

**INTEGRATED REVIEW SERVICE
FOR RADIOACTIVE WASTE AND
SPENT FUEL MANAGEMENT,
DECOMMISSIONING AND
REMEDICATION (ARTEMIS) -
REVIEW OF DEEP GEOLOGICAL
REPOSITORY PROJECT
IN
LITHUANIA**

Vilnius, Lithuania

16-25 July 2023

DEPARTMENT OF NUCLEAR SAFETY AND SECURITY
DEPARTMENT OF NUCLEAR ENERGY



IAEA

Integrated Review Service for Radioactive
Waste and Spent Fuel Management,
Decommissioning and Remediation

ARTEMIS



Integrated Review Service for Radioactive
Waste and Spent Fuel Management,
Decommissioning and Remediation

ARTEMIS

**REPORT OF THE
INTEGRATED REVIEW SERVICE FOR RADIOACTIVE WASTE AND
SPENT FUEL MANAGEMENT, DECOMMISSIONING AND
REMEDICATION (ARTEMIS) - REVIEW OF DEEP GEOLOGICAL
REPOSITORY PROJECT
IN
LITHUANIA**





Integrated Review Service for Radioactive
Waste and Spent Fuel Management,
Decommissioning and Remediation

ARTEMIS

**REPORT OF THE
INTEGRATED REVIEW SERVICE FOR RADIOACTIVE WASTE AND
SPENT FUEL MANAGEMENT, DECOMMISSIONING AND
REMEDICATION (ARTEMIS) - REVIEW OF DEEP GEOLOGICAL
REPOSITORY PROJECT
IN
LITHUANIA**

Mission dates: *16-25 July 2023*
Location: *Vilnius, Lithuania*
Organized by: *IAEA*

ARTEMIS REVIEW TEAM

Mr Jean-Michel Hoorelbeke	ARTEMIS Team Leader (France)
Mr Frédéric Bernier	Reviewer (Belgium)
Mr Ben Belfadhel	Reviewer (Canada)
Ms Päivi Mäenalanen	Reviewer (Finland)
Mr Toivo Wanne	Reviewer (Germany)
Ms Adela Mršková	Reviewer (Slovakia)
Mr Gérard Bruno	IAEA Team Coordinator
Ms Karina Lange	IAEA Deputy Team Coordinator
Ms Mathilde Prevost	IAEA Facilitator

IAEA-2023

The number of recommendations, suggestions and good practices is in no way a measure of the status of the national infrastructure for nuclear and radiation safety. Comparisons of such numbers between ARTEMIS reports from different countries should not be attempted.

CONTENTS

I.	INTRODUCTION	3
II.	OBJECTIVE AND SCOPE	4
III.	BASIS FOR THE REVIEW	5
1.	ADEQUACY OF THE OVERALL DGR SITE SELECTION PROCESS, INCLUDING TIMEFRAMES	7
1.1	PLANS AND RESPONSIBILITIES FOR THE SITING PROCESS.....	7
1.2.	REGULATORY INVOLVEMENT	11
1.3.	PUBLIC INVOLVEMENT	13
1.4.	PLANNING ITERATIONS BETWEEN SITE CHARACTERIZATION EVALUATION, SAFETY ASSESSMENT AND DESIGN	14
1.5.	RESOURCES	16
1.6.	RECORD KEEPING AND TRANSPARENCY	17
1.7.	EXTERNAL ADVICE AND REVIEWING.....	18
2.	METHODOLOGY, QUALITY AND CONTENT OF STUDIES PREPARED FOR EACH PHASE OF SITE SELECTION PROCESS.....	20
2.1	PRIORITIZATION BASED ON SOCIO-ECONOMIC CRITERIA	20
2.2	SAFETY EVALUATION	22
2.3	SITE SELECTION CRITERIA.....	24
3.	ASSESSMENT OF THE OUTCOMES OF THE DGR SITE SELECTION PROCESS AND THE PRIORITIZATION OF POTENTIALLY SUITABLE SITES FOR THE DGR ..	28
	APPENDIX A: TERMS OF REFERENCE.....	32
	APPENDIX B: MISSION PROGRAMME	35
	APPENDIX C: RECOMMENDATIONS AND SUGGESTIONS.....	36
	APPENDIX D: LIST OF ACRONYMS USED IN THE TEXT	39
	APPENDIX E: LIST OF REFERENCE MATERIAL	40

EXECUTIVE SUMMARY

On 27 October 2022, the Ministry of Energy of Lithuania requested the IAEA to undertake an ARTEMIS review of the Deep Geological Repository (hereinafter - DGR) project in Lithuania for spent fuel and intermediate level radioactive waste.

The ARTEMIS review provided an independent international evaluation of the studies carried out by Lithuania on the first phase of the siting process of the envisaged DGR, as part of the Programme for the “Development of the Decommissioning of Nuclear Power Facilities and Radioactive Waste Management for 2021–2030”, approved by the Lithuania Government on 3 February 2021. The Programme establishes that the only sustainable final method of disposal of spent fuel and intermediate level radioactive waste that can be considered at the moment is their placement in a DGR.

The team comprised of senior international experts in the field of radioactive waste management and decommissioning from Belgium, Canada, Finland, France, Germany and Slovakia, held discussions with the Lithuanian representatives of the Ignalina Nuclear Power Plant (INPP), VATESI, the Ministry of Energy, the Lithuanian Geological Survey (LGS), Lithuanian Energy Institute (LEI), as well as IDOM (Spain) and Posiva Solutions Oy (Finland).

The ARTEMIS Review Team commends Lithuania for its early development and implementation of the DGR programme in particular by initiating a site selection process and actively planning for the next steps of the project. The Artemis Review Team considers that the geological, socio-economic and safety studies form a comprehensive basis to support the initial stage of the siting process, the next stages of site evaluations and conceptual design.

As such, Lithuania is one of the few countries factually developing and implementing a programme for the safe and long term disposal of radioactive waste and spent fuel in a deep geological repository. In line with the above the ARTEMIS Review Team noted as a good practice that at this point a peer review was requested on the site selection process.

The ARTEMIS Review Team provided 8 recommendations (R) aiming at supporting Lithuania in the site selection process for their DGR project. Those recommendations address the following:

- For the Government to establish intermediate milestones until the final site selection and allocate responsibilities for decision making through this process.
- For INPP to develop a high-level document describing the overall site selection process
- For the Government, with the support of INPP, to establish a formal process for public engagement as early as possible.
- For INPP to develop a stepwise process where site characterization and evaluation are carried out iteratively with design and safety assessment.
- For INPP to develop an approach and work programmes including developing high level social criteria to begin integrating social conditions and community well-being aspects.
- For INPP to include intermediate level waste in the safety assessment for the next stage.
- For INPP to implement a systematic process to derive the safety related site selection criteria from safety functions.
- For INPP to develop an approach and an associated workplan for narrowing down to a subset of potential suitable sites and initiating dialogues with communities.

The ARTEMIS Review Team also identified 6 suggestions dealing with:

- For VATESI to consider developing comprehensive guidance on geological disposal facilities in support of national requirements on siting process.
- For INPP to consider identifying and managing uncertainties associated with the site selection process.
- For INPP to consider publishing the list of the selected sites as a group without any ranking, justifying the number of sites and reviewing the timeline for making the list of sites public.
- For the Government to consider providing INPP, LGS and VATESI with adequate resources to support the site selection and stakeholders' engagement process
- For INPP to consider developing a specific approach for record keeping and knowledge transfer
- For INPP, with the support of the Ministry of Energy, to consider establishing an external multidisciplinary advisory group to provide guidance, advice and technical reviews

The ARTEMIS Review Team is of the opinion that, by adequately considering the outcome of the present review, Lithuania will be in a good position to continue the safe development of the DGR project.

I. INTRODUCTION

On 27 October 2022, the Ministry of Energy of Lithuania requested the IAEA to undertake an ARTEMIS review of “Deep Geological Repository” (hereinafter - DGR) project in Lithuania for spent fuel and long-lived radioactive waste.

The ARTEMIS review provided an independent international evaluation of the studies carried out by Lithuania on the first phase of the siting process of the envisaged deep repository project, as part of the Programme for the “Development of the Decommissioning of Nuclear Power Facilities and Radioactive Waste Management for 2021–2030”, approved by the Lithuania Government on 3 February 2021. The Programme establishes that the only sustainable final method of disposal of spent fuel and other long-lived radioactive waste that can be considered at the moment is their placement in a deep geological repository.

The review was performed by a team of six senior international experts in the field of decommissioning and radioactive waste and spent fuel management, from multiple IAEA Member States, with IAEA staff providing coordination and administrative support. Subsequent to a virtual preparatory meeting in April 2023, and the receipt and review of Advanced Reference Material in May 2023, in July 2023 the ARTEMIS Review Team evaluated the adequacy of the overall DGR Site selection process, including timeframes; Methodology, quality and content of studies prepared for each phase of site selection process; and assessment of the outcomes of the DGR site selection process and the prioritization of potentially suitable sites for the DGR.

The ARTEMIS review comes shortly after a first full-scope ARTEMIS mission implemented in Vilnius from 15th to 25th May 2022, which reviewed the Lithuanian national programme and framework for executing the country’s obligations for safe and sustainable radioactive waste and spent fuel management, as required of all EU Member States by Article 14.3 of the Council Directive 2011/70/EURATOM of 19 July 2011, establishing a Community Framework for the Responsible and Safe Management of Spent Fuel and Radioactive Waste. The first ARTEMIS mission, hereinafter referred as “full-scope ARTEMIS mission,” provided among other findings a good practice (GP1) to Lithuania regarding the very early stage of DGR development and a recommendation (R5) for INPP to “prepare the safety case and safety assessment at the start of the process for the DGR”.

II. OBJECTIVE AND SCOPE

The ARTEMIS review provided an independent international evaluation of the studies and processes carried out by Lithuania for the selection of the DGR site.

The ARTEMIS review, organized by the Department of Nuclear Safety and Security and the Department of Nuclear Energy of the IAEA, was performed on the basis of the relevant IAEA Safety Standards and proven international practice and experiences, with the combined expertise of the international peer review team selected by the IAEA.

III. BASIS FOR THE REVIEW

A) PREPARATORY WORK AND IAEA REVIEW TEAM

At the request of the Ministry of Energy of Lithuania, a virtual preparatory meeting for the ARTEMIS review of DGR project in Lithuania, was conducted on 5 April 2023. The preparatory meeting was carried out by the appointed Team Leader Mr Jean-Michel Hoorelbeke, the IAEA Team Coordinator Mr Gérard Bruno, IAEA deputy Team Coordinator Ms Karina Lange, IAEA Facilitator Ms Mathilde Prevost and the team of National Counterparts led by Mr Dmitrij Jekateriničev from Ignalina NPP and Mr Renatas Šumskis from the Ministry of Energy of the Republic of Lithuania with participation of representatives of the Ignalina NPP and the Ministry of Energy of the Republic of Lithuania.

The ARTEMIS mission preparatory team had discussions regarding:

- the Terms of Reference with the relevant detailed aspects for organization and conduction of the review.
- the specific characteristics and organisation of ARTEMIS mission of Lithuania's National Programme on Lithuanian Deep Geological Repository siting process; and
- the relevant detailed aspects for organization and conduct of the review.

The appointed National Counterparts were Ignalina NPP and the Ministry of Energy of the Republic of Lithuania. The National Counterpart Liaison Officer appointed for the review was Mr Dmitrij Jekateriničev from Ignalina NPP, the contact person of the Ignalina NPP was Mr Andrius Vyšniauskas, and the contact person of the Ministry of Energy was Mr Renatas Šumskis.

Lithuania provided IAEA with the Advance Reference Material (ARM) for the review in May 2023.

B) REFERENCES FOR THE REVIEW

The ARTEMIS review was based on the relevant IAEA Safety Standards and proven international practice and experiences, following the guidelines of the ARTEMIS review service.

C) CONDUCT OF THE REVIEW

The initial ARTEMIS Review Team meeting took place on Sunday, 16 July 2023 in Vilnius, directed by the ARTEMIS Team Leader Mr Jean-Michel Hoorelbeke, the ARTEMIS Team Coordinator Mr Gérard Bruno and the IAEA deputy Team Coordinator, Ms Karina Lange.

The National Counterpart Mr Andrius Vyšniauskas was present at the initial ARTEMIS Review Team meeting, in accordance with the ARTEMIS guidelines, and presented logistical arrangements planned for the mission.

The ARTEMIS entrance meeting was held on Monday, 17 July 2023, with the participation of representatives from Ignalina NPP and the Ministry of Energy of the Republic of Lithuania senior management and representatives of regulator State Nuclear Power Safety Inspectorate (VATESI) and The Lithuanian Geological Survey. Opening remarks were made by Mr Dmitrij Jekateriničev, Director of Projects management department of Ignalina NPP, Mr Gerard Bruno,

ARTEMIS Team Coordinator, and Mr Jean-Michel Hoorelbeke, ARTEMIS Team Leader. Mr Andrius Vyšniauskas, national counterpart, gave an overview of the Lithuanian context.

During the ARTEMIS mission, a review was conducted for all review topics within the agreed scope with the objective of providing Lithuanian authorities with recommendations and suggestions.

The ARTEMIS Review Team performed its review according to the mission programme given in Appendix B.

The ARTEMIS Exit Meeting was held on Tuesday, 25 July 2023. Opening remarks were made by Mr Dmitrij Jekateriničev, Director of Projects management department of Ignalina NPP. A presentation of the results of the Review Mission was given by the ARTEMIS Team Leader Mr Jean-Michel Hoorelbeke. Closing remarks were made on behalf of the IAEA by Mr Gerard Bruno, ARTEMIS Team Coordinator.

An IAEA press release was issued.

1. ADEQUACY OF THE OVERALL DGR SITE SELECTION PROCESS, INCLUDING TIMEFRAMES

1.1 PLANS AND RESPONSIBILITIES FOR THE SITING PROCESS

Lithuanian position

The Republic of Lithuania has long lasting experience in the use of nuclear applications for peaceful purposes, respectively in the safe management of spent fuel (SF) and radioactive waste. A full institutional framework is developed to support nuclear applications. The established legal, regulatory and organizational framework in the Republic of Lithuania provides for safety of facilities and activities and for radiation protection, including clear assignment of responsibilities for licensing and operation of nuclear facilities. This framework sets out safety requirements for protecting people and the environment from radiation risks, both at present and in the future.

The Ministry of Energy of the Republic of Lithuania is the manager of the “Development Programme for Decommissioning of Nuclear Power Facilities and Radioactive Waste Management for 2021–2030”.

The Responsible executor of DGR project is INPP. INPP is the radioactive waste management organisation and in the course of managing the radioactive waste generated during the operation and decommissioning of the Ignalina NPP and other nuclear power facilities and the radioactive waste transferred by other radioactive waste generators:

- 1) collects radioactive waste and organizes its transportation from other producers of radioactive waste, performs initial, main and final processing of radioactive waste and stores it;
- 2) disposes of radioactive waste in repositories;
- 3) closes and maintains the radioactive waste repositories.

A Working Group (WG) on Radioactive Waste Management Monitoring (hereafter referred to Working Group) was established in 2017 by the Order of the Minister of Energy (renewed by Order No.1-142 from 6 April 2020) to facilitate interaction of different governmental and state stakeholders. The WG consists of representatives of the Ministry of Energy, the Ministry of Environment, the Ministry of Finance, State Nuclear Power Safety Inspectorate (VATESI), Radiation Protection Center (RSC), INPP and the Lithuanian Geological Survey (LGS). The WG should, among other tasks, submit proposals regarding the development of a DGR in Lithuania and review documents evaluated during the DGR programme. Such processes give the opportunity to institutional stakeholders to provide recommendations and influence the decision making process.

INPP implement the DGR programme according to the national strategy:

- 2021 Development Programme for Decommissioning of Nuclear Power Facilities and Radioactive Waste Management for 2021–2030 (hereafter referred as Development Programme), and
- Implementation Measure No.5 of the Radioactive Waste Management Development Programme (hereafter referred as Implementation Measure).

In 2021 INPP signed a cooperation agreement with LGS to assist INPP on the development of the DGR until 2030, with intention of its renewal.

According to Lithuanian legislation national strategy documents are drafted/evaluated for 10 years' time frame.

The Development Programme identifies that financing and resources have not been sufficiently ensured and the location and concept of DGR is not known.

While the Development Programme identified issues regarding development of the DGR programme, Implementation Measure declare full dedication of Lithuania to develop a DGR in its territory. The DGR is intended to dispose of Spent Fuel from Ignalina nuclear power plant as well as intermediate level radioactive waste. Implementation Measure of Development Programme provide the timeline for the DGR project, where the siting period is considered to take place from 2020- 2047.

Currently the Ignalina nuclear power plant (INPP) is implementing the initial stage of the conceptual planning project. At this stage research and evaluations of the site selection of the DGR are being carried out.

The preliminary implementation schedule of the DGR project, reflected in Implementation Measure document, envisages the following stages:

- Studies (including planning, selection of potential sites, concepts / assessment, geological / other studies) pending site approval of the deep geological repository for radioactive waste: 2020-2047;
- Design of a deep geological repository for radioactive waste (approved deep geological repository for radioactive waste sites): 2048–2057;
- Construction of a deep geological repository for radioactive waste: 2058–2067;
- Operation of a deep geological repository for radioactive waste: 2068–2074;
- Closure of a deep geological repository for radioactive waste: 2075–2079;
- Post-closure period: from 2080.

ARTEMIS Review team was provided with a detailed table outlining the site selection process:

- Screening of potential territories suitable for construction of DGR (2020)
- General geological (suitability) selection criteria (2021-2022)
- General socio-economic selection criteria (2021-2022)
- Main (general) safety selection criteria (2022-2023)
- Comprehensive evaluation of the results of the studies carried out in the DGR project (2023)
- Geophysical (seismic) surveys in representative areas (2022-2023)
- Compilation of the list of the most promising DGR places for further research (2023-2024).
- Preparation of the DGR descriptive model (2022-2023)
- DGR Megaproject (2023-2024)
- General concept of DGR in „Clay“ (2022-2024)
- General concept of DGR in "Crystalline foundation" (2024-2026)
- Comprehensive Research Programme (2024)
- Comprehensive research in prioritized areas (2025-2030).

The main reports to be provided before 2047 for the licensing process are also identified such as the Environmental impact assessment and the Site evaluation report.

According to the advance reference material (ARM) and provided presentations, INPP contracted a consultant to draft a project plan for the implementation of DGR. The plan is called "Megaproject". This plan is to include:

- The general strategy for the installation of a deep geological repository for radioactive waste;
- The cost estimate of the installation of the deep geological repository for radioactive waste project;
- The Cost estimate calculation methods / principle / conditions, price calculation tool.

Project plan proposed during Megaproject will be consulted by WG and proposed to Ministry of Energy to be taken into account for update of National programme for period 2025 – 2030 and for preparation of next upcoming period of National Programme.

ARTEMIS observation

The ARTEMIS Review Team commends Lithuania for its early development and implementation of the DGR programme in particular by initiating a site selection process and actively planning for the next steps of the project. As such, Lithuania is one of the few countries factually developing and implementing a programme for the safe and long term disposal of radioactive waste and spent fuel in a deep geological repository.

Milestones

The ARTEMIS Review Team observes that intermediate milestones, which could support evaluate performance indicators of the process, and deliverables and reviews after 2030 are not clearly identified today. Megaproject task is expected to deliver an action plan to update the vision of the work to be carried out in the 2025-2030 period (second half of the current 2021-2030 ten-year programme) and to provide a better view of the tasks needed to be performed after 2030.

These milestones should be regularly updated in order to keep the process as much flexible as possible.

Responsibilities

The ARTEMIS Review Team observes that responsibilities for decision-making and implementation are not clearly allocated.

In particular, legal framework does not cover decision-making at intermediate milestones and related responsibilities of various institutions during that process until Environmental Impact Assessment (EIA) and licensing process, which are scheduled for 2047. Also, the responsibilities for public engagement are not clearly identified for the site selection process.

The ARTEMIS Review team observes that the WG is composed of actors with different roles and responsibilities in the DGR process and is involved in regular reviews of the work programmes. Responsibilities for the ultimate decision-making process are not clearly defined.

Site selection process

The ARTEMIS Review Team observes that while a set of geological criteria was developed and a site national screening evaluation was performed, no high-level siting document

describes the overall site selection process, the successive site evaluation phases, siting milestones and related siting decision making process.

International experience shows that the chances of success as well as stakeholders' confidence in the siting process and the overall DGR programme are increased when the following components are present, but not limited to, in the programme:

- Clear technical siting criteria to ensure that the selected site meets all the safety requirements;
- Social criteria to assess how the DGR project will affect the well-being of the potential host communities;
- A clear and transparent site evaluation process such as screening studies, preliminary site evaluations and detailed site characterization carried out consistently with the development of the safety case;
- Clear and transparent decision milestones and process with clear roles and responsibilities of the various stakeholders involved such as the Government, the Regulator and the Implementor during all phases of the site selection process;
- A clear process for the role of the communities in the decision-making process;
- Adequate capacity building programmes for communities to learn about the siting process and participate in a meaningful manner.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

Observation: *Intermediate milestones, with appropriate decision-making process and allocation of responsibilities, are not defined at this stage of the site selection process between now and final site selection.*

The national programme for radioactive waste management is prepared for a fixed 10-year period and measures for performance indicators are not clearly defined.

There is no high-level document presenting the overall site selection process describing the successive site evaluation phases, the siting milestones and the related decision-making process, covering the period between today and the licensing phase.

(1)	<p>BASIS: SSR-5 Requirement 1 states that “The government is required to establish and maintain an appropriate governmental, legal and regulatory framework for safety within which responsibilities shall be clearly allocated for disposal facilities for radioactive waste to be sited, designed, constructed, operated and closed. This shall include: confirmation at a national level of the need for disposal facilities of different types; specification of the steps in development and licensing of facilities of different types; and clear allocation of responsibilities, securing of financial and other resources, and provision of independent regulatory functions relating to a planned disposal facility.”</p>
(2)	<p>BASIS: SSR-5 Requirement 3 states that “The operator of a disposal facility for radioactive waste shall be responsible for its safety. The operator shall carry out safety assessment and develop and maintain a safety case, and shall carry out all the necessary activities for site selection and evaluation, ... in accordance with national strategy, in compliance with the regulatory requirements and within the legal and regulatory infrastructure.”</p>

(3)	BASIS: SSR-5 Requirement 11, para. 4.2 states that “ <i>A step by step approach to the development of a disposal facility for radioactive waste refers to the steps that are imposed by the regulatory body and by political decision making processes</i> ”.
(4)	BASIS: SSG-14 para. 6.21 states that “ <i>Criteria should be established to indicate and justify when an operator should proceed from one stage to the next stage of Site characterization (e.g. to move from surface based investigations to underground investigations), under what conditions a site may be confirmed as suitable for disposal facility construction or operation and when investigations may be considered complete.</i> “
(5)	BASIS: SSG-14 para. 6.22 states that “ <i>A key requirement for decision making, and possibly one of the most difficult to justify, will relate to the sufficiency of site information.</i> “
R1	Recommendation: The Government should establish intermediate milestones until the final site selection and allocate responsibilities for decision making through this process. These milestones should be regularly updated as appropriate.
R2	Recommendation: INPP should develop a high-level document describing the overall site selection process including: the siting criteria, the site evaluation steps and relating timelines, the decision-making milestones, and the decision-making process for intermediate and final site selection.

1.2. REGULATORY INVOLVEMENT

Lithuanian position

Lithuania has set up legislative and regulatory framework. In the area of disposal, there are legal acts, government resolutions and general requirements. The licensing steps are defined in the Law of Nuclear Safety. In the siting process the regulator reviews safety of the siting in the Environmental Impact Assessment process and in the Licensing process.

The purpose of the WG is to comment on and also evaluate the studies made on the geological disposal facility site selection and share the information and opinions. The regulator, as a member of the WG, may comment the results supporting the site selection on the reports provided by the INPP, the operator.

The regulator has issued a set of regulations. These regulations contain general requirements in various areas of safety of radioactive waste. The regulation BSR-3.2.2-2016 ‘Radioactive Waste Disposal Facilities’ includes the regulations for the geological disposal facility. Its Chapter VIII focuses on the requirements for the justification disposal facility site.

ARTEMIS observation

The ARTEMIS Review Team understands that the regulator may give its opinion on the site selection studies through participation in the WG. The regulator also may provide guidance on implementation of requirements upon request by the operator.

To facilitate the work of the operator and to ensure the clarity of regulatory expectations on fulfilling the requirements on the site selection phase and future phases the regulator should consider developing comprehensive guidance on the expectations fulfilling the requirements.

The licensing steps defined in the legislation will likely not take place for a number of years from now.

The ARTEMIS Review Team considers that the regulator should review the outcomes of the site selection process at regular interval independently to the WG. The benefit for the regulator is to facilitate formulating their opinion on fulfilment of safety requirements along the disposal process while the benefit for INPP is to have feedback from the regulatory body about the proper fulfilment of the requirements.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
<p>Observation: <i>There is no regulatory guidance to support the site selection process at this stage.</i></p> <p><i>The development of regulatory guides and the consistent involvement of the regulator during the site selection process would benefit the operator and the regulator.</i></p>	
(1)	<p>BASIS: SSR-5 Requirement 2, Para. 3.8 states that “<i>The regulatory body has to provide guidance on the interpretation of the national legislation and regulatory requirements, as necessary, and guidance on what is expected of the operator in respect of each individual disposal facility.</i>”</p> <p>Para. 3.9 states that “<i>The regulatory body has to engage in dialogue with waste producers, the operators of the disposal facility and interested parties to ensure that the regulatory requirements are appropriate and practicable. [...]</i>”</p> <p>Para. 3.11 states that “<i>in respect of each individual disposal facility, the regulatory body has to set out the procedures that an operator is expected to follow in demonstrating compliance with the conditions for the development and operation of the facility. The regulatory body also has to set out the procedures that it follows to assess compliance with the conditions throughout all stages of the development, operation and closure of the facility.</i>”</p>
S1	<p>Suggestion: The regulatory body should consider developing comprehensive guidance on geological disposal facilities in support of national requirements on siting process. Also, the regulatory body should ensure regular dialogue with the operator on expectations in fulfilling the requirements.</p>

1.3. PUBLIC INVOLVEMENT

Lithuanian position

The Development Programme states that one of the necessary conditions for site selection is: “*sufficient public awareness*”. An adequate and objective public information on the DGR project is considered by INPP as one of the important factors for siting of DGR.

Until now, through the WG, only institutional stakeholders were involved in the site selection process. On 2023-07-13 basic presentation of DGR project and its goals to wide society was published on the largest Lithuanian news portal Delfi.lt. This date is considered by INPP as the starting point of proactive wider DGR public information campaign.

INPP with Ministry of Energy will organize formal public consultation with wide society taking into account the findings of the present ARTEMIS mission. The particular steps of the public consultation are not decided yet. Any information provided to public are carefully prepared by internal as well as external communication experts.

INPP intends to maintain flexibility in the site selection process so that new information can be incorporated as it comes along. The programme deliberately intends to leave flexibility for the decision makers the possibility to decide according to the existing situation of the time, the prevailing attitude of the whole society and the reactions of the society.

ARTEMIS observation

The ARTEMIS Review Team considers that the siting process is at critical stage. It is important that the siting effort is supported by a robust public information and involvement programme that provides a clear framework on how the public, communities and other stakeholders will be actively involved in the process.

From the discussions during the ARTEMIS mission, the ARTEMIS Review Team notes that INPP is aware of the importance of public information process and of the content of information provided.

The ARTEMIS Review Team commends Lithuania for including the notion of “*public awareness*” in the programme and encourages INPP to start as early as possible developing a public engagement programme to support the initial and later stages of the selection programme. The meaning of “*sufficient public awareness*” also needs clarification. The engagement programme should consider involving all stakeholders that may be impacted by the site selection process and its associated decisions, including local communities.

No formal engagement programme to support proactive dialogue with civil society and representatives from the communities has been established on national or local level although envisaged public consultation can be considered as its first stage. However, it is not clear how information gained during public consultation will be taken into consideration for future decisions and what are consecutive steps in interaction with public.

The ARTEMIS Review Team considers that such engagement process should be formalised at the appropriate level.

A document establishing a formal process should reflect further management of results of public consultation and subsequent steps of interaction with public, what will be the term of enabling future participation in the site selection and evaluation of criteria for decision-making.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

Observation: *Interaction with public is mainly addressed through transfer of information rather than through a two-way dialogue which would enable public engagement. So far, no space for dialogue with civil society/ communities representatives has been created on the national or local level.*

(1)	BASIS: SSR-5 Requirement 11, para. 4.4 states that “ <i>The step by step approach to the development of a disposal facility also allows opportunities for independent technical review, regulatory review, and political and public involvement in the process. The nature of the reviews and involvement will depend on national practices and on the facility in question [...]</i> ”
(2)	BASIS: SSR-5 Requirement 11, para. 4.5 states that “ <i>Alternative waste management options, the site selection and evaluation process and aspects of public acceptability, for example, may be considered in farther reaching reviews. [...]</i> ”
R3	Recommendation: The Government should establish a formal process for public engagement supporting the siting process of the DGR and the overall DGR programme as early as possible, with the support of INPP for its implementation.

1.4. PLANNING ITERATIONS BETWEEN SITE CHARACTERIZATION EVALUATION, SAFETY ASSESSMENT AND DESIGN

Lithuanian position

At the current stage, the geological evaluation of 110 initial potential sites has been carried out by LGS on the basis of criteria found in the international literature and specific Lithuanian geological conditions and data available.

Posiva Solutions OY evaluated geological formation suitability for DGR from safety point of view. Geological evaluation study was focused on evaluation of sites via geological suitability criteria.

LGS first study was finally accepted on 2022-05-24, and Posiva agreement regarding Safety Criteria Preparation came into force on 2022-01-21. Therefore its results were not used in the LGS outcomes.

INPP is in the process of developing DGR concepts for both crystalline and sedimentary sites (see § 1.1). Outcomes of these conceptual design studies will be available in 2024 for clay formations and in 2026 for crystalline formations.

INPP is intended to initiate an iterative process between siting, design and safety assessment which would comply with IAEA requirements.

ARTEMIS observation

The ARTEMIS Review Team notes that the approach of initiating an iterative process between siting, design and safety assessment is not documented at this stage. According to INPP, the “Megaproject” to be carried out in 2023-2024 would address such an iterative process. However, at this point, the ARTEMIS Review Team considers that there is no sufficient element indicating if and how this will be implemented, and consequently, if it will reach its overall objective.

The ARTEMIS Review Team notes that INPP is proactively preparing for the next steps of the site evaluation process including conceptual designs. Conceptual designs will make it possible to elaborate safety cases which will be updated at each step of the programme to be developed according to recommendation R1. As conceptual designs are intended in particular to take into account ILW such as graphite waste, this might improve consideration of ILW in the next safety study (see also § 2.2).

Iterative conceptual design and related safety assessment will allow safety issues to be better addressed in the site evaluation process. This will allow the outcomes of the design and safety studies to be taken into account in updating the criteria used in the progressive reduction of the number of considered potential sites. These outcomes will also include needs for new geological data to be acquired in the field which will enable improving the conceptual design in the next iterative step and progressively optimizing safety (as recommended by Posiva Solution Oy in pages 238-240 of its report).

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

Observation: *At the current stage, the geological evaluation of 110 initial potential sites has been carried out on the basis of criteria found in the international literature. A safety evaluation has been carried out in parallel, the results of which were not used as input data for the geological evaluation. Conceptual design begins now. Its outcomes will be provided in 2024 or later. Iterative conceptual design and related safety assessment allow safety issues to be progressively better taken into account in the siting process, giving consistent criteria for site selection and identifying the needs for new geological data to be acquired in the field.*

(1)	BASIS: SSR-5 Requirement 11 states that “Disposal facilities for radioactive waste shall be developed, operated and closed in a series of steps. Each of these steps shall be supported, as necessary, by iterative evaluations of the site, of the options for design, construction, operation and management, and on the performance and safety of the disposal system”
(2)	BASIS: SSG-14, para. 4.3 states that “The development of a geological disposal facility involves an iterative process of site characterization and the design and evolution of the safety case and the supporting safety assessment to provide an optimized level of operational and post-closure safety [...]”.
R4	Recommendation: INPP should develop a stepwise process where site characterization and evaluation are carried out iteratively with design and safety assessment.

1.5. RESOURCES

Lithuanian position

The document Implementation Measure states that in order to ensure the necessary high-quality and consistent decisions, the authorities must allocate continuous and sufficient resources for the implementation of a DGR from its initial stage. Main actors involved in DGR implementations, INPP and LGS, manage tasks related to DGR project with limited number of technical and communication experts. Resources allocated at VATESI for DGR site selection process are also limited.

Based on discussions and moving forward the programme will involve many streams of technical and engagement work. The work will increase in scope and complexity.

INPP plans to contract out several upcoming studies. In the site selection process, INPP is targeting to narrow the number of suitable sites to perform more detailed studies in the sites. In this phase, INPP is planning to publish site selection process and identify the sites for detailed studies. To plan and perform publication it is essential to have expertise in public communication.

ARTEMIS observation

The ARTEMIS Review Team confirms there are not sufficient resources to support the DGR site selection process and associated work programmes. Consequently, the INPP team has outsourced all technical work and furthermore synthesizing work, planning and strategic plans.

It is important that INPP has sufficient internal capacity to endorse and integrate the outcomes of all studies that are contracted. In the site selection process also, social sciences should be included to be sure that the perspective of peoples living in nearby communities to the site is taken into account. This aspect is important to achieve acceptance in communities around the disposal site.

In the same manner, VATESI should have sufficient resources to ensure its regulatory functions during all stages of the site selection process.

Similarly, LGS should have sufficient resources allocated to support the geological site evaluation process.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

Observation: *The site selection phase includes studies from various areas. The operator, regulator and other parties have to be able to build competence and expertise for reviewing the studies and to make conclusions and plan the future work.*

(1)

GSR Part 1 (Rev 1) Requirement 11, Para 2.35 states that “*The building of competence shall be required for all parties with responsibilities for the safety of facilities and activities, including authorized parties, the regulatory body and organizations providing services or expert advice on matters relating to safety.*”

(2)

SSR-5 Requirement 2, Para 3.9 states that “*The regulatory body [...] also has to maintain competent staff, to acquire capabilities for independent assessment and to undertake international cooperation, as necessary, to fulfil its regulatory functions.*”

(3)	SSR-5 Requirement 1, Para 3.7 states that “Government responsibilities [...] include [...] ensuring that the necessary scientific and technical expertise remains available both to the operator and for the support of independent regulatory reviews and other national review functions;”
S2	Suggestion: The Government should consider providing INPP, LGS and VATESI with adequate resources to support the site selection and stakeholders' engagement process (e.g. communication, facilitation, social science).

1.6. RECORD KEEPING AND TRANSPARENCY

Lithuanian position

To find a suitable site for the facility a considerable number of surveys, studies, reviews and decisions has to be performed.

The INPP management system is used for record keeping and knowledge transfer. It is not specific to the DGR project which covers very long timescales.

Decisions and recommendations made by the WG are recorded by INPP.

ARTEMIS observation

In DGR projects, the record keeping has an important role for several reasons. DGR projects are typically long projects in time and usually take decades in time and should even take into account the post closure period. The information is shared between several participating organizations and also between the operator and the contractors and sometimes between the contractors.

Early phases as siting and design of the disposal facility are iterative processes involving decision making in various phases. The ARTEMIS Review Team considers that an adequate records management system should be in place to ensure that justification and traceability of decision making is preserved for the duration of the DGR programme and beyond.

INPP is responsible for disposal project but is also a nuclear power plant operator now in decommissioning phase. It has a quality management system in place including a system for keeping the data. ARTEMIS Review Team recommends INPP to ensure that the record management system is suitable for the data produced for the disposal facility and that it is preserved during the whole lifetime and after the closure of the facility.

Similarly, to record keeping, the transfer of knowledge needs to be ensured for the whole duration of the project.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

Observation: *The INPP management system used for record keeping and knowledge transfer is not specific to the geological disposal project which covers very long timescales.*

(1)	<p>BASIS: GSR Part 2 Requirement 8 states that <i>“The management system shall be documented. The documentation of the management system shall be controlled, usable, readable, clearly identified and readily available at the point of use.”</i></p> <p>Para 4.19 states that <i>“Records shall be specified in the management system and shall be controlled. All records shall be readable, complete, identifiable and easily retrievable.”</i></p>
(2)	<p>SSR-5 Requirement 3, para 3.15: <i>“The operator has to retain all the information relevant to the safety case and the supporting safety assessment for the disposal facility [..]”</i></p>
S3	<p>Suggestion: INPP should consider developing a specific approach for record keeping and knowledge transfer for the geological disposal project, including for the site selection process.</p>

1.7. EXTERNAL ADVICE AND REVIEWING

Lithuanian position

This ARTEMIS review is organized at a crucial milestone of the site selection process. However, at this point no other review is planned for the future stages of the site selection process and the broader DGR development, as these stages firstly need to be clarified (see recommendations above).

Currently the INPP relies on the expertise of its internal staff and the WG to review plans, work programmes and outcomes.

ARTEMIS observation

The ARTEMIS Review Team commends the Ministry of Energy and INPP for requesting an ARTEMIS review at this critical stage of the site selection process. This is consistent with best international practice to seek guidance and advice and learn from other DGR programmes. Moreover, the ARTEMIS Review Team points out that organizing a peer review at a so early stage is not commonly observed and denotes a remarkable pro-active attitude.

The ARTEMIS Review Team notes that contracting with international consultancy companies enables the integration of international experience and expertise in the programme, which is good in principle.

However, the Team considers that there is no sufficient technical expertise outside the WG, used to independently review work plans and outcomes.

The work programme will increase in the next steps both in scope and complexity. DGR design and safety assessment will become more detailed, which will require increasing expertise. The programme will also involve more and more social aspects.

As this programme should be organized in the future in a stepwise and iterative manner, new crucial milestones will be planned for decision making between today and the 2047-time target. Decisions will require qualified input data and proper identification of risks. The reliability of the decision support elements can be increased by taking into account as wide feedback as possible. Therefore, independent technical reviews are needed to validate the outcomes of a programme phase and to prepare proper decision making. They will complement the work of consultants by challenging the outcomes. Independent technical reviews will also provide an integration tool for the various activities both technical and social.

It is also suggested to take into account lessons learnt from broader experience, especially foreign DGR programme, in the preparation and verification of work plans.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
<p>Observation: <i>At this time there is not enough external technical expertise to review work plans and outcomes. The future work programme will increase in scope and complexity as site characterization, DGR design and safety assessment become more detailed, which will require increasing expertise. Decisions will require qualified input data integrating associated risks, which can notably be based on a broader possible feedback. Independent expertise can complement the work of the consultants by challenging the outcomes and providing independent advice based on their feedback, particularly that of more advanced foreign DGR programmes.</i></p>	
(1)	<p>BASIS: GSR Part 2 Requirement 6, para. 6.7 states that “<i>The management system shall include evaluation and timely use of the following: (a) Lessons from experience gained [...] both within the organization and outside the organization, [...] Technical advances and results of research and development; [...] Lessons from identifying good practices.</i>”</p>
(2)	<p>BASIS: SSR-5 Requirement 11, para. 4.4 states that “<i>The step by step approach to the development of a disposal facility also allows opportunities for independent technical review [...]</i>” and para 4.5 states that: “<i>Technical reviews have to be undertaken prior to selection of a disposal option, prior to selection of a site (...).</i>”</p>
(3)	<p>BASIS: SSR-5 Requirement 14 states that “<i>The safety case and supporting safety assessment for a disposal facility shall be documented [...] to allow for independent review [...]</i>”.</p>
GP1	<p>Good Practice: The Ministry of Energy, together with INPP, decided to organize an international peer review at an early stage of the site selection process of the DGR programme.</p>
S4	<p>Suggestion: INPP, with the support of the Ministry of Energy, should consider establishing an external multidisciplinary advisory group to provide guidance, advice and technical reviews on site selection process and the overall DGR programme.</p>

2. METHODOLOGY, QUALITY AND CONTENT OF STUDIES PREPARED FOR EACH PHASE OF SITE SELECTION PROCESS

2.1 PRIORITIZATION BASED ON SOCIO-ECONOMIC CRITERIA

Lithuanian position

INPP used an external consultant firm to develop a socio-economic study to further assess the potential suitability of site.

The consultant, in agreement with INPP, developed a methodology to be used during the assessment of social and economic impact in potentially suitable Lithuanian regions or sites. The study was conducted using three different analytical dimensions, such as socio-economic, territory planning and environment and considering the various phases of the DGR construction, transportation and disposal of spent fuel. The methodology included the definition of a set of criteria as well as qualitative and quantitative weighting factors.

The input data used in the assessment is based on current statistical socio-economic information and existing environmental data. The application of the criteria and the weighting factors was determined using expert judgement without input from communities within and in the vicinity of the sites considered in the assessment. The study also included a sensitivity analysis to test the robustness of the assessment by varying the weights applied to the socio-economic, environmental and territory planning criteria considered.

The assessment resulted in the exclusion of 2 of the initial 110 sites considered.

ARTEMIS Observation

The ARTEMIS Review Team considers that the methodology used to prioritize the sites based on socio-economic criteria is a useful exercise to assess the various sites considered in the assessment and develop a better understanding of their socio-economic characteristics. The ARTEMIS Review Team notes that taking environmental issues into consideration at an early stage of the siting process is also appropriate.

The ARTEMIS Review Team considers that the interpretation of the results of the prioritization needs to be carefully managed. A certain level of caution should be applied when comparing sites at the very early stages of the siting process due to nature of available data and associated uncertainties.

For example, the socio-economic assessment is based on today's socio-economic conditions which will change over the decades. Also, some of the potential impacts of the DGR on the socio-economic conditions of the communities were evaluated based on the socio-economic study's hypothesis and not on input from communities regarding their concerns, expectations and aspirations.

Waste transportation between the Ignalina NPP site and potential DGR sites is another example. The socio-economic study considered a longer distance between potential sites and the NPP as an unfavourable condition. The weight given to this criterion resulted in a large number of preferred sites within 60 kilometers of the NPP. It is noted that international experience shows that transport of radioactive material can be safely transported over long distances in a socially acceptable manner.

The ARTEMIS Review Team considers the scoring and ranking methodology used to prioritize the sites on a socio-economic basis to be more a trend analysis rather than an absolute ranking process given the early stage of the site selection process. There is a need to highlight and emphasize the uncertainties and the subjectivity that are involved as well as their impact on the outcomes.

The ARTEMIS Review Team considers that future site evaluations stages should ideally include social and community well-being studies. The aim of these studies is to better understand the social conditions of communities including their concerns, aspirations and expectations and determine how the DGR project can be implemented in a manner that will have a positive impact on the potential host communities. Such studies should be conducted in collaboration and consultation with the communities participating in the site selection process.

The social studies should also be used to develop a series of high-level social siting criteria to assess the positive and potentially negative impacts on the communities and identify associated mitigation measures.

Such studies should involve experts in social sciences, who would bring a new and enriching vision to the current teams, made up of scientific and technical staff.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: <i>The socio-economic study was performed on the basis of available statistical data without interaction with communities and taking into account their concerns, expectations and aspirations. Assumptions were made by the assessor on what might be the impacts of the DGR on the communities. These assumptions will need to be confirmed in future steps based on the input from communities.</i>	
(1)	BASIS: GRS Part 5 Requirement 2 states that <i>“To ensure the effective management and control of radioactive waste, the government shall ensure that a national policy and a strategy for radioactive waste management are established. The policy and strategy shall be appropriate [...] shall consider relevant societal factors”.</i>
(2)	BASIS: SSR-5 Requirement 11 para. 4.4 states that <i>„The step by step approach to the development of a disposal facility also allows opportunities for [...] political and public involvement in the process. The nature of the reviews and involvement will depend on national practices and on the facility in question...”</i>
(2)	BASIS: SSR-5 Para. 1.18 states that <i>“ Such a step by step approach enables: the ordered accumulation and assessment of the necessary scientific and technical data; the evaluation of possible sites; the development of disposal concepts; iterative studies for design development and safety assessment with progressively improving data; technical and regulatory reviews; public consultation and political decisions.”</i>
R5	Recommendation: INPP should develop an approach and work programmes including developing high level social criteria to begin integrating social conditions and community well-being aspects in the evaluation of the potential suitability of sites.

2.2 SAFETY EVALUATION

Lithuanian position

INPP contracted a safety study to identify and apply general safety criteria to site screening with an attempt of prioritization of the considered geological formations. The study addresses post closure safety only at this stage. It includes the following steps:

- Consideration of waste streams as provided by INPP
- Consideration of available geological formations and constraints
- Safety concept and safety functions
- Consideration of Features Events and Processes (FEP) on the basis of OECD/NEA international data base
- Target properties
- Definition of scenarios, including base, sensitivity and disturbance
- Simplified design (no Engineered Barrier System (EBS) material is specified at this stage), selection of DGR depth for the purpose of the study
- Models formulation and data selection
- Safety calculations, comparison of scenario calculation results obtained in different geological configurations
- Identification of general safety criteria for site selection.

Safety assessment is based on spent fuel only, giving that its toxicity is much higher than that of other waste to be disposed of. Posiva Solutions Oy explained during the mission that DGR performance for intermediate level waste (ILW according to IAEA classification) can be appreciated through the sensitivity scenarios where various lifetimes of the canister are considered: 1,000, 10,000 and 100,000 years.

One of the conclusions of the study was to propose the exclusion of Permian evaporite geological formation in the Lithuanian context as a result of disturbance scenarios. This conclusion was similar to that of the study carried out in parallel by LGS on the basis of purely geological criteria. This resulted in the decision taken by the WG to exclude Permian evaporite geological formation as suitable, that resulted in exclusion of 1 potential site.

ARTEMIS observation

The ARTEMIS Review Team considers that the safety study is an excellent starting point for a future iterative process between siting activities, design and safety. The ARTEMIS Review Team agrees that having focused on long term safety at this early stage is consistent.

The report outlines a number of preliminary “target properties” (TP) for the potential host formations (see Table 6.2.7-1 of the report; for example TP34 is the thermal conductivity of the rock) as well as recommendations for future site survey. These target properties and recommendations should be exhaustively taken into account in the next stages of the site selection process, consistently with the iterative stepwise approach to be implemented.

The ARTEMIS Review Team points out the case of ILW such as graphite waste which is an important issue in Lithuania. The Team agrees that the hazards of this waste is considerably lower than that of spent fuel. However, due to larger volumes and to cost constraints, ILW need to be considered. For example, targeting lower permeability and greater thickness than considered in the minimal criteria will favour diffusion-controlled transport and dispersion.

The ARTEMIS Review Team notes that the study provides some information on the basis of sensitivity/disturbance scenarios. However, the early release of radionuclides of ILW in the geosphere will relate to base scenarios.

In parallel, there is a need to clarify consistently the safety functions expected from the disposal package of this waste in order to prepare packaging and storage activities.

The ARTEMIS Review Team notes that the report differentiates between the « containment » safety function and the « retention/retardation » safety function, which is commonly considered for HLW safety concept where these two functions are carried out by different barriers. For ILW the canister contribution to containment is usually more limited.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

Observation: *The Posiva Solutions Oy safety study identifies all waste streams to be disposed of including spent fuel and intermediate level waste (see IAEA classification). Intermediate level waste includes in particular graphite waste for which international experience shows that disposal presents specific issues. However, the safety study is based mainly on the disposal of spent fuel. Intermediate level waste is not treated explicitly in the scenarios developed for calculations.*

(1)	BASIS: SSR-5 Requirement 8 states that: <i>“The engineered barriers, including the waste form and packaging, shall be designed, and the host environment shall be selected, so as to provide containment of the radionuclides associated with the waste.”</i>
(2)	BASIS: SSR-5 Requirement 14 states that <i>“The safety case and supporting safety assessment for a disposal facility shall be documented to a level of detail and quality sufficient to inform and support the decision to be made at each step [...]”.</i>
(3)	BASIS: SSR-5 Requirement 16, para. 4.30 states that <i>“The designs of disposal facilities for radioactive waste may differ widely, depending on the types of waste to be disposed of and the host geological formation [...]. In general, optimal use has to be made of the safety features offered by the host environment ”.</i>
(4)	BASIS: SSR-5 Requirement 20 states that <i>“Waste packages [...] accepted for emplacement in a disposal facility shall conform to criteria that are fully consistent with, and are derived from, the safety case for the disposal facility”</i> and para. 5.1 states that <i>“examples of possible parameters for waste acceptance criteria include the characteristics and performance requirements of the waste packages [...] to be disposed of, such as [...] the properties of the waste form and packaging”.</i>
R6	Recommendation: INPP should include intermediate level waste in the safety assessment for the next stage of the site selection process.

2.3 SITE SELECTION CRITERIA

Lithuanian position

LGS performed a detailed and comprehensive site screening study of the country territory, based on existing geological data.

There are four geological formations in Lithuania, which are potentially suitable for DGR construction: Crystalline basement, Cambrian clay, Lower Triassic clay and Permian evaporates.

Screening was performed to exclude sites. Preliminary unsuitable areas were identified, and then excluded.

After excluding areas according to the above exclusion criteria, 110 potentially suitable sites were identified. Their total area is 5632 km².

This study took into consideration geological criteria. The geological criteria for the suitability of the geological formations for a DGR in Lithuania were then determined on the basis of IAEA, OECD/NEA and EU normative documents and the analysis and application of best practices from advanced DGR programmes. The geological criteria were divided into two main groups as follows, related to sufficient stability and sufficient physical isolation of a DGR.

Areas where the geological conditions did not meet the suitability criteria were excluded in the first LGS study. In the second LGS study, site scoring was based on expert opinions. From the 110 potential sites previously identified, 31 potential sites were excluded. A total of 79 potential areas were therefore recognized as suitable and prioritized for further research.

The WG decided to reject the Permian evaporites formation as potentially suitable for the DGR, considering the very limited research data on the behaviour of evaporites in the world, the questionable long-term mechanical and geochemical stability and the possible damage of the formation during the expected exploitation of minerals in the future.

Future climate processes and thermal conductivity were not taken into consideration as separate criteria at this stage of investigations, because no sufficient data were available.

INPP plans to consider these issues during the next stages of DGR investigation programme.

The safety study established safety-related criteria for the DGR as presented in the previous section.

The socio-economic study assessed the 110 potential sites based on a scoring and weighting system using expert judgement.

The Lithuanian Energy Institute (LEI) carried out a "Comprehensive Evaluation of DGR Studies". The study used the previous three studies as input for a statistical analysis of "global" site suitability. The study ranked sites based on numerical indicators. The annual dose rate from the safety study was considered as "safety indicator".

INPP plans to establish a subset of the sites identified within the potential areas. The objective of this prioritization is to initiate further detailed site investigations.

ARTEMIS observation

The ARTEMIS Review Team considers the LGS study high quality based on extensive knowledge of Lithuanian geology and its expertise in geosciences. The ARTEMIS Review Team observes that geological suitability criteria were identified without presenting either the safety strategy or the approach to derive them from safety functions. It is not clear how the interface between safety issues and geological investigations have been taken into account at the current site screening stage.

The ARTEMIS Review Team considers that the overall safety approach presented in the safety study is appropriate to define safety functions. However, this approach was established after the site screening was performed and was therefore not considered in this stage. The ARTEMIS Review Team advises for the next stages to implement such a systematic process to derive the safety related site selection criteria from safety functions taking advantage of the implementation of an iterative process as recommended earlier.

For example containment was not explicitly mentioned for the development of the geological screening criteria. The ARTEMIS Review Team advises to develop the criteria according to the IAEA terminology with regard to containment and isolation.

Recommendation 5 of the full-scope ARTEMIS mission on the radioactive waste management programme held in May 2022 relates to the need to prepare the safety case and safety assessment at the start of the process for the DGR. The ARTEMIS Review Team considers that the development of a safety case would help to guide the selection process, to formalise the position of INPP and to facilitate independent review by VATESI.

INPP wishes to keep the decision process as flexible as possible. The actual suitability criteria list is expected to be extended in the future e.g. for establishing the list of subset of sites. The ARTEMIS Review Team considers this approach to be adequate but questions the decision to definitively exclude a single rock formation (evaporites) at this early stage.

The ARTEMIS Review Team notes that at this stage only minimal criteria (e.g. formation depth, clay thickness, hydraulic conductivity) were taken into account while some design and safety relating criteria (e.g. ratio between in-situ stresses and rock strength, thermo-hydro-mechanical criteria and future climate processes) were not taken into account as existing information and data are not sufficient.

The ARTEMIS Review Team highlights that it is important to establish, at the beginning of the site selection process, the whole set of criteria that will have to be considered during the entire site selection process. A subset of criteria that can realistically be assessed during each subsequent stage should be identified. This will provide a comprehensive and transparent framework for future site selection and evaluations.

It is important to keep the selection process traceable by justifying and documenting the rationale supporting the choices, the weighting and the scoring of the criteria, and the decisions made.

In the site screening study, the ARTEMIS Review Team notes that the available data and level of characterisation for the different sites differs sometimes significantly. The lack of data for specific site cannot be used as a systematic argument to affect the suitability potential of the site.

The safety study ranked the main Lithuanian rock types for DGR suitability. The ARTEMIS Review Team stresses that it is important to be cautious on making strong statements regarding relative suitability considering the early stage of the programme and the associated lack of comprehensive geological data. INPP should avoid the ranking in the prioritized list to

definitely exclude entire host rock formations or sites in this very early stage of the entire DGR process.

Regarding the LEI study making an evaluation of past studies, the ARTEMIS Review Team considers that the outcome of the study depends highly on the input data from previous studies for which many uncertainties still exist. The ARTEMIS Review Team points out that a comprehensive evaluation of the three studies should have been more qualitative and descriptive, presenting sites that have more potential to host a DGR and sites that might have less potential to host a DGR.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
<p>Observation: <i>The Posiva Solutions Oy study provided a first range of safety functions, target properties and safety criteria. However, these properties and criteria were not used in the LGS site screening.</i></p> <p><i>The identification and management of uncertainties in the site screening process have not been done.</i></p>	
(1)	<p>BASIS: SSR-5 Requirement 4 states that “Throughout the process of development and operation of a disposal facility for radioactive waste, an understanding of the relevance and the implications for safety of the available options for the facility shall be developed by the operator. This is for the purpose of providing an optimized level of safety in the operational stage and after closure.”</p>
(2)	<p>BASIS: SSG-23 para. 4.26 states that “The early development and adoption of a strategy for safety is a key point in the development of the safety case. The Safety Strategy is [...] a high-level integrated approach adopted for achieving safe disposal. [...] the safety strategy should comprise an overall management strategy for the various activities required in planning, operation and closure of a disposal facility, including siting and design, development of the safety case, safety assessment, site characterization, waste form characterization, and research and development.”</p>
(3)	<p>BASIS: SSG-23 para. 4.28 states that “The safety strategy should address a number of key elements, namely: the provision of multiple safety functions and defence in depth, containment and isolation of the waste, the adoption of passive safety features, robustness of the disposal system, demonstrability of safety related features and aspects, and interdependences with the predisposal management of the waste.”</p>
(4)	<p>BASIS: SSG-14, para. 4.3 states that “The development of a geological disposal facility involves an iterative process of site characterization and the design and evolution of the safety case and the supporting safety assessment to provide an optimized level of operational and post-closure safety. [...] Key decisions, such as decisions on the choice of concept, site selection and evaluation, design, construction, operation and closure of the disposal facility, are expected to be made as the project develops [...]”.</p>

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

R7	Recommendation: INPP should implement a systematic process to derive the safety related site selection criteria from safety functions. This process should be documented, and the derived criteria should be justified.
S5	Suggestion: INPP should consider identifying and managing uncertainties associated with the site selection process in order to reduce the risk that the suitable sites are excluded at an early stage and that the safety of the final selected site is not demonstrated later in the process.

3. ASSESSMENT OF THE OUTCOMES OF THE DGR SITE SELECTION PROCESS AND THE PRIORITIZATION OF POTENTIALLY SUITABLE SITES FOR THE DGR

Lithuanian position

INPP completed a national screening including geological, socio-economical and safety assessments to identify potentially suitable DGR sites across Lithuania. This national screening initially considered 110 sites with various geological settings across the country. Based on exclusion criteria, the second step resulted in the exclusion of 33 sites. A prioritization (ranking) of the remaining 77 sites was then carried out using comprehensive evaluations involving a multi-attributes geological, socio-economic and safety using a scoring and weighting system. The three studies were performed in parallel.

INPP plans to select a subset of sites from the prioritization list for further consideration as potentially suitable sites, and at the same time, to begin engagement and dialogues with stakeholders and communities associated with these sites.

The number of sites to be considered for further evaluations is still to be determined. The plan was to select the sites by the end of 2023. The ARTEMIS Review Team understands that this number could range from 5 to 10 sites.

ARTEMIS observation

Prioritization based on geological criteria

The ARTEMIS Review Team considers that the methodology used to prioritize the sites based on geological criteria is a useful exercise to develop a better understanding of the characteristics of the various geological formations across Lithuania. A level of caution should be applied when comparing sites at this very early stage in the siting process due to for example the limited geological data that is available and resulting uncertainties. Uncertainties are also driven by the discrepancy in the amount and resolution of data between the various sites.

Also, the 1 to 3 scoring system used in the assessment is too narrow to effectively differentiate between sites in an absolute manner due to the uncertainties discussed above and subjectivity involved in attributing the scores. At this early stage of the site evaluation process, the scoring and ranking methodology is viewed more as a trend analysis exercise rather than an absolute ranking exercise. This aspect needs to be carefully considered when interpreting the outcomes and making site selection decisions.

Overall prioritization and outcomes

The ARTEMIS Review Team considers that moving from 77 sites to a subset of sites and engaging with communities is a critical step in the site selection process. This step needs to be carefully and strategically managed as it may have an impact on the credibility of the site selection process and stakeholders' confidence because of the inherent uncertainties involved in prioritizing (ranking) sites at this early stage of the siting process, and the lack of prior public and community engagement.

The following four important aspects that INPP needs to consider before implementing this step include: ranking the subset of sites; communicating to the public and communities the

decision to move forward with a subset of sites; the number of sites that will be selected; and the timeline for selecting and communicating the subset of sites.

- i. In terms of ranking the subset of sites, while the top sites in the prioritization list represent the sites with most potential as a group, it is too early to state with enough confidence that some are better than others. Publishing a list of ranked sites has the potential to raise questions and concerns amongst various stakeholders regarding the adequacy and credibility of the prioritization assessment given the uncertainties associated with the various assessments.
- ii. In terms of publishing the subset of sites, the identification of potentially suitable sites without an adequate communication and community engagement programme has the potential to create a perception that communities are being targeted without prior information and dialogue. International experience shows that identifying potential DGR sites without prior dialogue and engagement with local communities could seriously affect siting process.
- iii. Regarding the number of sites that will be selected, INPP is still in the process of deciding how many sites will be moved forward. Given that no broad engagement was undertaken, it is difficult to predict how communities within and in the vicinity of selected sites would react to this decision. It is therefore important that the number of selected sites allows for enough flexibility to successfully identify communities that are interested in participating in the siting process. The larger the number of selected sites, the higher are the chances of identifying interested communities and moving forward with additional site evaluation studies. The decision on the number of sites should also be based on the uncertainties and related risks.
- iv. Regarding the timelines for communicating the subset of sites in a successful manner, sufficient time has to be devoted to prepare the work programmes that are required to successfully engage communities and identify communities that are interested in participating in the siting process. INPP should ensure that the current timeline for selecting and communicating the subset of potential sites allows for sufficient time to develop the required work programmes.

Based on the experience from other siting programmes around the world, the chances of success of the next siting decision step in Lithuania would be increased if the following components, but not limited to, are considered and adapted to the Lithuanian context:

- A clear and transparent description of the purpose and intent of the national site screening including a qualification and description of the outcome.
- A strong rationale for the selection of the subset of sites, including the acknowledgement of uncertainties and the need for further site evaluations to confirm the suitability of the identified subset of sites.
- A clear siting process including both social and technical criteria, the siting steps, the milestones and the decision-making process (see section 1.0)
- A community engagement programme describing the intent of this stage of the site selection process, the next steps and the role of the communities moving forward.
- Communication and engagement material including a high-level description of the DGR project, the various components involved, timelines, and socio-economic characteristics associated with the project in terms of duration, jobs etc.

Finally, decision making throughout the site selection process should be supported by risk management considering both technical and social risks. Risk management is to be carried out consistently with uncertainty management (Suggestion S5). For example, short term risks include that none of the communities associated with the subset of potential sites would be interested in participating in the siting process. Longer term risk include that the preferred site selected in final site selection would not sufficiently meet the requirements of the safety case.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

Observation: *There is no formal detailed work plan to implement the narrowing down process of the selection of sites (from 77 sites to a subset by 2024).*

Regarding the ranking of the subset of selected sites, the prioritization assessment is considered to be more a trend analysis rather than an absolute ranking process because of the inherent uncertainties and subjectivity involved in multi-attributes prioritization assessments at this early stage of the site evaluation process.

Regarding the number of sites that will be considered for the next step, there are no criteria to decide on the subset of sites that will be moved to the next stage taking into account that no prior engagement has taken place with communities.

It is important to ensure that the timeline of selecting the subset of sites by 2024 is sufficient to prepare all the work programmes and engagement material that need to be in place before communicating the decision.

(1)	BASIS: SSR-5 Requirement 3 states that <i>“The operator of a disposal facility for radioactive waste shall be responsible for its safety. The operator shall carry out safety assessment and develop and maintain a safety case, and shall carry out all the necessary activities for site selection and evaluation, design, construction, operation, closure and, if necessary, surveillance after closure, in accordance with national strategy, in compliance with the regulatory requirements and within the legal and regulatory infrastructure.”</i>
(2)	BASIS: SSR-5 Requirement 11 para. 4.4, states that <i>“The step by step approach to the development of a disposal facility also allows opportunities for independent technical review, regulatory review, and political and public involvement in the process. The nature of the reviews and involvement will depend on national practices and on the facility in question. Technical reviews by, or on behalf of, the operator and the regulatory body may focus on site selection and evaluation and design options, the adequacy of the scientific basis and analyses, and whether safety standards and requirements have been met.”</i>
(3)	BASIS: SSG-14 para. 6.21 states that <i>“Criteria should be established to indicate and justify when an operator should proceed from one stage to the next stage of site characterization (e.g. to move from surface based investigations to underground investigations), under what conditions a site may be confirmed as suitable for disposal facility construction or operation and when investigations may be considered complete.”</i>

R8	<p>Recommendation: INPP should develop an approach and an associated workplan for narrowing down to a subset of potential suitable sites and initiating dialogues with communities.</p>
S6	<p>Suggestion: With regard to the selection of the subset of sites and in order to build public and community confidence, INPP should consider:</p> <ul style="list-style-type: none"> - publishing the list of the selected sites as a group without any ranking - justifying the number of sites and - reviewing the timeline for making the list of sites public.

APPENDIX A: TERMS OF REFERENCE

1. Introduction

On 27 October 2022, the Ministry of Energy of Lithuania requested the IAEA to undertake an ARTEMIS review of Deep Geological Repository (hereinafter - DGR) project in Lithuania for spent nuclear fuel and long-lived radioactive waste.

Background

“Development Program for Decommissioning of Nuclear Power Facilities and Radioactive Waste Management for 2021–2030” (hereinafter - the Program) was approved by the Resolution No. 76 of the Government of the Republic of Lithuania on 3 February 2021.

The Program establishes that the only sustainable final method of disposal of spent nuclear fuel and other long-lived radioactive waste that can be considered at the moment is their placement in a deep geological repository.

Currently, Ignalina NPP (hereinafter - INPP), appointed as the responsible institution for the implementation of the DGR project, is carrying out the initial stage of the conceptual planning project - the selection of the site.

2. Objective

The Review will provide an independent international evaluation of the studies carried out by Lithuania on the development of criteria for the selection of the DGR site.

The review, organized in the IAEA by the Department of Nuclear Safety and Security and the Department of Nuclear Energy will be performed by an independent, international peer review team selected by the IAEA.

3. Scope

The given ARTEMIS review will evaluate the following aspects:

1. Adequacy of the overall DGR Site selection process, including timeframes,
2. Methodology, quality and content of studies prepared for each phase of site selection process,
3. Assessment of the outcomes of the DGR site selection process and the prioritization of potentially suitable sites for the DGR.

4. Basis for the review

The ARTEMIS review will be based on the relevant IAEA Safety Standards and proven international practice and experiences, following the guidelines of the ARTEMIS review service.

5. Reference material

The review will cover all documentation submitted by National Counterpart for the considered scope of the review.

The provisional list of reference material is provided in the Annex 1 (such a list is subject to updates and should be finalized by submission of the advance reference material).

All documents for the purpose of the ARTEMIS review will have to be submitted in English.

6. Modus operandi

The working language of the mission will be English.

The National Counterparts are Ignalina NPP and the Ministry of Energy of the Republic of Lithuania. The National Counterpart Liaison Officer for the review is Mr. Dmitrij Ekaterinicev from Ignalina NPP, contact person of the Ignalina NPP Mr. Andrius Vyšniauskas , contact person of the Ministry of Energy is Mr. Renatas Šumskis.

The timeline for the key steps of the review process is provided below:

- Preparatory Meeting: 5 April 2023 (WebEx meeting).
 - The reference material (in English) will be provided to the IAEA as soon as they are available and not later than 15 May 2023.
 - Questions based on the preliminary analysis of the reference material will be provided by the review team by 30 June 2023.
 - Peer review mission: 16-25 July 2023 (10 days (without site visit))¹
- Sunday 16 July: arrival of experts;
 - Monday 17 July to Thursday 20 July: interviews/exchange/discussion with Counterpart(s) on the basis of preliminary analysis and drafting of recommendations and suggestions;
 - Friday 21 July - Saturday 22 July: preparation of the draft mission report (Review Team);
 - Sunday 23 July noon: Delivery of draft report to the Counterparts for fact checking;
 - Monday 24 July: discussions between the Review Team and the Counterparts and finalization of draft mission report;
 - Tuesday 25 July: exit meeting - delivery of the draft mission report and mission closure.

¹ The delivery of the Peer Review Mission will be reviewed by IAEA and the Ministry of Energy of the Republic of Lithuania 12 weeks before the scheduled dates to consider the impact of the COVID-19/international situation, specifically travel restrictions.

7. International peer review team

The IAEA will convene a team of international experts to perform the ARTEMIS review according to the agreed Terms of Reference. The team will comprise of:

- Six qualified and recognized international experts from government authorities, regulatory bodies, waste management organizations, and technical support organizations with experience in the safe management of radioactive waste and spent fuel;
- Two IAEA staff to co-coordinate the mission: Ms Karina Lange from the Department of Nuclear Energy and Mr Gerard Bruno from the Department of Nuclear Safety and Security;
- One IAEA facilitator;
- A senior member of IAEA staff will oversee the closure of the review.

The peer review team will be led by a Team Leader as defined in the ARTEMIS draft guidelines. The Team Leader will be Mr Jean-Michel Hoorelbeke consultant from France. The IAEA will inform the National Counterparts regarding the composition of the proposed review team prior to submission of reference material.

As a pre-condition for their participation, the experts selected by the IAEA will be asked to sign a confidentiality and non-disclosure agreement to protect any classified or restricted material provided by the Counterparts.

8. Reporting

The findings of the peer review will be documented in a final report that will summarize the proceedings of the review and contain any recommendations, suggestions and good practices. The report will reflect the collective views of the review team members and not necessarily those of their respective organization or Member State or the IAEA.

Prior to its finalization, the ARTEMIS Review Report will be delivered to the National Counterparts for fact-checking.

9. Funding of the peer review

The peer review will be funded by Ignalina NPP. The costs for the services will be limited to the travel costs and per diem of the peer review team (external experts and IAEA staff) in line with IAEA Financial Regulations and Rules.

The cost of the ARTEMIS review is estimated to the amount of 41 000 EUR, to be paid to the IAEA as voluntary contribution before the start of the mission. Austria is aware that the review cost includes 7% programme support costs.

If the actual cost of the ARTEMIS review exceeds the estimated voluntary contribution, Ignalina NPP agrees to cover such additional cost to the IAEA. Similarly, if the actual cost is less than the estimated voluntary contribution, any excess will be refunded to Ignalina NPP through the Counterpart.

These Terms of Reference have been agreed between the IAEA and the Ministry of Energy of the Republic of Lithuania during the preparatory meeting 5 April 2023.

APPENDIX B: MISSION PROGRAMME

Time	Sun, 16 July	Mon, 17 July	Tue, 18 July	Wed, 19 July	Thurs, 20 July	Fri, 21 July	Sat, 22 July	Sun, 23 July	Mon, 24 July	Tue, 25 July
9h00-10h00	Arrival of Team members	Opening General presentation	Socio-economic evaluation	Safety criteria	Comprehensive evaluation	Finalisation of Suggestions and Recommendations to Counterparts	Presentation of Suggestions and Recommendations to Counterparts	Draft report to be sent to Counterparts	Internal reflection of comments	Delivery of final draft report
10h00 - 12h00		Determination of geological criteria	Socio-economic evaluation	Safety criteria	Comprehensive evaluation				Discussions with the Counterparts on the draft report	EXIT MEETING
12h00 - 13h00	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Lunch	Departure of Team Members
13h00 - 16h00		Determination of geological criteria	Socio-economic evaluation	Safety criteria	Session reserved for further discussions if required/drafting of the report	Drafting of the report	Drafting of the report	Counterparts review the draft report	Finalising draft report	
16h30 - 17h30	Artemis Team meeting	Team meeting	Team meeting	Team meeting	Team meeting	Finalisation of Suggestions and Recommendations				
17h30		Drafting of report	Drafting of report	Drafting of report	Drafting of report					

APPENDIX C: RECOMMENDATIONS AND SUGGESTIONS

Area		R: Recommendations S: Suggestions G: Good Practices	Recommendations, Suggestions or Good Practices
1.	ADEQUACY OF THE OVERALL DGR SITE SELECTION PROCESS, INCLUDING TIMEFRAMES	R1	The Government should establish intermediate milestones until the final site selection and allocate responsibilities for decision-making through this process. These milestones should be regularly updated as appropriate.
		R2	INPP should develop a high-level document describing the overall site selection process including: the siting criteria, the site evaluation steps and relating timelines, the decision-making milestones, and the decision-making process for intermediate and final site selection.
		S1	The regulatory body should consider developing comprehensive guidance on geological disposal facilities in support of national requirements on siting process. Also, the regulatory body should ensure regular dialogue with the operator on expectations in fulfilling the requirements.
		R3	The Government should establish a formal process for public engagement supporting the siting process of the DGR and the overall DGR programme as early as possible, with the support of INPP for its implementation.
		R4	INPP should develop a stepwise process where site characterization and evaluation are carried out iteratively with design and safety assessment.
		S2	The Government should consider providing INPP, LGS and VATESI with adequate resources to support the site selection and stakeholders' engagement process (e.g. communication, facilitation, social science).

Area		R: Recommendations S: Suggestions G: Good Practices	Recommendations, Suggestions or Good Practices
		S3	INPP should consider developing a specific approach for record keeping and knowledge transfer for the geological disposal project, including for the site selection process.
		GP1	The Ministry of Energy, together with INPP, decided to organize an international peer review at an early stage of the site selection process of the DGR programme.
		S4	INPP, with the support of the Ministry of Energy, should consider establishing an external multidisciplinary advisory group to provide guidance, advice and technical reviews on site selection process and the overall DGR programme.
2.	METHODOLOGY, QUALITY AND CONTENT OF STUDIES PREPARED FOR EACH PHASE OF SITE SELECTION PROCESS	R5	INPP should develop an approach and work programmes including developing high level social criteria to begin integrating social conditions and community well-being aspects in the evaluation of the potential suitability of sites.
		R6	INPP should include intermediate level waste in the safety assessment for the next stage of the site selection process.
		R7	INPP should implement a systematic process to derive the safety related site selection criteria from safety functions. This process should be documented, and the derived criteria should be justified.
		S5	INPP should consider identifying and managing uncertainties associated with the site selection process in order to reduce the risk that the suitable sites are excluded at an early stage and that the safety of the final selected site is not demonstrated later in the process.

Area		R:Recommendations S: Suggestions G: Good Practices	Recommendations, Suggestions or Good Practices
3.	ASSESSMENT OF THE OUTCOMES OF THE DGR SITE SELECTION PROCESS AND THE PRIORITIZATION OF POTENTIALLY SUITABLE SITES FOR THE DGR	R8	INPP should develop an approach and an associated workplan for narrowing down to a subset of potential suitable sites and initiating dialogues with communities.
		S6	With regard to the selection of the subset of sites and in order to build public and community confidence, INPP should consider: <ul style="list-style-type: none"> - publishing the list of the selected sites as a group without any ranking - justifying the number of sites and - reviewing the timeline for making the list of sites public.

APPENDIX D: LIST OF ACRONYMS USED IN THE TEXT

DGR	Deep Geological Repository
EBS	Engineered Barrier System
EIA	Environmental Impact Assessment
EU	European Union
FEP	Features Events and Processes
HLW	High Level Waste
IAEA	International Atomic Energy Agency
ILW	Intermediate level waste
INPP	Ignalina Nuclear Power Plant
LEI	Lithuanian Energy Institute
LGS	Lithuanian Geological Survey
OECD/NEA	Organisation for Economic Co-operation and Development/ Nuclear Energy Agency
RSC	Radiation Protection Center
SF	Spent fuel
VATESI	State Nuclear Power Safety Inspectorate
WG	Working Group on Radioactive Waste Management Monitoring

APPENDIX E: LIST OF REFERENCE MATERIAL

- 1. The development programme for decommissioning of nuclear power facilities and radioactive waste management for 2021–2030
- 2. „Determination of geological criteria for the suitability of the geological environment for the Deep Geological Repository of the radioactive waste“ together with the report „Final report on detailed analysis of formations potentially suitable for the construction of the Deep Geological Repository of the radioactive waste and prioritisation of potential sites according to the main geological (suitability) selection criteria “ (Lithuanian Geological Survey under Ministry of Environment, 2022);
- 3. "Social and economic evaluation for selection of potential region for Deep Geological Repository (DGR)" (IDOM Consulting, Engineering, Architecture, S.A.U (Spain), 2022);
- 4. "Safety-related criteria for deep geological repository construction in Lithuania" (Posiva Solutions Oy (Finland), 2023);
- 5. „Comprehensive evaluation of the studies results carried out in the Deep Geological Repository project“(Lithuanian energy institute (Lithuania), 2023).