RADIOACTIVE WASTE MANAGEMENT PROGRAMMES IN OECD/NEA MEMBER COUNTRIES

SLOVENIA
[2013]

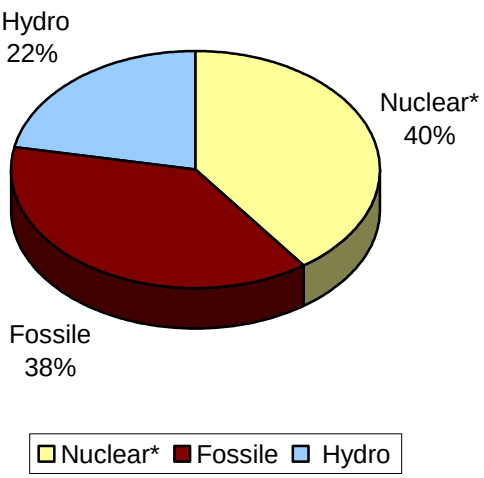
NATIONAL NUCLEAR ENERGY CONTEXT

Production of nuclear energy plays a significant role in the national electricity supply. In The Resolution on the National Energy Programme that is currently being revised (in public hearing), nuclear energy shall remain an important factor in generation of electric energy in Slovenia in the coming decades.

Electricity Production by Energy Sources 2012*

Type of Energy	Percentages (%)
Nuclear*	40
Fossile	38
Hydro	22

* only one half of the nuclear electric energy produced in Slovenia's NPP Krško is supplied to Slovenia. The other half is, based on a bilateral agreement, supplied to the Republic of Croatia.



SOURCES, TYPES AND QUANTITIES OF WASTE

Nuclear Programme

The Republic of Slovenia has a small nuclear programme: one operating nuclear power plant, one research reactor and one central storage facility for radioactive waste from small producers. In addition, there is also a uranium mine and mill in the decommissioning stage at Žirovski vrh. The geographical locations of the nuclear and radiation facilities are given in the figure below. The Republic of Slovenia has no facility for final disposal of radioactive waste or spent nuclear fuel, however the site for LILW repository has been approved.

Figure 1: Nuclear programme in the Republic of Slovenia

The Krško Nuclear Power Plant

It is a Westinghouse two-loop Pressurised Water Reactor with nominal output power 727/696 MW_e (gross electrical power/net electrical power). It started with commercial operation in 1983 and is designed to operate until the end of 2023. The designed life extension is being considered. The plant is owned by state-owned Slovenian and Croatian electrical power companies, GEN energija d.o.o. and Hrvatska Elektroprivreda d.d., respectively. It is operated by the public enterprise Krško NPP d.o.o.

The TRIGA Mark II research reactor

It is a General Atomic open-pool type research reactor with the thermal power of 250 kW. It was initially licensed in 1966, and is after re-licensing in 1991 still in operation. It is used in research projects, and to a limited extent for the production of isotopes for medicine and industry, as well as for education. It is operated by the Jožef Stefan Institute.

Use of Ionizing Sources in industry and research

At the end of 2012, 778 sealed sources were used in 84 industrial organizations, out of which 50 were declared as waste. About 25,253 radioactive smoke detectors are still in use in Slovenia. Due to their replacement with optical smoke detectors, annually about 1,500 are dismantled and declared as radioactive waste.

Use of Ionizing Sources in medicine

Seven hospitals and clinics in Slovenia use unsealed sources (radiopharmaceuticals) for diagnostics and therapy in nuclear medicine. Altogether about 11 TBq of short-lived open source isotopes were applied for diagnostics and therapy in 2012. Most of the generated radioactive waste was stored for decay and disposed of on the municipal waste disposal sites.

Radioactive waste in Slovenia at the end of 2012

Spent Nuclear Fuel

- The Krško Nuclear Power Plant

  Spent fuel is stored in the spent fuel pool inside the Fuel Handling Building of the Krško NPP. In 2003, a project of increasing the storing capacity of the spent fuel pool (reracking) was completed. After the reracking, 1694 storage locations are available for spent fuel. The storage capacity is sufficient for the planned lifetime operation until the year 2023. In 2012 1,041 locations were occupied with nuclear fuel, out of which 849 are spent fuel elements.

- The TRIGA Mark II research reactor

  In 1999 all spent fuel elements (219) were returned to the USA. The total number of the remaining fuel elements (irradiated and fresh) at the reactor is 84.

Low and Intermediate Level Waste

- The Krško Nuclear Power Plant

  - The Krško NuclearPowerPlant in the Solid Radioactive Waste Storage Facility the operational waste, such as ashes from incineration, blow down resins, compressible waste, evaporator bottom,

filters, super-compacted waste, and spent resins, is stored in several types of drums. Due to volume reduction campaigns, various waste forms were produced by means of super-compactions, incineration and melting. By the end of 2012, 3,824 drums were in store with total volume of 2,261 m^3, net weight of 2,689 t and total activity of 20.4 TBq.

- In theDecontaminationBuilding, built in 2000, two old steam generators and approximately 60 other bulk items, such as heat exchangers, reactor head, concrete blocks, insulation, valves, scrapiron, ingots, pipes, lead blankets, and other items are stored. The total volume and mass are 983 m3 and 1,005 t respectively..

- Central Interim Storage for Low and Intermediate Level Waste

  In the Central Storage for Radioactive Waste in Brinje, low and intermediate level radioactive waste arising from medical, industrial and research applications is stored. At the end of 2012, there were 742 packaging units: 418 packages of solid wastes, 6 packages of miscellaneous wastes, 152 packages with sealed sources and 166 packages with ionization smoke detectors. At the end of 2012, the total activity of the 89.1 m3 of waste stored was estimated at 3,1 TBq.

- Žirovski vrh Uranim Mine

  The Žirovski vrh Uranium Mine was in operation in the period from 1984 to 1990. Its lifetime production was 610,000 tons of ore, from which 452.5 tons of U_3O_8 was produced. The resulted wastes were disposed of on the mine and mill tailings. On the mine tailing the total volume of disposed material is 1,198,900 m^3 with total activity of 21.7 TBq. On the mill tailing 415,543 m^3 of material is disposed of. The majority of this (339,000 m^3) is hydro-metallurgical waste with total activity of 48.8 TBq. Remediation is almost finished. In order to minimise radon exhalation, the surfaces of both sites are covered with an about two-meter thick layer of inert material.

RADIOACTIVE WASTE MANAGEMENT POLICIES AND PROGRAMMES

Waste management policy

The waste management policy in the area of safety of spent fuel management and safety of radioactive waste management is demonstrated through the adoption of legislation and international agreements and measures, such as:

- Establishment and functioning of the regulatory body, the Slovenian Nuclear Safety Administration (SNSA), which is competent in the area of nuclear and radiation safety and radioactive waste management. It was established in 1987. Previously, the functions of the regulatory body were held by the Committee of Energy and Industry.

- Establishment of the ARAO as a state-owned public institution for radioactive waste management (1991).

- Establishment of the Žirovski vrh Mine d.o.o., a public enterprise for the decommissioning of the uranium production site (1992).

- Establishment of the Fund for the Decommissioning of the Krško NPP (1995).

- The Resolution on the National Energy Programme, adopted by the Slovenian Parliament in 2004 (currently under revision).

- The Agreement between the Government of the Republic of Slovenia and the Government of the Republic of Croatia on the Regulation of the Status and Other Legal Relations Regarding the Investment, Exploitation and Decommissioning of the Krško NPP (hereinafter the Agreement). According to the Agreement:

  - Decommissioning of the Krško Nuclear Power Plant and management of its radioactive waste and spent fuel are a joint responsibility of the contracting parties, and they should ensure efficient common solutions both from the economic and environmental protection standpoints.

  - If the contracting parties do not reach agreement on a joint solution for RW and SF management during the lifetime of the Krško NPP, they undertake that two years after that period they must finish removal of operational RW and SF from the location of the Krško NPP (one half by each party) and will individually bear the costs of their management (including subsequent division and removal of RW from decommissioning).

  - The contracting parties shall in equal shares assure funds for the preparation of the decommissioning programme and its execution and the funds for the preparation of the programme for the disposal of radioactive waste and spent fuel. If the contracting parties agree on a joint solution for the disposal of radioactive waste and spent fuel they shall finance it in equal shares or they shall finance their shares of activities.

  - The Republic of Slovenia and the Republic of Croatia shall jointly prepare and approve a new plan for decommissioning of the Krško NPP and disposal of LILW and high level waste (hereinafter the Decommissioning Plan).

  - The Croatian party has, according to the Agreement, established its own fund for the management and collection of financial resources for its share of decommissioning and radioactive waste disposal costs.

- The Slovenian Parliament adopted in 2006 the Resolution on the National Programme for Managing Radioactive Waste and Spent Nuclear Fuel. According to the Resolution:

  - After termination of NPP Krško operation, the spent fuel will be transferred to dry storage for a period of about 35 years, when the spent fuel repository should be operable.

  - The LILW waste repository shall be built in Slovenia. The design of the repository should be modular, with sufficient capacity to accommodate all future LILW waste arising in Slovenia.

  - The Triga Mark II research reactor shall continue to operate until 2016. The spent fuel will be returned to the country of origin.

  - The waste stored at the Central Storage for Radioactive Waste in Brinje and the waste from small producers, meeting the waste acceptance criteria, shall be disposed of in the LILW repository. The remaining waste from the Central Storage for Radioactive Waste in Brinje shall be stored at the facilities of the repository, if agreement on this issue is reached with the local community.

Spent nuclear fuel management

The spent nuclear fuel generated by the NPP Krško is stored in the reactor spent fuel pool, which has sufficient capacity for spent fuel arising until the designed life time of the NPP. The spent fuel is managed under the operating license of the NPP Krško. At the research reactor TRIGA Mark II there is no spent fuel.

Low and intermediate level waste management

- The LILW generated by the NPP Krško is stored in the Solid Radioactive waste Storage Facility and is managed under the operating license of the NPP Krško. Due to almost exhausted storage capacity, the NPP applied several volume reduction campaigns: incineration, melting, super-compaction, decontamination and in-drum drying of liquid waste. Through these processes relatively many waste forms were generated. In order to assure enough storage space for solid LILW, the NPP is working on some transitional measures until operation of the LILW repository is assured.

- The LILW generated in industry, medicine and research (including that of the TRIGA research reactor) is stored in a central storing facility for radioactive waste located in Brinje near Ljubljana. The construction of the facility started in 1984 and it was put into operation in 1986. It is operated by the Agency for Radwaste Management (ARAO). Major refurbishment of the storage was finished in 2004. After trial operation the ARAO obtained the operating license from the SNSA. The repacking and conditioning of waste was performed in steps over several years in the nearby hot cell facility at the Jožef Stefan Institute. All non-radioactive material, empty packages, and waste which already decayed below clearance limits were exempted from storage. The volume of the LILW was reduced by approximately 30 %.

Programmes and projects

- Siting of the LILW repository

  One of the mayor achievements in the area of radioactive waste management is approval of the Vrbina site (Krško municipality) for the LILW repository. Based on the consent of the Municipality Council of Krško, the Government approved the site by decree at the end of 2009. After about two decades of efforts to get a location for LILW repository in Slovenia, siting process, led by the ARAO, was successfully completed in five years period 2004 - 2009. Considerable effort and attention were devoted to communication with stakeholders, both local communities, non-governmental organisations and others.

  The preliminary design of the repository project is completed and verified thru corresponding safety analyses and waste acceptance project. Significant inputs in the ongoing activities are findings and recommendations of the numerous international peer reviews and expert missions. Investment program was prepared and submitted to the responsible ministry. Approval from the ministry is required to continue with the project development. The investment program describes technical, financial and scheduling aspects of the repository project. The project is progressing at a slower pace as it should. Governmental elections, lack of coordination between involved ministries and overall weak support to the project may jeopardise the project continuation and challenge the capabilities of safe management especially of LILW at Krsko NPP on long term.

RESEARCH AND DEVELOPMENT

The Ministry of Higher Education, Science and Technology financially supports research and development projects in the field of nuclear safety in the Republic of Slovenia through a research fund, with the participation of the nuclear industry, the ARAO and the SNSA. The staff of the technical support organisations participate in the R&D of the EU research project and other international projects. The engineering and technical support and expertise are assured also through outsourcing at Slovenian research and engineering organisations or from abroad.

DECOMMISSIONING POLICIES AND PLANS

- Krško NPP

The Agreement between Slovenia and Croatia on the Krško NPP of 2003 requires preparation of a Decommissioning Plan for the Krško NPP by the Slovenian and Croatian agencies for the management of radioactive waste. In accordance with the Agreement a Review of the "Programme for the Decommissioning of the Krško NPP and Disposal of Low and Intermediate Level Waste and Spent Fuel" was prepared in April 2004. Revision 2 of the Decommissioning plan started in September 2008, with the purpose to incorporate relevant developments since the first revision, to improve the level of details and reliability of the decommissioning plan, and to provide updated and more accurate cost estimates and appropriate financing models. The second revision of the decommissioning plan was prepared. The document is still under discussion and pending for approval by intergovernmental commission. According to current information the levy per kWh (0,3 Euro cent) shall be increased and will be sufficient to cover the decommissioning costs

The Slovenian share of assets for decommissioning of the Krško NPP is collected and managed by the Fund for Decommissioning of the Krško NPP.

As the decommissioning of the Krško NPP will take place after the year 2023, it is assumed that the Krško NPP staff will perform decommissioning together with external contractors.

- Jožef Stefan Institute Reactor Infrastructure Centre

  A research project estimating the quantity and composition of LILW material resulting from dismantling was carried out and the Decommissioning Plan for the reactor prepared in 2007. The IJS decided to operate the reactor until 2016 and to ship all spent fuel (presumably 84 fuel elements) to the US within the scope of the "US originating fuel repatriation program" by 2019. The reactor will be decommissioned after the year 2020. It has been estimated that not more than 50 tons of LILW would be produced in decommissioning. The Decommissioning Plan will be revised during the Periodic Safety Review, which started in the year 2011.

- Žirovski vrh Uranium Mine

  Safety of remediation of the Jazbec mine waste pile and the Boršt mill tailings site is ensured through licensing and regulatory supervision. Both tailings and appropriate surrounding land shall become the property of the Government, who shall assure long-term monitoring and finance remedial actions when needed.

- Central Storage for Radioactive Waste in Brinje

No detailed plans have been adopted so far for the decommissioning of the Central Storage for Radioactive Waste in Brinje. There is a general chapter in the Safety Report for the Central Storage Facility which indicates possible approaches to decommissioning of the facility. According to the National Programme for Managing Radioactive Waste and Spent Nuclear Fuel, the short lived radioactive waste meeting the acceptance criteria for LILW disposal shall be disposed of in LILW repository. Long lived waste will be moved to the LILW disposal facility location for storage, if agreement with local community will be reached. The Central Storage for Radioactive Waste in Brinje will then be decommissioned.

REGULATORY AND IMPLEMENTING ORGANISATIONS

Regulation and Licensing

The main Act of the Republic of Slovenia in this area is the Ionising Radiation Protection and Nuclear Safety Act of 2002 (as amended in the years 2003, 2004 and 20011). Based on this Act, 6 Governmental decrees and 21 rules prescribed by pertinent Ministers were issued. Almost all of them are relevant also to radioactive waste management.

By the Act of 2002, the authorities and responsibilities are assigned to the Ministries responsible for environment, health, agriculture and the interior. The majority of administrative functions are assigned to the Slovenian Nuclear Safety Administration and to the Slovenian Radiation Safety Administration. The latter mainly deals with the use of radioactive sources in medicine and occupational radiation exposure. The Ministry of the Interior has major responsibilities in the area of physical protection of nuclear material.

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

- Decree on Establishment of a Public Agency for Radwaste Management,
- Decree on the Method and Subject of and Conditions for Performing a Public Utility Service of Radioactive Waste Management,
- Act Governing the Fund for Financing Decommissioning of the Krško Nuclear Power Plant and Disposal of Radioactive Waste from the Krško NPP,
- Act on Permanent Cessation of Exploitation of the Uranium Ore and Prevention of Consequences of Mining in the Uranium Mine at Žirovski vrh.
- The Agreement between the Government of the Republic of Slovenia and the Government of the Republic of Croatia on the Regulation of the Status and Other Legal Relations Regarding the Investment, Exploitation and Decommissioning of the Krško NPP

Besides the above mentioned legislation and authorities, the provisions of other national legislation should be fulfilled in the particular areas of environment and health protection. The laws on environment protection and civil protection, together with relevant authorities, play an important role in the process of siting, construction and decommissioning of facilities.

FINANCING

The licensing and regulatory activities are financed through the annual national budget. The NPP Krško finances its operational radioactive and SF management from its income.

The polluter pays principle is in force in Slovenia. All small radioactive waste producers have to transfer their radioactive waste to the ARAO and to pay reduced price for the further steps of radioactive waste management. After transfer, the financial liability rests with the ARAO. Besides this, the ARAO is partially financed through the national budget through the Ministry of Economy. The activities of ARAO related to the future repository for LILW are financed both, from the below mentioned Slovenian decommissioning fund and state budget.

Based on levy per KWh, the NPP Krško is contributing the Slovenian share of cost to the Slovenian Fund for Financing Decommissioning of the Krško Nuclear Power Plant and Disposal of Radioactive Waste from the Krško NPP. The Croatian share of the cost shall be, according to the bilateral agreement, financed from the adequate fund established in Croatia.

The activities related to the remediation of the Žirovski vrh uranium mine are financed by the government through the budget of the Ministry of the Environment and Spatial Planning.