

PREPARATION OF NATIONAL PROGRAMME FOR SPENT FUEL AND RADIOACTIVE WASTE MANAGEMENT TAKING INTO ACCOUNT THE POSSIBLE FUTURE EVOLUTION OF ERDO (EUROPEAN REPOSITORY DEVELOPMENT ORGANISATION)

IZZIVI VKLJUČITVE EVOLUCIJE ERDO (EVROPSKA ORGANIZACIJA ZA RAZVOJ SKUPNEGA ODLAGALIŠČA) V PRIPRAVO NACIONALNEGA PROGRAMA RAVNANJA Z RADIOAKTIVNIMI ODPADKI IN IZRABLJENIM GORIVOM

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Abstract

According to Council Directive 2011/70/Euratom establishing a Community framework for the responsible and safe management of spent fuel and radioactive waste (Waste Directive), each European Union member state shall ensure the implementation of its national programme for the management of spent fuel (SF) and radioactive waste (RW).

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On 1 February 2006, the Parliament of the Republic of Slovenia passed the Resolution on the 2006–2015 National Program for Managing Radioactive Waste and Spent Nuclear Fuel (Official Gazette of the Republic of Slovenia, No. 15/2006), which expired at the end of 2015. In March 2016, the Slovenian government adopted reviewed national programme, which sets out general activities related to SF and RW management for all radiation and nuclear facilities in Slovenia for the next ten years (2016–2025) in the fields of low-level and high-level waste management.

Like some other European countries, Slovenia operates a small nuclear fleet and can be expected to generate relatively small amounts of spent fuel. For such a small program, the financial and human resources required to develop a national geological disposal facility (GDF) may not be feasible or economically practical within the framework of the open and connected markets of European Union. A multinational repository that would accept spent fuel or waste packages from such countries could present a potential solution for disposal challenges. In the European Commission, this idea was recognised some years ago and was developed through two SAPIERR preparatory projects and is now being further promoted through a Working Group on the European Repository Development Organization (ERDO-WG).

This paper presents an approach how to incorporate this multinational/regional developments in the field of SF management in the national programme through a dual-track approach.

Povzetek

Vse države članice Evropske Skupnosti so v skladu z Direktivno Sveta 2011/70/Euratom (poznano pod imenom direktiva o radioaktivnih odpadkih) obvezane implementirati lastne nacionalne programe ravnanja z izrabljenim gorivom (IG) in radioaktivnimi odpadki (RAO). Parlament Republike Slovenije je prvo resolucijo o nacionalnem programu o ravnanju z RAO in IG za obdobje 2006-2015 sprejel že 1. februarja 2006 (skoraj 5 let pred omenjeno direktivo). Veljavnost prve resolucije se z letom 2016 izteka, zato je Vlada RS v marcu 2016 v postopek potrditve poslala novo resolucijo z nacionalnim programom ravnanja z RAO in IG za obdobje 2016-2025.

Pri pripravi strokovnih podlag za novo resolucijo smo se soočali z izzivom, kako v nacionalni program ravnanja z IG vključiti razvoj na področju mednarodnih oziroma regionalnih odlagališč izrabljenega goriva in visoko-radioaktivnih odpadkov. Slovenija ima podobno kot še nekaj evropskih držav, majhen jedrski program, v katerem bodo nastale majhne količine izrabljenega goriva. Za takšne majhne količine IG pa so človeški in finančni viri potrebni za razvoj globokega geološkega odlagališča za odlaganje IG skoraj neodvisni od količine odloženega materiala. Skupno mednarodno ali regionalno odlagališče IG bi za takšne programe pomenilo velike ekonomske, varnostne in praktične prednosti, posebej v luči enotnega in povezanega trga držav Evropske Skupnosti.

Ideja regionalnega odlagališča visoko-radioaktivnih odpadkov in IG je bila prepoznana v okviru projektov SAPIERR in jo sedaj naprej razvija delovna skupina držav članic ERDO-WG; European Repository Development Organization Working Group (delovna skupina za razvoj organizacije evropskega odlagališča).

V prispevku je predstavljen vzporedni pristop k obravnavi razvoja nacionalnega odlagališča in razvoja organizacije skupnega odlagališča v nacionalnem programu ravnanja z RAO in IG.

1 INTRODUCTION

Slovenia has a small nuclear program: it owns one nuclear power plant in co-ownership with Croatia in a 50:50 share located in Krško (Krško NPP), operates one research reactor (TRIGA) and central interim storage facility for radioactive waste from small producers (medicine, industry and research) both at same location Brinje near capital Ljubljana, has one approved location for low and intermediate radioactive waste repository and one closed and remediated uranium mine and mine tailings repository at the Žirovski vrh uranium mine. In Slovenia all spent and fresh nuclear fuel is located only at reactor sites. Irradiated fuel in the Krško NPP is either loaded in the core or stored in spent fuel pool. All irradiated fuel in TRIGA is currently loaded in the reactor itself, [1][2].

Current international and national regulatory and legal frameworks in all European countries require a national programme for managing radioactive waste and spent fuel. The main goal of these programmes is not only to fulfil legal requirements but to ensure safe and efficient management of radioactive waste (RW) and spent fuel (SF). The ultimate goal of radioactive waste management programmes and plans is to provide for the safety of people and the environment at all times, simultaneously to the implementation of long-term, technologically modern and rational infrastructure support to all users of nuclear and radiation technologies.

In Slovenia, the national programme is adopted in the form of a resolution. The resolution proposal is prepared by the competent ministry. After the public consultation process, the resolution will be approved first by the government and later also by the national parliament. Moreover, this procedure is repeated every 10 years.

In its history, Slovenia has adopted several strategic documents related to RW and SF management. In 1996, the first Strategy on SF management was accepted with some general direction regarding how to manage all SF. The strategy for NPP Krško fuel was superseded in 2004 due to the Bilateral Agreement on the status and other legal issues related to the investment, exploitation, and decommissioning of the NEK (Bilateral Agreement between Croatia and Slovenia on NEK). Almost at the same time, Slovenia was also joining the EU. In this process, its legal system was harmonized with EU directives, which resulted in adopted nuclear acts. After this, in 2006, Slovenia approved the Resolution on radioactive waste and SF management for the 2006–2015 period which included all relevant topics for the management of the radioactive waste and spent fuel, from the legislation and identification of different waste streams in Slovenia, to the management of radioactive waste and spent fuel, the decommissioning of nuclear facilities, and the management of naturally occurring radioactive materials, [2][3].

In 2016, Slovenia is approving the next revision of the national plan: the Resolution on radioactive waste and spent fuel management for the 2016–2025 period. This document incorporates several relevant changes that influence RW and SF management plans which took place since 2006. It was adopted by the Slovenian government in March 2016 and sent to Slovenian parliament for final approval, [4].

2 THE PROPOSED CONCEPTS OF REGIONAL AND INTERNATIONAL COOPERATION REGARDING RADIOACTIVE WASTE MANAGEMENT

The idea of regional and international cooperation regarding RW management is not new and has its roots in the previous century. Over 50 countries currently have spent fuel stored in temporary locations, awaiting reprocessing or disposal. Not all countries have the appropriate geological conditions for such disposal; for many countries with small nuclear programs, the financial and human resources required for the construction and operation of a geological disposal facility are daunting, [5][6].

The need for country assistance in arranging their cooperation for shared facilities was widely recognised by the international organisations such as the International Atomic Energy Agency (IAEA), the Nuclear Energy Agency (NEA) within the Organisation for Economic Co-operation and Development and it was recognised recently also within The International Framework For Nuclear Energy Cooperation (IFNEC), [7].

In 2003, Dr Mohamed El-Baradei, Director-General of the IAEA told the UN General Assembly that multinational approaches to the management and disposal of spent fuel and radioactive waste should be considered and concluded that “considerable advantages in cost, safety, security and non-proliferation would be gained from international cooperation in these stages of the nuclear fuel cycle”, [6].

With respect to the implementation of the Waste Directive in the EU, the Member States with advanced programmes can meet the requirements on their own, but those with slower-paced or less-advanced disposal programmes face particular challenges in doing so. By cooperating in a regional grouping, countries could develop a common programme for addressing many of the requirements of the Waste Directive, [7].

In Europe, the European Commission (EC), recognizing that less advanced countries need assistance in arranging their cooperation, funded two preparatory projects, SAPIERR I and II, aimed at studying the technical, financial, organisational and legal issues involved in preparing for implementation of shared facilities. Following SAPIERR II, a Working Group on the European Repository Development Organisation (ERDO-WG) was established in 2009. The ad-hoc ERDO-WG was established with support at the government level offered from nine Member States and is operated as a self-funded group. Slovenia is represented in ERDO Working group by the decision of the Ministry competent for energy by ARAO, which has been (from the beginning of the activities) involved in related communication and is providing a public service of radwaste management in Slovenia, [7].

3 THE ERDO-WG INITIATIVE

ERDO-WG is a multinational working group that is investigating the feasibility of implementing regional solutions for the safe management and disposal of long-lived RW. The group is studying the feasibility of setting up a European Repository Development Organisation (ERDO) that would implement one or more shared geological repositories in Europe. The secretariat of the group is currently managed by the national waste agency of the Netherlands (COVRA) and by

the Arius Association, which covers international cooperation in waste management for the rest of the world, [8].

Important goals of the ERDO-WG are to exchange information, to build up competence and to promote the concept of shared repository development as a complement to the national facilities being developed. ERDO-WG is promoting a volunteer model including a bottom-up approach with stakeholder involvement at all stages. Clearly unsuitable regions for the storage or disposal of RAW are excluded at the start of the selection process for the location, [8].

The benefits of an ERDO to partner countries should be felt at local, national and international level, [7]:

Internationally

- increased national visibility and influence in addressing a widely acknowledged issue of global environmental protection and nuclear security
- contributing to Europe-wide investment savings of several billions of euros
- increased influence in European and international agencies dealing with nuclear energy and nuclear safety
- increased influence on suppliers of nuclear technologies and fuels

Nationally

- a clear demonstration of a credible approach to responsible management of national radioactive wastes
- reduced R&D burden
- increased, pooled resources to develop a realistic and timely solution
- significant economic incentives and infrastructure improvements to the host country
- access to wider skills and technology

Locally

- involvement in modern, stakeholder-led approaches to solving environmental problems
- increased influence of local host communities in national environmental decision-making
- substantial economic and infrastructure benefits to the host communities, both today and for many decades to come

The credibility of the shared solution approach is established through the operation as a self-funded group, but experience in recent years has shown that even the modest financial input needed to finance an ERDO-WG secretariat and attendance at group meetings has proven to be an insurmountable obstacle for some Member States. A stable funding regime for the continuing work is required. For this purpose, ERDO-WG prepared a COMS-WD proposal searching for direct partial funding by the EC for coordination work and supporting actions regarding waste directive implementation for less advanced Member States, [9]. On that basis, the focus has lately changed from more technical questions to discussion how to encourage further ERDO-WG visibility at the European and national level. ERDO-WG activities should go beyond research and address general shared responsibilities and the need for improved communication with carefully selected target audiences and addressing more political levels

including the European Council, the European Energy Forum (EEF) in the European Parliament, EC staff, the Committee of Regions, and national governments and parliaments.

4 IMPLEMENTATION OF NATIONAL PROGRAMME AND COMPLIANCE OF REGIONAL INITIATIVES

According to Article 11 of the Waste Directive, each member state shall ensure implementation of its national programme, including all phases of the management of SF and RW, from generation to disposal. The disposal of RW and SF (if not considered to be a usable resource that can be reprocessed) in another MS or a 3rd country is allowed according to the Article 4 (4). The articles of the Waste Directive do not explicitly allow or prohibit shared responsibility between the Member States in the case of a regional initiative. In the framework of Recital 33, which recognizes a potentially beneficial consideration of some MSs towards the sharing of facilities for SF and RW based on an agreement between the MSs, they are allowed to form a regional initiative concerning these questions. The principle is implemented in Article 12 (k), which accepts agreements with a member state or a 3rd country on the management of SF or RW as part of the national programme, [7].

Member States shall ensure the implementation of their national policies from generation to the disposal of RW; and even after if long-term monitoring of disposal facility is required. Solely regional or international solutions fulfil the requirements of the Waste Directive when *inter alia* an agreement between the exporting member state and country of destination has been signed, and the exporting member state takes reasonable measures to be assured that the disposal facility in the country of destination is authorized for the radioactive waste to be shipped and is operating prior to the shipment. What such reasonable measures are depends on the interpretation. Nevertheless, it is clear that country shall have at least a confirmed location with a building permit for the disposal with clear plans, technical solutions, milestones and public acceptance, [7].

However, to cover all the uncertainties and possibility of failure of the regional initiative, the dual-track approach is practically necessary at the moment to gain credibility of the regional initiative.

5 THE DUAL TRACK APPROACH

Experience shows that in every national programme, the route to an operational disposal facility is long and beset with uncertainties, and any specific initiative could end in failure. The same must be acknowledged for a shared disposal facility. Consequently, Member States interested in sharing need to explore national solutions in parallel to supporting a shared solution. This has become known as the “dual-track approach” and, although it is not a specific requirement of the Waste Directive, it is considered to be a necessary feature to underpin the credibility of the ERDO model, [7].

Countries with small amounts of SF and RW and without nuclear power and its associated infrastructure and knowledge base will find it extremely difficult to develop all the components of a necessary disposal facility programme. Economic considerations must also come into play in such cases, even though they cannot override safety requirements or legal obligations. The

dual-track approach must thus be able to accommodate participating countries with very different nuclear infrastructures and radioactive waste inventories, [7].

The principles of the dual-track approach in reference to membership of the ERDO can be stated as follows, [7]:

- Participating countries should develop, maintain, and promote knowledge and expertise in the safe management of radioactive wastes (requirement of the Waste Directive and the Joint Convention)
- The minimum level of activity required to maintain a continuing national expertise in some aspects of geological disposal, including supporting a minimum level of academic or institutional research.
- Participating countries with wastes from nuclear electricity generation programmes are expected to have an active parallel national disposal programme on their own territory and are expected to operate this programme in an interactive and complementary manner to the ERDO programme.
- All participating countries will thus contribute in varying measure to shared knowledge and will receive the benefit of shared R&D and technology development for all aspects of their national radioactive waste management programmes.

6 NATIONAL RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT PROGRAMME FOR THE 2016-2025 PERIOD (RENPROG 2016-2025)

The Resolution on the 2006–2015 National Programme for Managing Radioactive Waste and Spent Nuclear Fuel expired at the end of 2015. The process of approval for a new revision is currently underway in Slovenia. Based on several technical inputs and background documents (including technical basis for the revision prepared by ARAO) the competent ministry (Ministry of the Environment and Spatial Planning) prepared a draft Resolution on the 2016–2025 National Programme for Managing Radioactive Waste and Spent Nuclear Fuel (ReNPROG 2016-2025) that successfully passed a public consultation process. The document was approved by the Slovenian government in March 2016 and was sent to Slovenian parliament for final approval.

In ReNPROG 2016-2025, draft various SF and HLW solutions are implemented, which include options for long-term storage and different options for fuel reprocessing and final disposal in a geological repository either national, regional or multinational, [10].

The idea of shared facilities and regional cooperation in waste management for the EU Member States with small or no nuclear programme, including the dual track approach, was implemented in the draft of the document. For long-term spent fuel management, a dual-track strategy has been adopted as a reasonable solution in the present situation. The option of multinational disposal is kept open, and the basic reference scenario for geological disposal has been developed, assuming the disposal of spent fuel in 2065.

First, shared responsibility and the opportunity to safely and sustainably resolve issues related to radioactive waste and spent fuel management together with other countries was

implemented in the general policy on management of radioactive waste and spent fuel, in which the principle of international cooperation regarding radioactive waste and spent fuel was included.

This principle states that actions of Slovenia regarding shared responsibility and the opportunity for safe and sustainable solutions related to radioactive waste and spent fuel management should take into account the principles adopted in the Resolution and policy and regional and international agreements. National responsibility for radioactive waste and spent fuel management is considered in parallel with active participation in international, regional efforts to make progress in connection with joint regional programmes on disposal, [10].

The strategy and programme of radioactive waste and spent fuel management for SF and HLW storage and disposal summarize in one part international status of some countries which are introducing long-term storage of SF and HLW. Associated reasons for such a decision include monitoring of international development for the safe and efficient handling of SF and the intention to use advanced methods for processing SF and the benefits due to radioactive decay and the reduction of the residual heat of fuel. During long-term storage, the gathering and refinement of financial assets in the fund shall continue, together with the monitoring of the development of multinational or regional deep geological repositories, [10].

In the end, all SF and HLW management options require a solution in the form of deep geological disposal of SF or HLW. The proposed resolution RENPROG 2016-2025 introduces a proposal for all irradiated and spent fuel owners to evaluate also a possibility of reprocessing and reusing spent fuel as an option that could significantly reduce the volume and radiotoxicity of waste for final disposal, [11]. The construction of deep geological disposal (national, regional, or multinational) is a necessary solution regardless of the selected option for storage, processing, and other forms of SF and HLW management, [11][10].

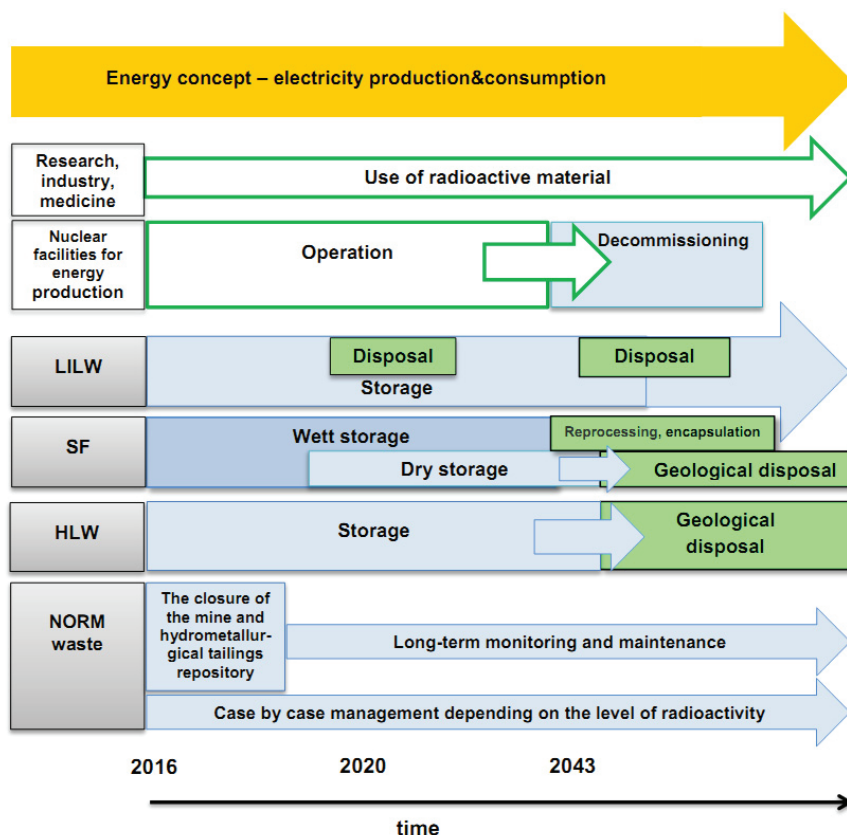


Figure 1: Schematic representation of the national RW and SF management strategy. The national programme of radioactive waste and spent fuel management is developed as an infrastructure program. RW and SF management strategy correlate to other national programmes and strategies in the fields of economy, research, and energy, [10].

The reference scenario for a national repository in suitable solid rocks is proposed; however, the possibility of discussion for a multinational repository also remains open with the dual-track strategy approach. Slovenia is a member of the European Repository Development Organisation Working Group (ERDO-WG), which brings together a group of EU countries with the aim of considering the model for the development of shared solutions for the Member States. The main reason for the cooperation and integration in this area is the extremely small nuclear programme in the Republic of Slovenia; with the participation in joint or shared programmes significant positive economic effects can be achieved, [10].

7 CONCLUSIONS

ARAO is a Slovenian waste management organization considering long-term waste management planning including long term SF management strategies. The planning has to consider all relevant aspects, including geological, financial, technical, and human resource factors. Some of these factors are especially limiting for a deep geological facility for Slovenia's very small nuclear program. In this respect, ARAO also considers the progress in international and regional efforts in the field of shared or regional disposal solutions. Slovenia is not alone because many countries operate or will operate small nuclear fleets and can be expected to generate relatively small amounts of spent fuel over the life of their programs. For some of these countries the financial, technical, and human resources limitation may hinder the potential to develop, construct, and operate a GDF. A multinational repository approach that would accept spent fuel or waste packages from such countries could provide a solution for their back-end management and disposal challenges. However, planning a long-term spent fuel policy based only on a yet multinational approach is not a viable solution. For those countries, a dual-track approach to long-term GDF planning option is a potential solution to short term planning needs.

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Nomenclature

ARAO	Slovenian Radioactive Waste Management Organization
COMS-WD	A new proposal for cooperation between the EU Member States responding to the EC Waste Directive
COVRA	National waste agency of the Netherlands
EC	European Commission
EEF	European Energy Forum
ERDO-WG	European Repository Development Organisation Working Group
ERDO	European Repository Development Organisation
GDF	Geological Disposal Facility
HLW	High-Level Waste
IAEA	International Atomic Energy Agency
IFNEC	The International Framework For Nuclear Energy Cooperation
LILW	Low and Intermediate Level Waste
MS	Member States
NEK	Nuklearna Elektrarna Krško
NORM	Naturally Occurring Radioactive Materials
NPP	Nuclear Power Plant
ReNPROG	RESOLUTION on the 2016–2025 National Programme for Managing Radioactive Waste and Spent Nuclear Fuel
RW	Radioactive Waste
R&D	Research&Development
SAPIERR I	Support Action: Pilot Initiative for European Regional Repositories
SNSA	Slovenian Nuclear Safety Authority
SF	Spent Fuel
UN	United Nations