

# ENVIRONMENTAL REQUIREMENTS TO BE CONSIDERED FOR PLANNING THE NATIONAL GEOLOGICAL DISPOSAL PROGRAM

## *CERINTE DE MEDIU CE TREBUIE CONSIDERATE LA PLANIFICAREA PROGRAMULUI DEPOZITULUI GEOLOGIC NATIONAL*

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***Abstract:** The elaboration of a comprehensive national program of the National Geological Repository destined for the disposal of the spent nuclear fuel in accordance with the European Directive on radioactive waste 2011/70/Euratom and at the level of the actual national geological disposal programs should consider the risks of the national context.*

*The paper presents some information related to the environmental aspects that can be significant risk factors induced by the national context in the planning of the National Geological Repository. Based on the experience of over 20 years of direct participation in environmental authorization procedures of major nuclear projects in Romania, the authors confirm the results of a national risk management study on the current planning of the National Geological Repository and recommend integrated planning of major environment actions in the work breakdown structure of the stages for Siting and Licensing the Repository Site in order to minimize the negative impact of these risks on the development of the repository.*

**Keywords:** National Geological Repository (NGR), national context risks, NGR program, risk planning

***Rezumat:** Elaborarea unui program cuprinzator de sine-stator al Depozitului Geologic National destinat depozitarii finale a combustibilului nuclear ars, in acord cu Directiva europeana de deseuri radioactive 2011/70/Euratom si la nivelul unor programe nationale efective de depozitare geologica trebuie sa considere riscurile contextului national.*

*Lucrarea de fata prezinta unele informatii cu privire la aspectele de mediu care pot constitui factori de risc semnificativ indusi de contextul national la planificarea Depozitului Geologic National. Pe baza experientei de peste 20 de ani de participare directa in procedurile de autorizare de mediu a unor*

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*proiecte majore nucleare in Romania, autorii confirma rezultatele unui studiu al managementului riscului contextului national asupra planificarii curente a Depozitului Geologic National si recomanda planificarea integrata de actiuni majore de mediu in structura activitatilor din etapele de selectare si autorizare a amplasamentului depozitului in scopul minimizarii impactului negativ al acestor riscuri asupra dezvoltarii depozitului.*

**Cuvinte cheie:** depozit geologic national (DGN), managementul riscurilor contextului national, , integrare planificare raspunsuri la riscuri in planificarea DGN

## 1. Introduction

In the last decades, organizations responsible for the disposal of radioactive waste, scientists and regulatory bodies have developed comprehensive knowledge demonstrating that deep geological disposal (hereafter referred to as geological disposal) is a feasible and safe technology [1]. The safety, the emplacement and feasibility of the engineering solutions for the final disposal of spent nuclear fuel, high-level radioactive waste and long-lived radioactive waste have been demonstrated by waste management organizations, evaluated by nuclear regulators and approved by governments as the basis for the stage of selecting the site of a geological repository.

Research, development and demonstration issues to be pursued in the future, including uncertainties associated with them, will no longer question the feasibility of geological disposal. Finland and Sweden are the first countries in the world that have already demonstrated that it is possible to establish the site of a geological repository following a process involving the broad participation of society. At the time of writing this paper, the French Nuclear Safety Authority, IRSN, gave its final agreement on the safety case sent by the French radioactive waste management agency, ANDRA, for the construction of the Cigéo geological repository [2].

However, international experience has shown that, and under the conditions of a strengthened national nuclear system, from the early stage of the development of a geological disposal program, a worrying question arises about the sustainability of the program for societal reasons [3].

From the study of the international standards and reports issued by IAEA, OECD/NEA, JRC-CE, etc., certain observations support the need to study the national context when designing and planning the geological disposal program [4].

The lessons learned from the reconsideration of some national geological disposal programs (e.g. programs in the UK, Canada, or the Czech Republic) included those that:

- In the discussions with the community, any "benefit package" must be an early and transparent part of the placement process;
- Communities have not encouraged the formation of a group to support the siting process, until the impetus of those against has been manifested;
- An adapted management is recommended, in which the plans of the program are divided into manageable steps or phases, each phase being

characterized by a decision that is taken in consultation with all stakeholders [5];

- Program managers should act to identify and implement solutions that will enable communities to accept how decision-making is being approached in site selection.

This paper further provide some information on the environmental aspects that can be a significant risk factor for NGR planning and the authors' recommendation for an integrated approach to action planning that minimizes the negative impact of identified risks on NGR planning.

## **2. Challenges of the national context to the application of environmental regulatory procedures for nuclear projects**

Based on the international experience demonstrated in Finland, Sweden and recently in France, an average time scale for siting phases of a NGR program was about 25 years. This duration makes it difficult to predict the national context, as it includes many non-technical aspects, and its complexity and diversity bring about a degree of uncertainty for these forecasts. Therefore, the analysis of the national context may need to be resumed by the management of the responsible factors, if the uncertainties increase and the structure of the sources of impact and their actual impact impose. Much more, the analysis of the national context, beyond the authorization of the site of a geological repository, seems no longer necessary be treated by itself, because the international experience and the evolution of the Romanian society and economy will offer viable options for solving the risk sources in program development.

SNN specialists earlier have presented the experience and lessons learned in the authorization procedures for major nuclear capital projects on the CNE Cernavoda platform [6]. Thus, in a paper presented at Foren 2016 [7], the authors presented a topical issue encountered in the development of major nuclear projects, which are still topical and require effective solutions to solve. It is about the need to correlate the level of detail of the Environmental Impact Report (RIM) with the level of technical and safety information that is objectively available at the time of its collection for RIM. Furthermore, in order to produce RIM, the environmental requirements for RIM's detailed documentation should be applied in a manner that is integrated with design and safety requirements. It is obviously about the design and safety requirements imposed by the Nuclear Regulatory Body for the development phase of the project that corresponds to the environmental impact assessment phase.

The authors support the view that the issue of complying with environmental requirements is more complex when preparing a geological disposal program.

A PESTEL analysis on the geological disposal of radioactive waste in Romania made in 2013 [8] showed that some aspects of the national context

associated with the Legal and Environmental Factors (from the PESTEL analysis) should be changed in order to have a sustainable program and to make the probability of errors in the program as small as possible.

Currently, there is no experience in Romania regarding the development of an appropriate environmental assessment or environmental impact study for a repository for radioactive waste.

It is necessary to correlate and integrate the legal environmental requirements [7, 9] with the legal requirements in the nuclear field and to establish the degree of detail / development of the disposal concept and all necessary data allowing a proper environmental impact assessment.

Ensuring the availability of data necessary for the environmental impact assessment would be in correlation with the development stage of the geological disposal program. To make clear this correlation implies a collaboration between the central environmental authority and the regulatory authority in the nuclear field, from the initiation of the NGR program, given the fact that the experience and knowledge in regulating geological disposal belongs to the nuclear authority

The PESTEL analysis mentioned above has shown that more in-depth analysis should clearly identify which are the risks specific to these risk factors, response actions to risk factors and how to integrate the actions into the NGR program planning. Such analyzes were conducted in a risk-management study of the national context that took place between 2013 and 2016 [10].

The environmental risks specific to the national context identified in the risk management study are presented in Table 1.

Table 1. The risks of the national context due to environmental and legal environmental factors

Risk Identifier*	Risk title
16E1	Lack of expertise/ technical support in the field, to authorities issuing environmental
17E2	The tradition of presenting technical information at technical design level in the EIA phase
20L3	The absence of the first authorization step in environmental legislation (SEA procedure)
21L4	The need to obtain the urbanism certificate for construction as a prerequisite for obtaining the environmental agreement

\* *The risk identifier is consistent with that in the Risk Register.*

For performing the risk analysis and establishing how to integrate the planning of risk response actions into updating the current NGR Strategy (the current NGR Strategy means the strategy developed at the level of 2009; there is no

public update of this strategy until the elaboration of the present paper) contributed the following:

- An in-depth analysis of the requirements of the current European and national environmental legislation;
- Experience in the development of similar approval, authorization and environmental approval processes in other similar national nuclear projects. It is about the activities carried out at Cernavoda NPP during the period 1996-2013 regarding: elaboration of the environmental balance and the procedure for obtaining the environmental permit at Unit 1 CNE Cernavoda; the procedure for obtaining the environmental agreement at the Intermediate Dry Spent Fuel Storage Facility at Cernavoda NPP; the procedure for obtaining the environmental agreement for Units 3 and 4 Cernavoda NPP [6];
- Consultation of an environmental expert with large expertise at national level; The expert had direct responsibilities in the environmental authorization procedures of the major nuclear installations in Romania.

The National Risk Management study proposed a revision of the current NGR Strategy planning in order to propose an optimal solution to integrate the risk response due to the environmental factor and legal environment factor. The results relevant to this paper are briefly discussed in the next section.

### **3. Integrating the response to national environmental risks due to the environmental factor into DGN planning**

The risks of the national context were considered to be the risks associated with entrances, actions and inactions outside the NGR program developer organization over which the developer organization's management has no control but could have a significant impact on the program. This impact can be manifested itself in technical terms, cost, planning and / or acceptance of the program.

The national context for initiating the development of the NGR program was considered as described by the PESTEL analysis conducted in 2013. In the opinion of the authors of this paper, the results of the PESTEL analysis maintain its validity for the Legal and Environmental factors. We make this observation in the context in which the activities of the current NGR Strategy that was developed in 2009 have not been carried out as planned, and an effective geological disposal program is to be developed in the coming years by the Nuclear Agency and for Radioactive Waste.

The study on the management of the national context risks[10] has shown that effective integration of responses to these risks in NGR program planning can be done through a step-by-step approach to a set of actions that need to be deployed in the planning of the NGR program, in an integrated or iterative manner, because they are interconditioning. The optimal integrated risk response solution is to identify and establish the processes contributing to the planning of the NGR program and which should ensure such integration.

The authors of this paper confirm that, among all the processes that ensure the integration of the responses to the national context risks identified in the mentioned risk management study and which are presented in Figure 1, the "Environmental Agreement, Authorization and Approval (Based on the Environmental Impact Assessment and population health)" is the process that makes a significant contribution to the planning of the NGR program, as it relates significantly to the strategic planning of the program, particularly the planning of the program's technical activities. As a result of the schedule risk analysis on the current NGR Strategy, it has resulted, among other things, that necessary actions in this process are:

- A more realistic planning of the NGR program due to the need to reconsider the structure of those major activities within the program in which the risk response actions can be integrated

- The planning of major environmental activities whose work breakdown structure falls wholly or predominantly within the structure of activities on the critical route of estimating the NGR graphic.

More realistic planning of the selection and authorization schedule of the geological repository site has led to a 32 year duration estimated by expert judgment in the most likely scenario by difference with the 20.5 year duration of the current NGR Strategy. As a result of integrating the response to the risks induced by the environmental factor and the legal environmental factor, the new duration of the stages of selection and authorization of the NGR site was estimated at about 25 years, about 7 years less than the duration in the case of the most likely scenario.

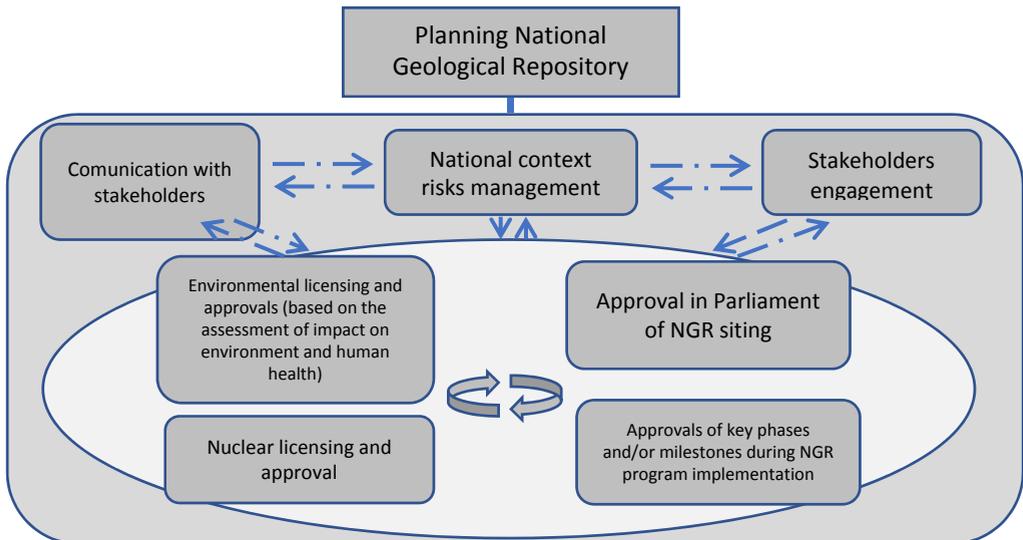


Figure 1. Processes that ensure the integration of the response to the national context risks in the planning of the current NGR Strategy

More realistic planning has led to a new structure for major activities on "Environmental Endorsement, Authorization and Approval", as identified in Figure 2.

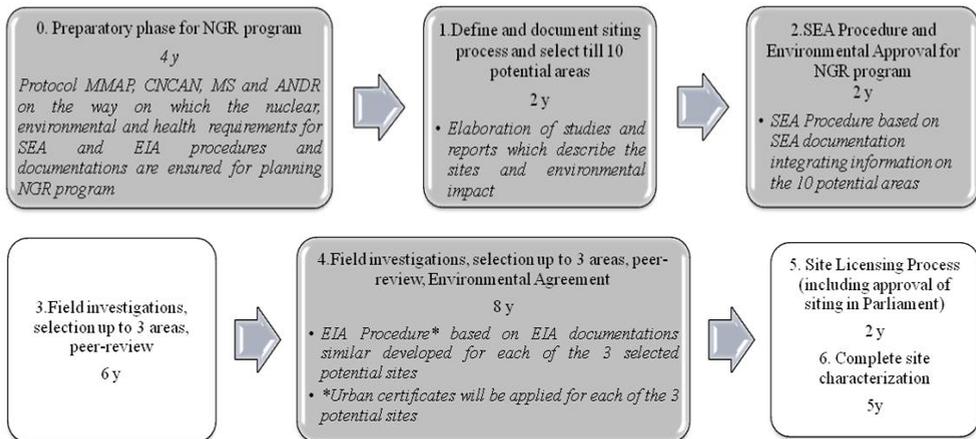


Figure 2. General planning of the „Environmental Permit, Authorization and Approval with reconsideration of the current NGR Strategy

Based on their own experience, the authors confirm that the structure of the major activities proposed by the risk management study ensures minimization of risks to the national context and beyond. However, where these risks combines with other risks of the national context, they can still have a significant impact, so it is also the study. The authors appreciate that the results of the study are useful to NGR program managers/ planners in the context of making the decision to develop a sustainable NGR program, for at least the following reasons:

- Effective recommendations based on previous national experience judgment is welcome given that there is very little information on how environmental permitting activities should be included in the project's graph in a practical way for managers and planners and/or executers of the project;

- Risk management cannot be approached properly or not at all if managers/planners are not aware of activities in the NGR program, within which risk response actions can be integrated; the study helps with the description of the actions that could prevent risk causes.

#### 4. Conclusions

In this paper, the authors contribute by analyzing and interpreting, based on their experience of over 20 years of direct participation in the environmental authorization procedures of major nuclear projects in Romania, to increase the

transparency of the results of a risk management study of the national context on the planning of the future National Geological Repository destined for disposal of spent nuclear fuel.

The authors recommend to managers/planners of the National Geological Repository program to approach the program's preparation stage, integrated planning of major environmental activities in the structure of the activities of the stages of selection and authorization of the site of the repository, which according to the international experience lasts over 20 years, namely: the strategic environmental assessment of the program and the procedure for obtaining the environmental agreement, in order to minimize the negative impact of the environmental risks on the development of the repository.

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