for global contamination in the living environment in the Republic of Slovenia was determined in acordance with the Regulation on the locations, methods and time periods for the radioactive contamination control (based on the former Official Gazette of the SFRY, No. 40/86), and on the basis of expert opinions adopted after the Chernobyl accident. The programme is performed by the Institute for Occupational Safety of the Republic of Slovenia and the Jožef Stefan Institute. The programme encompasses of measurements of radioactivity in: surface waters, air, soil, precipitations, drinking water, food and animal feed.

Results

The measurements of activity concentration in environmental samples: in 1996 in air and in precipitations, there was no significant reduction in levels compared to the previos period.

The measurement of the external gamma radiation dose rate showed that the Chernobyl contribution still accounted for an average 20% of the total external outdoor dose measured in Slovenia. The country average annual dose of external gamma radiation measured by thermoluminescent dosimeters amounted to 856 microSv.

The results of measurements of specific activity in samples of unploughed soil taken in Ljubljana, Murska Sobota and Kobarid showed a similar distribution of the Chernobyl isotopes Cs-134/Cs-137 in deeper layers (only 40-50% in the first 5 cm). Samples from Ljubljana and Kobarid showed an almost uniform distribution of Cs-134/Cs-137 in all three layers, while in Murska Sobota 70% of contamination was located in the first layer, depending on local hydrometeorological and pedological characteristics. The content of Sr-90 was the same as in previous years, i.e. it was uniformly distributed in all three layers of soil.

In 1996 there was a significant decline in radioactivity in the food samples of vegetable origin. Since the contamination of vegetables with Cs-137 was mainly the foliar deposit, the content in 1996 was negligible. On the other hand, radionuclide Sr-90 may, due to its mobility, contaminate vegetables via the roots. The activity of gamma emitters and Sr-90 in fruit samples remained, with a few exceptions, at the same level as in the previous year.

The results of specific activity of gamma emitters and Sr-90 in food samples of animal origin showed that contamination with Sr-90 in 1995 did not change compared to results of the preceding year.

On the basis of measured concentrations of artificial and natural radionuclides in food samples, the effective doses from ingestion pathway were estimated. The annual dose from external gamma radiation was measured in larger towns in Slovenia. In Ljubljana, the annaul dose (measured by TLD) was 844 microSv, out of which the Chernobyl accident was estimated to be responsible for 54 microSv.

Based on the results of environmental contamination, it was established that the annual intake of artificial radionuclides in 1996 was well within the limits prescribed by the Regulations on the maximum contamination of human environment and on decontamination (Official Gazette of the SFRY, No. 8/87).

Water from the Sava river showed a high contamination with radio iodine from hospitals, so the contribution of I-131 and of other isotopes from the Krško nuclear power plant seems quite negligible.

Radioactivity of soil in Slovenia - Surface activity of Sr-90 in the top layer of the grass land (0 to 5 cm) in Bq/m^2			
Year	LJUBLJANA	KOBARID	MURSKA SOBOTA
1982	126	222	69
1983	157	161	43
1984	102	161	48
1985	107	154	56
1986*	123	680	115
1987	115	465	90
1988	120	395	84
1989	129	384	89
1990	130	335	81
1991	80	240 +	73
1992	82	255	71
1993	93	280	54
1994	77	230	70
1995	71	210	79
1996	41	155	65

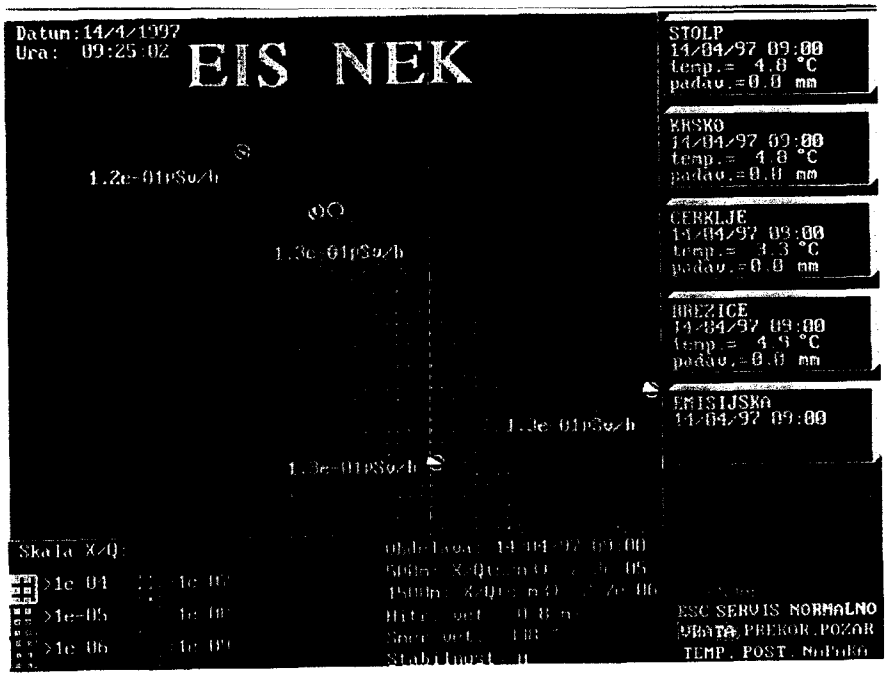
* Results are not reliable due to the presence of short-lived radio nuclides with high activity in the period following the Chernobyl accident

+ Sampling site was changed

Radioactivity of milk in Slovenia - Sr-90 concentrations in milk correlated with its specific activity in precipitations						
	Sr-90(Bq/kg) in milk		Rainfall Sr-90(Bq/m^3)		Rainfall (mm)	
Year	Ljubljana	Kobarid	Ljubljana	Bovec	Ljubljana	Bovec
1984	0.17	0.33	1.1	2	1423	2792
1985	0.19	0.33	0.9	1.9	1611	2855
1986*	0.28	0.81	450	630	1264	2137
1987	0.4	87	6.1	12	1528	3316
1988	0.22	0.53	1.8	5.3	1179	2498
1989	0.17	0.38	1.2	3.6	1212	2125
1990	0.19	0.43	0.38	1.1	1334	2865
1991	0.16	0.36	0.48	1.8	1178	2340+
1992	0.22	0.32	0.65	1.2	1434	3164
1993	0.15	0.3	1.4	1.1	1178	2343
1994	0.14	0.22	1.1	1.4	1397	2282
1995	0.12	0.22	0.43	0.6	1404	2549
1996	0.13	0.29	0.16	0.14	1443	3345

* Results are not reliable due to the presence of short-lived radio nuclides with high activity in the period following the Chernobyl accident ; + results for May 1986 not included

Radioactivity of the soil in Slovenia - External gamma radiation, Ljubljana		
Year	External gamma radiation (micro Sv)	Calc. Chernobyl contribution (micro Sv)
1988	1080	360
1989	1131	280
1990	994	220
1991	966	190
1992	975	190
1993	904	180
1994	876	146
1995	872	150
1996	844	145



Map of Cesium-137 contamination in Slovenia

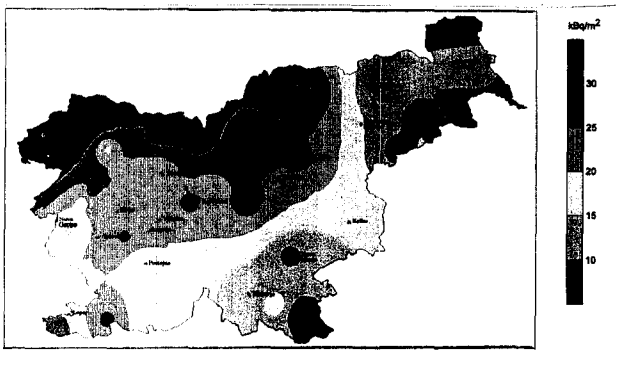
In the year 1986, immediately after the Chernobyl accident, the radioactive contamination of grassland soil was measured by the Jozef Stefan Institute. The method used was the gamma spectrometry of soil samples. On this basis, a map of Cs-137 surface contamination in the country was elaborated by the Institut for geology and geophysics.

Results showed that the highest values were measured in the Alpine areas (50-70 kBq/m^2) due to high precipitations. Typical values for the Cs-137 contamination in the central part of Slovenia were around 20-25 kBq/m^2.

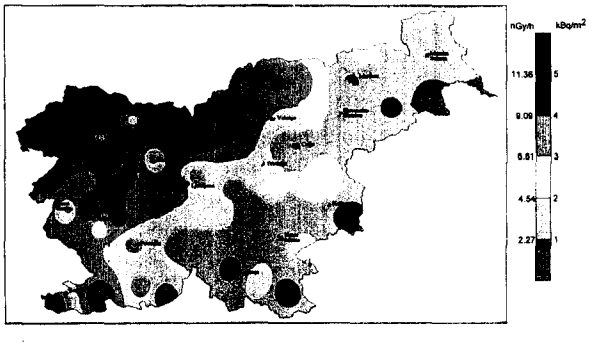
In 1996, the Cs-137 ground contamination was measured with in-situ gamma spectrometry with NaJ(Tl) detector. Ten years after Chernobyl accident the situation was obviously different from that of the year 1986. In that time there was mainly surface contamination, while in the following years a large amount of Cs-137 penetrated towards deeper layers of soil. The depth distribution of radiocaesium was not uniform and depended on the soil structure.

The results of this study showed a similar distribution of Cs-137 to those obtained ten years before. They also revealed the highest contamination in NW (Alpine) part of Slovenia and the lowest in the region of Bela krajina, the East Štajerska region and the Prekmurje and Coastal area. The main difference between the results of two studies is a factor of 2-3; the results of the last study do not reflect the real situation. One can expect 20% decrease in Cs-137 activity due to physical decay in 10 years but actual results revealed only the 40% of the remaining contamination from the year 1986. The real ground contamination (expressed in kBq/m^2) is probably twice of that presented in the study. The study gives no explanation for the missing 40% of actually deposited radiocaesium. In-situ gammaspectrometry is therefore not suitable method for delayed measurements of the Cs-137 contamination of the ground.

Regional Cs-137 surface contamination after the Chernobyl accident (1986) determined on the basis of laboratory gammaspectrometric analysis of soil samples (JSI).



The Cs-137 ground contamination determined ten years after the Chernobyl accident (1996) - on the basis of in-situ gamma spectrometry. *(Note: The results are 2-3 times lower than in previous case and do not reflect the real situation).*



CONTROL OF IONIZING RADIATION

The Health Inspectorate of the Republic of Slovenia is responsible for the control of the sources of ionizing radiation and for safety at work.

In 1996, 3788 persons were registered as being under the regular dosimetric control; 1880 in the health sector; 458 in the commerce; 889 in the Krško NPP; 31 in the Žirovski Vrh Mine; the remaining 561 persons were monitored in other institutions (Ministry of the Interior, Customs, SNSA, etc.). 2845 workers (75%) received radiation doses lower than 1 mSv; 769 workers (20%) received doses between 1 and 4.99 mSv and 174 workers (5%) received doses higher than 5 mSv but no worker received dose higher than 30 mSv. The majority of workers were from the Krško NPP performing the annual outage works, surgeons at intervention radiology, workers at industrial radiography and employees of the Institute of Oncology. Some workers at the Institute of Oncology (thirteen persons) and at the University Medical Center of Ljubljana, the Department of Nuclear Medicine (four persons) were using also thermoluminiscence dosimeters on their hands. No one received more than the allowed annual dose of 50 mSv. X – ray examinations represent a major contribution to the radiation of the population, because of the use of artificial sources of ionizing radiation.

UNSCEAR is constantly collecting data about the exposure of the population to the radiation of all sources. In 1996, Slovenia made its contribution, as well. It proved that Slovenia, in practice, does not carry out such statistics which would enable filling the questioner completely. This goes especially for medical examinations.

X - Ray in Medicine and Veterinary				
Purpose	Status in 1995	Number of New Permits	Registered Write-offs	Status in 1996
Teeth	259	+ 33	- 3	289
Mamography	15	+ 4	- 4	15
CT	9	+ 3	0	12
Therapy	5	+ 1	- 1	5
Diagnosis	270	+ 12	- 3	279
Veterinary	5	+ 3	0	8
Total	563	+ 56	- 11	608

Distribution of effective doses for all workers in Slovenia for 1996								
	Number of the Workers	Range of Doses mSv/year						
		0-0,99	1-4,99	5-9,99	10-14,9	15-19,9	20-29,9	≥30
Total	3788	2845	769	131	36	5	2	0
NPP Krško	889	485	255	119	27	3	0	0
IJS	174	151	23	0	0	0	0	0
OI	113	94	14	4	1	0	0	0
Others (ZVD)	2396	1899	477	8	8	2	2	0
Others (IJS)	216	216	0	0	0	0	0	0

Table does not include workers who received internal doses by radon and its doter elements like miners and cave guides.

REPUBLIKA SLOVENIJA
MINISTRSTVO ZA OKOLJE IN PROSTOR

UPRAVA REPUBLIKE SLOVENIJE
ZA JEDRSKO VARNOST

REPUBLIC OF SLOVENIA
MINISTRY OF ENVIRONMENT AND
PHYSICAL PLANNING

SLOVENIAN NUCLEAR SAFETY
ADMINISTRATION

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rujv@rujv.sigov.mail.si
Potrudili se bomo, da vam najdemo pot, kako priti do te informacije.

We are glad that you are browsing through the SNSA's Internet Pages. In case you would be interested in an information which is not presented, please, do not hesitate to contact:
rujv@rujv.sigov.mail.si
We shall do our best to show you the way to reach the information.