

EXPERIENCE OF DEVELOPING AND SITING A NEAR SURFACE REPOSITORY IN LITHUANIA

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SUMMARY

In this paper the experience of establishing a near surface repository in Lithuania is presented. During preparation for the decommissioning of Ignalina NPP the Lithuanian radioactive waste management agency (RATA) started plans for the establishment of an NSR. The role of an independent waste disposal organization is underlined in the proper planning of a waste management system at a national level. A reference design for an NSR is described and the criteria used for identification of prospective sites for detailed site investigations are discussed in the paper. It is shown that public acceptance and good relations with neighboring countries are no less important than geological criteria in selecting the site for an NSR. Negotiations with Belarus and Latvia in accordance with international conventions and gaining acceptance from local communities were the key factors in the final decision for selecting the site for an NSR. An international peer review by the IAEA of the major steps in this process and its importance for the approval by the Lithuanian authorities and in international discussions is emphasized as well. The review team of the IAEA concluded that the process of site selection was conducted according to international good practice. Taking all aspects into account the Lithuanian Government in November 2007 confirmed Stabatiškė site in the vicinity of Ignalina NPP as a site for construction of an NSR. Finally funding estimates and procedures for design and construction of an NSR are outlined.

1. CREATION OF A WASTE MANAGEMENT ORGANIZATION AND IT'S ROLE IN NEAR SURFACE REPOSITORY ESTABLISHMENT

1.1. Foundation of the radioactive waste management agency

The Radioactive Waste Management Agency (RATA) was established in 2001 for disposal of radioactive waste generated by the Ignalina NPP during operation and decommissioning. RATA is also involved in the collection, processing and disposal of waste from research, medicine and industry. The creation of RATA as a waste disposal organization was defined in the Law on the management of radioactive waste [1]. Article 13 of this law describes the main functions of RATA:

- the principal objective of RATA shall be to manage and dispose all radioactive waste transferred to it, assuring nuclear safety and radiation protection;
- RATA shall be the operator of storage facilities and repositories assigned to it.

Following the best practices in the European Union and recommendations of the International Atomic Energy Agency (IAEA), Lithuania separated waste disposal from waste generation and established a classic triangle for the safe management of radioactive waste (Fig.1).

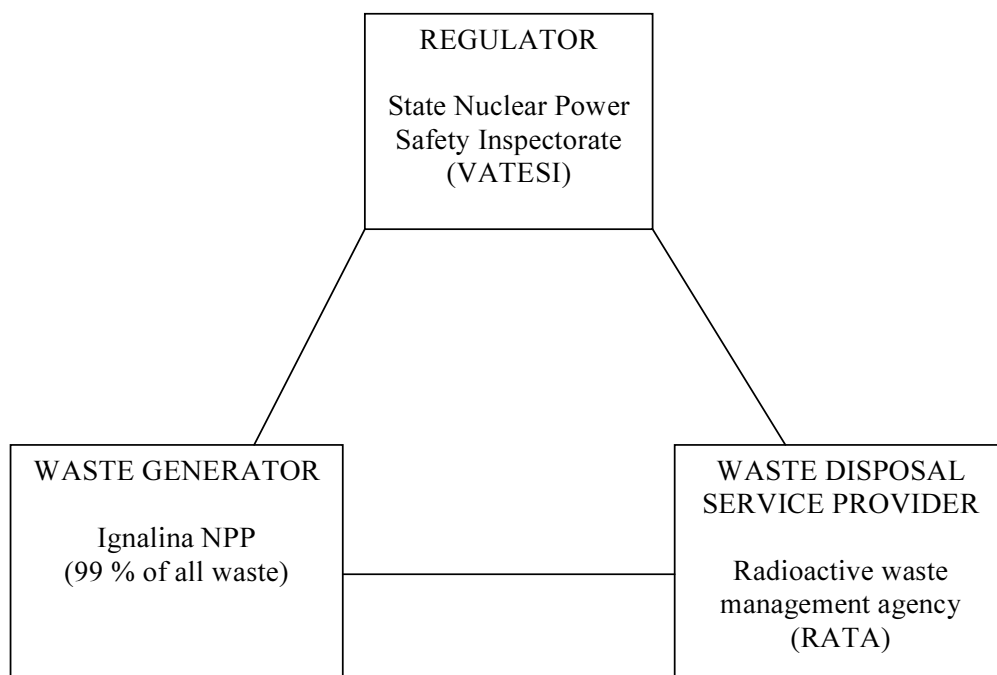


FIG.1. Organizational chart of radioactive waste management in Lithuania

Before the establishment of RATA Ignalina NPP planned to construct interim storage facilities for all decommissioning waste and postpone the final solution for safe management of waste to future generations. After the creation of waste disposal organization RATA the situation changed. With the support of Swedish experts under

a bilateral cooperation programme the main decision-making bodies in Lithuania were convinced to opt for immediate disposal of short-lived radioactive waste and start the necessary preparations for the establishment of a near surface repository (NSR) for low and intermediate level waste (LILW).

1.2. Reference design of an NSR

First of all the general concept of an NSR was developed. The consortium of three Swedish companies SKB, SWECO International and Westinghouse Atom prepared a reference design of an NSR [2] in 2002. It was discussed and accepted by RATA and Lithuanian authorities. The basic principles of the proposed design are as follows:

- a repository of a hill type with reinforced concrete vaults constructed above the ground water level (Fig. 2);
- engineered and natural barriers should restrict the infiltration of water to the radioactive waste and block or delay the release of radionuclides from the repository;
- during the closure of the repository the sides and top of the reinforced concrete vaults are also to be covered with the nearly impermeable smectitic clay barrier, the whole system being covered by a long-lasting cover with an erosion-resistant top.

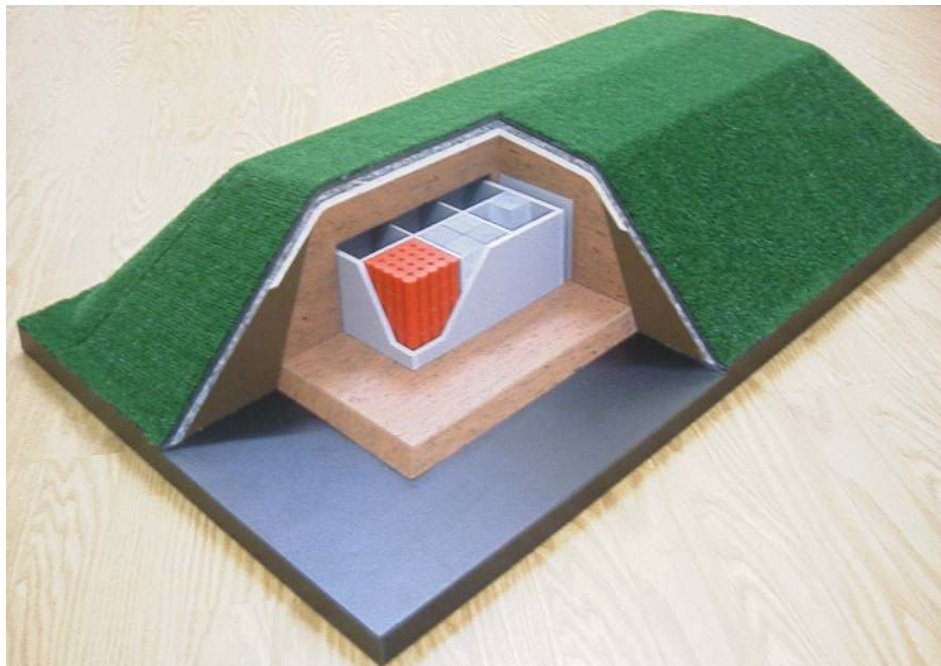


FIG. 2. Depiction of the reference design for an NSR

This reference design is applicable to the needs in Lithuania, considering its geological, climatic, hydrogeological and other environmental conditions. The engineered barriers (Fig. 3) consist of concrete cells surrounded by clay-based material of low permeability with about the same isolating capacity in all directions.

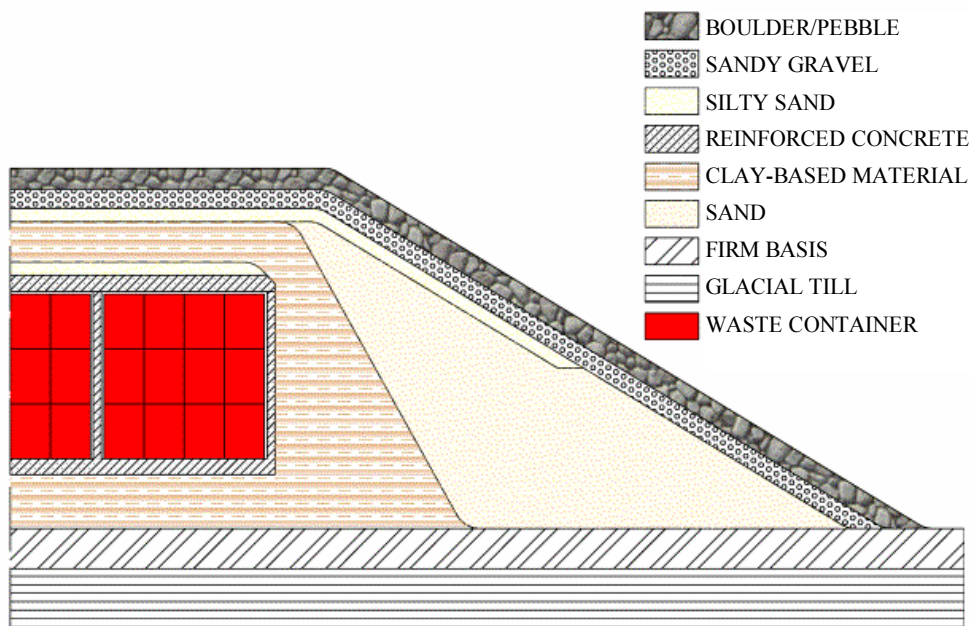


FIG. 3. Structure of engineered barriers (cross-section of an NSR in the post-closure phase [2])

The proposed NSR will also include a buffer storage, administration building, a control room and laboratory, premises for waste reception and for service systems and installations. According to preliminary estimates an area of some 40 hectares will be required for the NSR, auxiliary structures and protection zones to dispose of 100000 m³ of the radioactive waste that will form in the course of operation and dismantling of Ignalina NPP. The repository itself will occupy some 10 hectares. The planned NSR is of a modular type, therefore it could be easily adapted for another radioactive waste amount by reducing or increasing the number of vaults.

2. THE CRITERIA USED FOR IDENTIFICATION OF SITES FOR DETAILED SITE INVESTIGATIONS

In 2003, the search began for a site suitable for the repository, and criteria were developed for siting an NSR. The principal criteria are as follows:

- legal (compliance with the legislation of the Republic of Lithuania and its international agreements and treaties);
- environmental (the repository must have little impact on the environment);
- public approval (the project must be acceptable to local, national and international community);
- technical and safety aspects (the site must be geologically stable, the natural phenomena and processes must have little effect on the engineering barriers and the waste);
- location (the site must be located as close to Ignalina NPP as possible in order to minimize the probability of accidents and costs related to transportation of waste).

Following the assessment of geological, tectonic and hydrogeological conditions as well as identification of criteria determining the repository's safety (table 1), three areas were selected in the vicinity of Ignalina NPP where geological

and geographical conditions were found to be the most favorable for constructing an NSR. These were referred to as Dysnai, Zarasai, and Visaginas areas (Fig. 4).

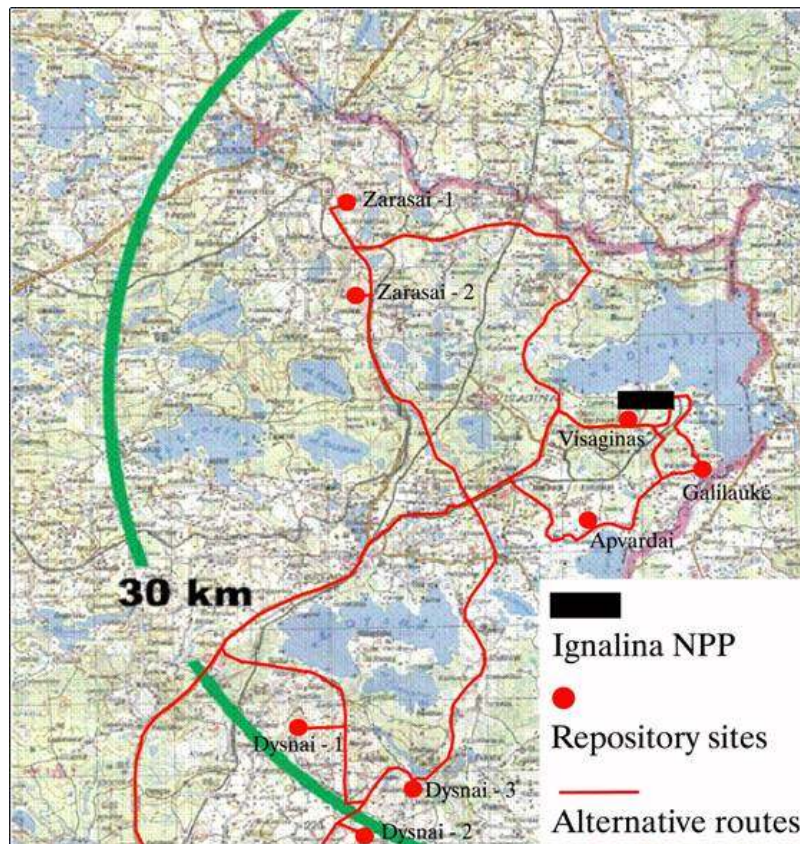


FIG. 4. Location of sites suitable for an NSR

Nine sites within these areas were chosen for more comprehensive studies. The terrain, topography, geomorphology, infrastructure as well as other specific properties and the geological and hydrological structures of the sites have been analyzed and assessed. Geologically, all the sites potentially suitable for constructing an NSR belong to the zone of boundary sediments of the most recent ice age, which accounts for the variable character of lithological and geomorphological properties of the sediments.

TABLE 1. Main site selection criteria

Main requirements for site	Site exclusion criteria	Desirable site features
Topographical features	Possibility for flooding of foundation	Surface inclination is sufficient and water can drain away into a surface water body. Preference should be given to a big hill.
	High erodability	High resistance to erosion – relatively smooth site, shallow water flow speed v is below the critical speed v_{cr} .

Geotechnical stability	Unstable slopes (safety factor $F_{\tan \phi}$ is less than 1.3)	Slope stability of friction material; safety factor $F_{\tan \phi} \geq 1.5$.
	High compressibility of bottom bed (high volume compression coefficient β)	Compressibility, compression strength, shear strength, internal friction angle and stiffness (E-modulus) of bottom bed shall comply with requirements for massive constructions.
	High liquefaction	1. Low pore water pressure. 2. The maximum seismic intensity on the MSK scale ≤ 6 .
	Bad constructability	Feasibility of excavation.
	Variety of ground features	Homogeneous ground.
Hydraulic conductivity	High hydraulic conductivity (filtration coefficient k is bigger than 10^{-5} m/s)	Low hydraulic conductivity. It is desirable that filtration coefficient k is less than 10^{-7} m/s or even 10^{-9} m/s.
Impact from natural phenomena	1. Unfavorable climate 2. Unfavorable hydrological conditions	1. Low and steady groundwater level. It is desirable that groundwater level is at least 3 m below bottom barrier. 2. No risk of being flooded.
Transport risks	Long distance to Ignalina NPP, transportation of waste through big settlements and protected or recreational territories.	1. Vicinity to Ignalina NPP. 2. Favorable infrastructure and logistics.

The Dysnai and Zarasai areas were found to be less suitable owing to a larger distance from Ignalina NPP and a higher population density. Relatively unfavorable public opinion is another negative factor, which reduced the suitability of these sites. After all the data was generalized, the two most promising sites were selected on a short way from Ignalina NPP: Apvardai and Galilaukė.

3. PROBLEMS TO GET ACCEPTANCE BY LOCAL COMMUNITIES

The laws of the Republic of Lithuania demand that the site for a radioactive waste repository be selected in accordance with the Law on environmental impact assessment of planned economic activities and the Law on territory planning. In 2004 RATA conducted an environmental impact assessment (EIA) study of an NSR to be constructed at Apvardai and Galilaukė sites located in the Ignalina District. The EIA report [3] was subject for approval by safety authorities and local municipality. In 2005 all the concerned institutions involved approved the study. The EIA law request that the comments and concerns of local public are taken into account. Population of Ignalina District was informed and consulted in many ways: publishing articles in local newspapers, broadcasting programmes on local TV, organizing seminars and meetings. However the Municipality of Ignalina District approved the EIA study on condition that measures will be created for mitigating negative social and economic impact. Having analyzed the Municipality's demands, the Ministry of Economy recommended to start looking for an alternative site outside the boundaries of the Ignalina District, with preference given to Visaginas Municipality and the territory belonging to the Ignalina NPP. RATA conducted a preliminary search for a site on the

territory of Visaginas Municipality in 2005. Three sites were selected in the vicinity of the Ignalina NPP, and the Stabatiškė site (Fig. 5) was deemed to be the most suitable. The Ministry of Environment assessed the submitted information regarding the studies at Stabatiškė site and recommended further investigations. RATA performed an EIA study for Stabatiškė site as well.



FIG. 5. Location of the Stabatiškė site

The majority of the local population in Visaginas district is familiar with nuclear activities and therefore accepted the proposal to construct an NSR there.

4. NEGOTIATIONS WITH NEIGHBOURING COUNTRIES IN ACCORDANCE WITH INTERNATIONAL CONVENTIONS

Consultations with Latvia and Belarus began in late 2005 and were continued in 2006 and 2007. The two neighboring countries were informed about the site selection and the environmental impact assessment in accordance with the provisions of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, and Espoo Convention on the Environmental Impact Assessment in a Transboundary Context. The Ministry of Environment in Latvia and the Ministry of Natural Resources and Environmental Protection in Belarus submitted their comments and proposals regarding the EIA report. The comments and proposals were discussed at bi- and trilateral meetings (Fig. 6). Belarus was specially concerned about Galilaukė site due to its close proximity to their border. As a result this site was absolutely unacceptable to them. This issue became one of the topics in the bilateral diplomatic relations between the two countries and was discussed not only at expert

level but in Prime Ministers meetings as well. A special inter-governmental working group was established and met twice a year to discuss nuclear energy development and radioactive waste management issues. Opposition against the Galilaukė site was raised by Belarus in various international forums including the IAEA.



Fig. 6. Press conferences in Minsk and Ryga to inform media on Lithuania's plans to establish an NSR

The Latvian Government and the general public did not show much interest and concern as the Belarusian Government. The proposed sites are located some 10-20 km from the Latvian border.

5. INTERNATIONAL PEER REVIEW VIA IAEA OF MAJOR STEPS IN THE PROCESS AND ITS IMPORTANCE FOR THE APPROVAL BY THE LITHUANIAN AUTHORITIES AND IN INTERNATIONAL DISCUSSIONS

To ascertain the quality of the conducted studies and acceptability of the proposed decisions, RATA requested the IAEA to conduct an independent assessment of the program of characterization of the proposed sites. A team of nine independent experts that worked in Lithuania on December 11 -16, 2005, favorably assessed the submitted information and the program of site selection implemented by RATA. Representatives of Belarus and Latvia observed the experts working and visited the sites under consideration. Each country delegated two observers. The following aspects were analyzed during the mission: the structure of radioactive waste management in Lithuania; quality management system; composition and amounts of radioactive waste; characterization of sites; the quality of applied methods and data; the conceptual plan of the repository, and preliminary assessment of the repository's safety. The experts emphasized that the program being implemented by RATA met international safety requirements and that the proposed technology with waste packages being housed in concrete vaults sealed with clay was very reliable. However, the experts submitted some comments. In their opinion, the data on radioactive waste and its packages was insufficient. They recommended continuing the geological and hydrological studies of the sites. They emphasized that more attention should be paid to continual safety assessment, quality management and insuring the quality of data, as well as to systematic planning of work with adequate human and financial resources being allocated. The report of the IAEA review team [4] (Fig. 6) is easily accessible on the IAEA website.

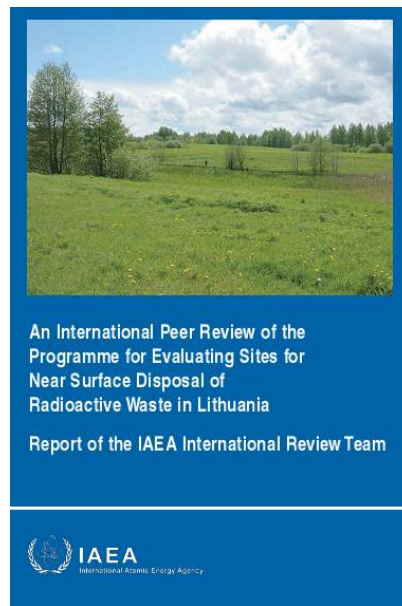


FIG. 6. Report of the IAEA review team

The positive results of the IAEA peer review mission facilitated the decision making process of the Lithuanian authorities regarding site selection for an NSR. In June 2007 the Ministry of Environment approved the EIA report of the NSR and concluded:

“The Apvardai site is not acceptable due to social aspects (the Council of Ignalina District Municipality expressed disagreement) and partially due to unfavorable hydrological and hydrogeological conditions.

The Galilauke site is acceptable due to very favorable natural conditions, but not acceptable due to social factors. The Council of Ignalina District Municipality disagreed with this option. The council suggested that establishment of the repository will have a negative influence on attractiveness of investments, will reduce the value of real estate and will negatively influence the tourism business. The location of proposed site was unfavorable in the context of bilateral relations because Belarus emphatically was against this option.

The Stabatiske site is acceptable due to existing developed infrastructure, favorable social conditions, short distance to Ignalina NPP and the endorsement of neighboring countries. The local community and administration of Visaginas municipality positively assessed the possibility to establish the repository at this site.

Decision: On the basis of the above-mentioned points, the Ministry of Environment agrees for establishment of the NSR at Galilaukė or Sabatiškė sites, priority be given to the latter site according to the provided EIA report.”

Based on the conclusion of the Ministry of Environment the Government of the Republic of Lithuania on 21 November 2007 adopted Resolution No. 1227 and approved Stabatiškė site for construction of an NSR.

6. FINANCING THE CONSTRUCTION OF THE NEAR SURFACE REPOSITORY

Conceptual design and site selection for an NSR were funded from National Ignalina NPP Decommissioning Fund with essential support from the Swedish Government in terms of providing experts, training of RATA staff and assisting RATA in public information. Further implementation of the project (preparation of detailed technical design, construction) is funded from the European Commission's Nuclear Decommissioning Assistance Programme. The Government of Lithuania agreed with the EC to shutdown Ignalina NPP earlier than its design lifetime on the condition that substantial financial support will be provided to help with the decommissioning of Ignalina NPP. A special International Ignalina NPP Decommissioning Support Fund (IIDSF) was established, the EC delegated the right to administrate this fund to the European Bank for Reconstruction and Development (EBRD). The design phase of the NSR is funded from the IIDSF. The target budget is 10 MEUR for the design contract, which is not signed yet. International tender for technical design of an NSR is going on now. The expected date for the design contract award is September 2009. According to the project implementation strategy the design phase will be followed by a construction phase that will be funded separately. The initial budget for the construction is 108 MEUR (contract placed in 2012 with expected NSR construction complete in 2016).

The total cost of the NSR [2] has been estimated to be (at 2002 prices) in the order of 138-239 MEUR. The higher price represents the concept as presented in a study with conservative assumptions and the lower price represents a cost evaluation considering probable reduction of the cost after optimization of the reference design with respect to costs for barrier properties and other factors.

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