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INTEGRATED REVIEW SERVICE FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT, DECOMMISSIONING AND REMEDIATION (ARTEMIS)

MISSION

TO

LITHUANIA

Vilnius, Lithuania

15-25 May 2022

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

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REPORT OF THE

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Mission dates: *15-25 May 2022*
Location: *Vilnius, Lithuania*
Organized by: *IAEA*

ARTEMIS REVIEW TEAM	
Mr Walter Blommaert	ARTEMIS Team Leader (Belgium)
Mr Geoff Williams	Reviewer (Australia)
Mr Peter Lietava	Reviewer (Czech Republic)
Mr Jaakko Leino	Reviewer (Finland)
Mr Boris Brendebach	Reviewer (Germany)
Mr Paolo Gui	Reviewer (Italy)
Mr Vladan Ljubenov	IAEA Team Coordinator
Ms Tetiana Kilochytska	IAEA Deputy Team Coordinator
Ms Irene Bollozos-Semana	IAEA Admin. Assistant

IAEA-2022

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

EXECUTIVE SUMMARY

At the request of Ministry of Energy of the Republic of Lithuania on 18 December 2018, the International Atomic Energy Agency (IAEA) organized an ARTEMIS review to fulfil Lithuania's obligations under 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 Waste Directive). The objective of the ARTEMIS Peer Review Service is to provide independent expert opinion and advice on radioactive waste (RAW) and spent nuclear fuel (SF) management, decommissioning and remediation, based upon the IAEA safety standards and technical guidance, as well as international good practice.

The review was performed by a team of senior international experts in the field of radioactive waste and spent fuel management, from IAEA Member States, with IAEA staff providing coordination and administrative support. The ARTEMIS Review Team comprised of six senior international experts in the field of radioactive waste management and decommissioning from Australia, Belgium, Czech Republic, Finland, Germany and Italy.

The review addressed the following topics, consistent with the elements of the Waste Directive:

- National policy and framework;
- National strategy;
- National inventory;
- Concepts, plans and technical solutions;
- Safety case and safety assessment of activities and facilities;
- Cost estimates and financing;
- Capacity building.

A virtual preparatory meeting was organized in November 2020, followed by the receipt of Advanced Reference Material (ARM) in October of 2021. The ARM included the following main legal acts and documents:

1. Law on the Management of Radioactive Waste (1999, as amended in 2018);
2. Law on Nuclear Energy (1996, as amended in 2018);
3. Law on Nuclear Safety (2011, as amended in 2017);
4. Law on Radiation Protection (1999, as amended in 2020);
5. Law on the Ratification of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (2003);
6. Law on Environmental Impact Assessment (1996, as amended in 2017);
7. Set of documents on national nuclear safety requirements;
8. Self-Assessment document;
9. Ignalina NPP Final Decommissioning Plan;
10. Development Programme;
11. Report to the 7th Review Meeting of the Join Convention (2020);
12. Implementation Report in relation to the European Commission;
13. IRRS Report 2016 and Follow-up Report 2020.

The ARTEMIS Review Team examined the provided material and in April 2022 sent a list of questions to the Lithuanian counterparts for additional information and clarifications.

The ARTEMIS mission had initially been planned for the second quarter of 2021, but was postponed to the end of the first quarter of 2022 due to the impact of the COVID-19 pandemic.

The mission took place from 15th to 25th May 2022 in Vilnius. The ARTEMIS Review Team performed the review according to the mission programme given in Appendix B, evaluating the Lithuanian national programme and the national framework for executing country's obligations for safe and sustainable radioactive waste and spent fuel management, with the objective of providing Lithuanian authorities with recommendations and suggestions for improvement and, where appropriate, identifying good practice.

During the ARTEMIS mission, presentations by the Lithuanian organizations involved in radioactive waste management, spent fuel management and decommissioning activities (Ministry of Energy of the Republic of Lithuania, the State Nuclear Power Safety Inspectorate (VATESI), Radiation Protection Centre (RSC) and Ignalina NPP), were provided, followed by extensive discussions, answering the questions of the ARTEMIS Review Team. Part of the review mission was a one-day visit to the Ignalina NPP site, which was organized on 18 May. The visit included technical tours to the dry spent fuel storage facility, the treatment and storage facility for solid radioactive waste, the reactor room and the spent fuel pool of the Ignalina NPP Unit 1 and the turbine hall of the NPP, where dismantling, segmentation and decontamination activities are being performed.

The ARTEMIS team noted the strong commitment of the Government of Lithuania to ensure a safe implementation of the RAW and SF management activities in the country, in accordance with applicable legal and regulatory system, international conventions and IAEA safety standards.

The ARTEMIS Review Team acknowledged the particular challenges associated with the waste inventory from past activities in Lithuania and with the decommissioning of the INPP. They commended the strong commitment of all involved Lithuanian organizations to ensure safe management of radioactive waste. They also were particularly encouraged by the very open and constructive manner, in which the counterparts engaged throughout.

The ARTEMIS Review Team concluded that many aspects relevant to the safe management of radioactive waste in Lithuania are in place. However, they noted some important aspects, which should be evaluated and strengthened. They made a number of recommendations and suggestions, of which the most significant addressed to:

- The Government:
    - to ensure that updates of the Development Programme include milestones and schedules contributing to the long-term commitment to safety and to avoiding an undue burden on future generations;
    - to revise the funding system for activities planned after 2030 (e.g., deep geological disposal facility, radioactive waste management after 2038) in order to ensure that adequate financial resources are available when necessary;
- The Ministry of Energy
    - to update the Development Programme (Part II - Financial Projections) and the Implementation Measures on the basis of an overall scope of activities and cost estimation approach;
- The Ignalina Nuclear Power Plant:

- to develop a safety evaluation and propose specific (conditional) clearance levels;
- to prepare the safety case and safety assessment at the start of the process for the deep geological disposal facility, in order to support the concept development, site selection, setting up research and development priorities.

The ARTEMIS Review Team commended Lithuania for establishing the Working Group on Radioactive Waste Management Monitoring, which contributes to improvement of the communication and coordination among different parties involved in the development of the deep geological disposal facility and limits the risks to the project. This was recognized as a good practice.

In summary, the ARTEMIS team considers that Lithuania has established a good basis for the safe and responsible management of radioactive waste and spent fuel, for which further improvements can be successfully implemented.

The ARTEMIS team is of the opinion that, by adequately considering the outcomes of the present review, Lithuania will be in a good position to continue meeting high standards of safety for radioactive waste and spent fuel management in the country.

In this regard, the ARTEMIS team suggests that a follow-up mission in around 3-4 years from now could bring value to Lithuania's efforts to improve its waste management.

I. INTRODUCTION

On 18 December 2018, the Ministry of Energy of the Republic of Lithuania requested the IAEA to organize and carry out, in the second quarter of 2021, the Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) peer review mission in Lithuania, as required of all EU Member States by Article 14.3 of the European 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 (hereinafter the EU Waste Directive).

In July 2021, the mission was postponed to the end of the first quarter of 2022 due to the impact of the COVID-19 international situation.

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 November 2020, and the receipt and review of Advanced Reference Material in October of 2021, in May 2022 the ARTEMIS Review Team evaluated the Lithuanian national programme and the national framework for executing the country's obligations for safe and sustainable radioactive waste and spent fuel management. Special emphasis was given to the decommisioning of Ignalina NPP. Management of NORM residues and environmental remediation were out of the scope of the review.

The review mission took into account the outcomes of the IRRS follow-up mission from 2020 that are related to the spent fuel and radioactive waste management programme of Lithuania.

This report provides the summary of the review process and the findings. All the tables and figures are taken from the Advance Reference Material or from the presentations provided by the Lithuanian counterparts.

II. OBJECTIVE AND SCOPE

The ARTEMIS review provided an independent international evaluation of Lithuania's radioactive waste and spent fuel management programme.

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

III. BASIS FOR THE REVIEW

A) PREPARATORY WORK AND IAEA REVIEW TEAM

At the request of the Government of Lithuania, a virtual preparatory meeting for the ARTEMIS Review mission, was conducted on 26 of November 2020. The preparatory meeting was carried out by the appointed Team Leader Mr Geoff Williams, the IAEA coordinator and deputy coordinator Mr Vladan Ljubenov and Ms Tetiana Kilochytska, and the team of National Counterparts led by Mr Renatas Šumskis from the Ministry of Energy of the Republic of Lithuania with participation of representatives of the State Nuclear Power Safety Inspectorate (VATESI), Ignalina NPP and RSC.

The ARTEMIS mission preparatory team had discussions regarding:

- the Terms of Reference for the ARTEMIS review of the Lithuanian strategy to fulfil obligations from article 14(3) of the EU *Waste Directive*; and
- the relevant detailed aspects for organization and conduct of the review.

IAEA staff presented the ARTEMIS principles, process and methodology. This was followed by a discussion on the work plan for the implementation of the ARTEMIS review in Lithuania in May 2022.

Mr Renatas Šumskis from the Ministry of Energy of the Republic of Lithuania was appointed as the National Counterpart for the ARTEMIS mission and designated IAEA point of contact.

Lithuania provided IAEA with the Advance Reference Material (ARM) for the review in October 2021.

In May 2022 Mr Walter Blommaert replaced Mr Geoff Williams as the Team Leader.

B) REFERENCES FOR THE REVIEW

The articles of the EU *Waste Directive*, the draft guidelines for the ARTEMIS review service and the responses to the self-assessment questionnaire were used as the basis for the review together with the ARM and materials presented during the mission and associated discussions. The complete list of IAEA publications used as the basis for this review is provided in Appendix E.

C) CONDUCT OF THE REVIEW

The initial ARTEMIS Review Team meeting took place on Sunday, 15 May 2022 in Vilnius, directed by the ARTEMIS Team Leader Mr Walter Blommaert, the ARTEMIS Team Coordinator Mr Vladan Ljubenov and the Deputy Team Coordinator, Ms Tetiana Kilochytska.

The National Counterpart Mr Renatas Šumskis 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, 16 May 2022, with the participation of the of representatives of the Ministry of Energy of the Republic of Lithuania, the Ministry of Environment of the Republic of Lithuania, the State Nuclear Power Safety Inspectorate (VATESI), RSC and Ignalina NPP. Opening remarks were made by Mr Albinas Zananavičius,

Vice Minister of Energy at the Ministry of Energy of the Republic of Lithuania and Mr Walter Blommaert, ARTEMIS Team Leader.

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 for improvement and, where appropriate, identifying good practice.

The ARTEMIS Review Team performed its review according to the mission programme given in Appendix B. Part of the review mission was a one-day visit to the Ignalina NPP site, which was organized on 18 May. The visit included technical tours to the dry spent fuel storage facility, the treatment and storage facility for solid radioactive waste, the reactor room and the spent fuel pool of the Ignalina NPP Unit 1 and the turbine hall of the NPP, where dismantling, segmentation and decontamination activities are being performed.

The ARTEMIS Exit Meeting was held on Wednesday, 25 May 2022. Opening remarks were made by Mr Albinas Zananavičius, Vice Minister of Energy at the Ministry of Energy of the Republic of Lithuania. A presentation of the results of the Review Mission was given by the ARTEMIS Team Leader Mr Walter Blommaert. Closing remarks were made on behalf of the IAEA by Mr Peter Johnston, Director of the Division of Radiation, Transport and Waste Safety, Department of Nuclear Safety and Security.

An IAEA press release was issued.

1. NATIONAL POLICY AND FRAMEWORK FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT

1.1. NATIONAL POLICY

Lithuanian position

The Republic of Lithuania has long lasting experience in use of nuclear applications for peaceful purposes, respectively in the safe management of spent fuel (SF) and radioactive waste (RAW). The first storage facility for RAW from scientific, industrial and medical applications has been in operation since 1963, when Maišiagala Radioactive Waste Storage Facility (Maišiagala RWSF) was put into operation. During operation of the Ignalina Nuclear Power Plant (INPP), the SF and RAW management program was extended gradually to dedicated facilities at the INPP site.

The national policy of the Republic of Lithuania for SF and RAW management (national policy) is based on the commonly accepted principles for the responsibilities of the current generation and for avoiding undue burden to future generations. The national policy is laid down in the national legislation, namely the Law on the Management of Radioactive Waste, Law on Nuclear Energy, Law on Nuclear Safety and the Law on Radiation Protection and the regulations for their application. The provisions of the regulatory framework ensure the protection of individuals, society and the environment against radiological and other risks.

According to the Law on Nuclear Energy, Law on Nuclear Safety and Law on the Management of Radioactive Waste, SF and RAW management is based on the following principles:

- Responsibility for ensuring nuclear safety and radiation protection lies in full with the persons, responsible for the facilities and activities and may not be transferred to others;
- Persons responsible for the facilities and activities shall establish and maintain an effective safety management system;
- The expected economic, social and other benefits, shall outweigh any possible adverse effects of the activities;
- Measures to ensure nuclear safety and radiation protection shall be optimized so as to ensure achieving the highest possible, reasonably achievable level of protection;
- Exposure of the personnel and public shall be limited and maintained as low as the reasonably achievable level;
- The concept of defence in depth shall be applied, while implementing all reasonably practicable measures, to prevent accidents and limit their consequences;
- An effective system for emergency preparedness and response, in case of a nuclear or radiological emergency, shall be established and maintained;
- Protective measures to reduce current and/or uncontrolled exposure shall be justified and optimized;
- The competent authority, which carries out the state regulation of the safe use of nuclear energy and ionizing radiation, shall be provided with human and financial resources, sufficient to carry out its responsibilities in full.

The prime responsibility for the safety of SF and RAW management facilities and/or activities rest with the license holder.

The international cooperation in the field of SF and RAW management is particularly important for the Republic of Lithuania. Close contacts with the regulatory authorities of the EU member countries are maintained. The programs of IAEA and the European Commission in the field of SF and RAW management are of particular significance and Lithuania will continue to participate actively in them.

The Republic of Lithuania is party to international treaties and agreements that govern the fundamentals of nuclear safety and radiation protection, including the Convention on Nuclear Safety and the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

ARTEMIS observation

The elements of the national policy on SF and RAW management as well as on decommissioning are mentioned in various legal documents. The national policy is based on the commonly accepted principles of, e.g.:

- the responsibilities of the current generation and for avoiding undue burden to the future generations;
- the protection against radiological, biological, chemical and other hazards;
- minimisation of RAW generation in terms of volume and activity;
- interdependencies among all steps in the RAW management;
- graded approach;
- disposal of RAW generated in the territory of the Republic of Lithuania in disposal facilities within its territory.

Although these commonly accepted principles of a national policy are reflected in the mentioned set of laws, the ARTEMIS Review Team considers it beneficial to have one policy document combining these principles.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: *The commonly accepted elements of a national policy for SF and RAW management as well as for decommissioning are presented in a number of laws.*	
(1)	**BASIS: GSR Part 1 (Rev. 1) Requirement 1 states that** *"The government shall establish a national policy and strategy for safety, the implementation of which shall be subject to a graded approach in accordance with national circumstances and with the radiation risks associated with facilities and activities, to achieve the fundamental safety objective and to apply the fundamental safety principles established in the Safety Fundamentals."*
(2)	**BASIS: GSR Part 1 (Rev. 1) Requirement 1 para. 2.3 states that** *"National policy and strategy for safety shall express a long term commitment to safety. The national policy shall be promulgated as a statement of the government's intent…"*
(3)	**BASIS: GSR Part 5 Requirement 2 states that** *"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 national policy and strategy shall form the basis for decision making with respect to the management of radioactive waste."*
(4)	**BASIS: GSR Part 5 Requirement 2 para 3.5 states that** *"The national policy on radioactive waste management has to set out the preferred options for radioactive waste management. It has to reflect national priorities […]"*
(5)	**BASIS: NW-G-1.1 Section 3 states that** *"A policy for spent fuel and radioactive waste management with defined goals and requirements is needed:* - *As a basis for the preparation, review or revision of related legislation;* - *To define roles and responsibilities for ensuring the safe management of spent fuel and radioactive waste;* - *As a starting point for the development of national spent fuel and radioactive waste management programmes (strategies);* - *As a starting point for further developments and modifications to existing national practices* - *To provide for the safety and sustainability of radioactive waste management over generations, and for the adequate allocation of financial and human resources over time;* *To enhance public confidence in relation to the subject of spent fuel and radioactive waste management"*
S1	**Suggestion: The Ministry of Energy should consider compiling the elements of the national policy in one document for the purpose of clarity.**

1.2. LEGAL, REGULATORY AND ORGANISATIONAL FRAMEWORK (PARTLY REFERRING TO IRRS)

Lithuanian position

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. This framework sets out safety requirements for protecting people and the environment from radiation risks, both at present and in the future.

The provisions for the safe decommissioning of facilities, the safe management and disposal of RAW arising from facilities and activities, and the safe management of SF are in place.

The safe management of SF and RAW is based on the following legal instruments:

- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management;
- European Union legislation – Council Directive 2011/70/Euratom of 19 July 2011 establishing a Community framework for the responsible and safe management of SF and RAW;
- Laws:
    - Law on the Management of Radioactive Waste;
    - Law on Nuclear Energy;
    - Law on Nuclear Safety;
    - Law on Radiation Protection;
    - Law on the Ratification of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management;
    - Law on Environmental Impact Assessment.

The hierarchy of the legislation is presented in Figure 1.

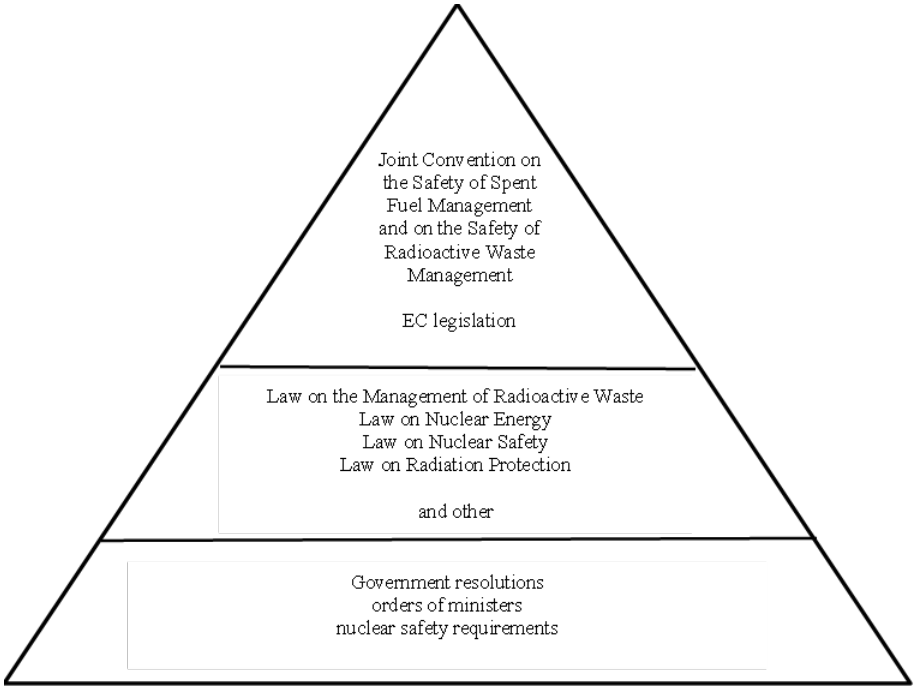

Figure 1. Hierarchy of the legislation

According to Article 9 of the Law on Radioactive Waste Management, generators of RAW are responsible for the safe management of the RAW, from their generation until delivery to the RAW manager Ignalina NPP that bears the full responsibility for their safe management.

This Law states that the Government approves the National Radioactive Waste Management Development Programme (Development Programme). The Development Programme is part of the national legal framework and is subject to the Law on Strategic Management and the Methodology on Strategic Planning (approved by Government Resolution No. 292 from 2021). The National Programme implements provisions 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, in accordance with the Joint Convention and the Law on the Management of Radioactive Waste of the Republic of Lithuania. The Development Programme covers SF and all types of RAW for all management stages, and shall be reviewed on a regular basis, taking into account technical and scientific developments, recommendations, lessons learned and good practices as a result of peer reviews.

According to the Law on Nuclear Energy, the Law on the Management of Radioactive Waste, and the Law on Radiation Protection, it is prohibited to carry out any activity related to SF and RAW management in Lithuania without a licence. The Law on Nuclear Energy and the Law on Nuclear Safety, together with the regulations made under other laws, establish the licensing system for activities related to nuclear materials or nuclear cycle materials (their transportation, acquisition, etc.), and for nuclear facilities of the following life stages: site evaluation, design, construction, commissioning, operation, and decommissioning. The Law on Radiation Protection establishes the licensing system for the transportation of RAW and the management of institutional waste, excluding disposal (to collect and sort radioactive waste; to undertake its pre–treatment, treatment, and conditioning; and to store, recover and decontaminate it) for small producers, i.e. waste producers with the exception of NPP operators.

ARTEMIS observation

Lithuania has developed a comprehensive set of laws, requirements and regulations for management of SF, RAW and decommissioning in general.

The ARTEMIS Review Team received information on the procedure to establish laws and regulations and how input from interested parties is taken into account.

The ARTEMIS Review Team was informed about the responsibilities of the different authorities in the area of SF management, RAW management and radiation protection in the nuclear and institutional sector, decommissioning and environmental impact assessments. The Lithuanian counterparts clarified which authorities are to be involved in the decision making of the stated areas and how different opinions are taken into account.

The ARTEMIS Review Team requested information on the inspection programme that is conducted on the INPP site. It was informed about the average number and example areas of inspections performed on site, including of control of material announced for clearance or environmental monitoring through sampling and evaluation performed by VATESI together with the RSC. It was acknowledged that the presence of site inspectors provides the regulator with a good overview of the actual activities happening on site.

The ARTEMIS Review Team noticed that the INPP Final Decommissioning Plan (INPP FDP) states that "u*ntil a decision regarding the reasonableness of achieving the brown condition ('brown field') is adopted, the target condition is a 'green field'*". Moreover it is stated that "*the final condition of the NF (nuclear facility) site will be selected taking into account the available funding, the relevant justification will be provided in the updated final decommissioning plan (e.g. if, due to insufficient funding, one or another structure cannot be dismantled, the appropriate 'brown' site option must be selected and justified)*". The ARTEMIS Review Team's position is that specifying the end state is an important prerequisite for performing a solid planning for decommissioning and conducting decommissioning actions efficiently. Moreover, selecting an end state other than releasing the site from regulatory control without restrictions needs to be rigorously justified. The counterparts reaffirmed that the planning for decommissioning right now is on the basis of reaching "green field". If the need to change the end state to "brown field" becomes apperent this should trigger a revision of the approved INPP FDP, according to No. 41 of the BSR-1.5.1-2019 "Decommissioning of Nuclear Facilities". According to No. 42 of BSR-1.5.1-2019, INPP coordinates the revised INPP FDP in the procedure specified in Part 4 of Article 32 of the Law on Nuclear Energy with VATESI, the Ministry of Environment, the Ministry of Health, the Ministry of Energy and the Ministry of Social Security and Labour, before it is approved by the Ministry of Energy. Beside the revised INPP FDP and the decommissioning safety alalysis report, according to the Article No. 6 of the BSR-1.5.1-2019 "Decommissioning of Nuclear Facilities" if "brown field" will be selected *"... it must be assured that sufficient financial resources should be available for monitoring, surveillance and control of the facility throughout the time period necessary for performing those functions.*" The ARTEMIS Review Team was informed that this procedure guarantees that interested parties (especially the public) are provided with the opportunity to express their opinions and recommendations with respect to a revised INPP FDP, e.g. addressing a change of the end state.

The ARTEMIS Review Team was informed that an environmental impact assessment is performed for individual decommissioning activities and not for the INPP decommissioning megaproject as a whole. The ARTEMIS Review Team pointed out that this practice seems not to be reflected in the Law on the Environmental Impact Assessment of the Proposed Economic Activity that mentions in Annex 1 No. 3.2. that *"nuclear power stations or other nuclear*

reactors and the dismantling or decommissioning of such power stations or reactors" are subject to an environmental impact assessment.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: *The environmental impact assessments are prepared for particular projects within the overall INPP decommissioning megaproject. Even though cumulative effects of individual projects are taken into account, an overall EIA will provide a better overview of the impact of the megaproject in its entirety.*	
(1)	**BASIS: GSR Part 4 Requirement 12 states that** *"Assessment of safety over the lifetime of a facility or activity. The safety assessment shall cover all the stages in the lifetime of a facility or activity in which there are possible radiation risks."*
(2)	**BASIS: GSR Part 6 Requirement 6, para. 3.4 states that** *"The responsibilities of the licensee shall include:* *- Performing safety assessments and environmental impact assessments in support of decommissioning actions."*
(3)	**BASIS: SSG-47, para. 2.9 states that** *"In addition to protection of workers and the public, licensees are required to consider and plan for protection of the environment during decommissioning (para. 2.3 of GSR Part 6 [1]). An environmental impact assessment should be developed concurrently with the final decommissioning plan, consistent with national requirements. As noted in IAEA Safety Standards Series No. GSG-10, Prospective Radiological Environmental Impact Assessment for Facilities and Activities [30], the term 'environmental impact assessment' is included in many international instruments and national legislations and regulations, and refers to a procedure within a governmental decision making process for identifying, describing and assessing prospectively the effects and the risk of effects of a particular proposed activity or facility on aspects of environmental significance."*
R1	**Recommendation: The Government should ensure that the overarching environmental impact assessment takes into account the impact of the INPP decommissioning megaproject in its entirety.**

2. NATIONAL STRATEGY FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT

Lithuanian position

According to the ARM, the national strategy is captured in:

- Development Programme for Decommissioning of Nuclear Power Facilities and Radioactive Waste Management for 2021–2030, which has been approved by the Government of Lithuania on 3 February 2021, and
- Implementation Measures of the Radioactive Waste Management Development Programme (hereinafter referred to as the Implementation Measures), which is under development and only elements of it were available to the ARTEMIS Review Team.

The objective of both documents is to contribute to the efficiency and safety of SF and RAW management as well as to the effective protection of workers, the public and the environment from potential risks related to these activities.

In order to achieve this aim, the Development Programme defines all necessary actions and designs tasks that will result in achievement of objectives of the national policy concerning management of SF and RAW. It is adopted for a period of 10 years, which coincides with the strategic planning rules applicable for all national development programmes in Lithuania. Whereas the Development Programme is a very general document, the Implementation Measures document will be a detailed document, assessing and determining the intended impact of a particular measure, target groups, expected changes, activities needed to implement the measure, area of implementation, established indicators of the implementation of the measure, details of the required funds and clearly defined implementers of the measure.

SF and RAW in Lithuania arises primarily from the decommissioning of Ignalina NPP (INPP), which is the main source of RAW, producing more than 99% of Lithuania's RAW, and the only source of SF. Other sources of RAW are applications of radioisotopes in industry, medicine and science. Legacy waste is stored in the RADON type Maišiagala Radioactive Waste Storage Facility, which stopped operation in 1989.

The draft of Implementation Measures summarises six main tasks (or planned actions) related to the management of SF and all classes of RAW and decommissioning of INPP, including their funding:

1. Dismantling of INPP
2. Pre-treatment of RAW from INPP decommissioning
3. Treatment and conditioning of all RAW that will be generated during the decommissioning of INPP, and the treatment of already generated short lived and long lived RAW
4. Disposal of short lived very low level RAW (SL-VLLW) and short lived low and intermediate level RAW (SL-LILW)
5. Disposal of long lived waste
6. Preparation of a management model for RAW generated by small producers after 2038

From the draft Implementation Measures it is obvious, that there is a need:

- to develop several new RAW and SF management facilities (storage facilities for long lived RAW, disposal facility for LLW and ILW, DGR, infrastructure for management of RAW generated by small producers after 2038), and
- to decide on further management of bituminised RAW that is currently stored in the existing facility B158.

In relation to the above mentioned tasks, the draft Implementation Measures identify preliminary indicators, which are expected to be followed when the above-mentioned tasks are addressed.

ARTEMIS observation

In general, the ARTEMIS Review Team considers that both the Development Programme and the elements of the draft Implementation Measures identify the main tasks and related actions for safe management of SF and RAW and for decommissioning of INPP and propose reasonable time schedules for their execution. The structures of the Development Programme and of the draft Implementation Measures do not fully comply with Article 12 pt. 1 of the Council Directive 2011/70/Euratom, but it is assumed that the final version of the Implementation Measures, together with the Development Programme, will reflect all the Directive's requirements.

In the ARM, the Lithuanian counterpart identified some challenging tasks which may delay the implementation of the Development Programme. The first of these is the conversion of the INPP storage facility for the bituminized waste product into a disposal facility without the need for removing stored bituminized RAW. This project is now under preparation and assessment. The second challenge concerns solutions/technology for dismantling the RBMK reactor core and management of contaminated graphite. It is scheduled that all R&D projects and dismantling of the reactor core itself will end by 2034, which in view of the ongoing work seems quite challenging.

With regard to interaction of different governmental and research stakeholders, VATESI informed the ARTEMIS Review Team, that a Working Group on RAW Management Monitoring (WG) has been established in 2017 by the Order of the Minister of Energy (renewed by Order No.1-142 from 1 April 2020). The WG consists of representatives of the Ministry of Energy, the Ministry of Environment, the Ministry of Finance, VATESI, RSC, INPP and the Lithuanian Geological Survey (LGS). The WG should, among other tasks, submit proposals regarding the development of a DGR in Lithuania or the implementation of another alternative solution for the management of long-lived RAW (item 2.1.5 of the Order). The WG issues annual reports on its activity. The last report, covering the work of the WG in 2021, has been presented to the ARTEMIS Review Team. Ten meetings of the WG took place in 2021.

In 2021 the INPP signed a cooperation agreement with LGS on the development of the DGR until 2030.

The DGR project will be under informal scrutiny of VATESI and other institutional stakeholders, which may provide their views about ongoing and planned work, while maintaining their independency. Such opportunity for wide-ranging interaction between the implementer and various regulatory bodies is regarded by the ARTEMIS Review Team as an excellent approach to facilitating the most efficient and effective means of achieving safe solutions for RAW management.

Based on the ARM and the discussions during the mission, it can be concluded that the Development Programme and presented elements of the draft of the Implementation Measures provide:

- an overall framework for safe management of SF and all categories of RAW,
- a summary of tasks to be implemented or planned till the end of 2030,
- some details of each identified measure to be performed, including performance indicators and expected indicator values at defined time periods.

The draft Implementation Measures and the Justification for the Development Programme contain long-term target deadlines for six measures, among which some milestones or timeframes seem to be unrealistic and should be revised. For example, the time period of six years for the operation of the DGR seems to be extremely short. The Development Programme considers that all SF (21 571 fuel assemblies), which is now in the dry SF storage (308 casks), and RAW not suitable for disposal in surface facilities, will be placed into the DGR in the time span of 6-7 years (2068-74). At the same time, the operation of the old SF storage facility is planned until 2050 and the new SF storage facility will be operational until 2067. These timeframes are in a clear collision with the scheduled operational period of the DGR.

The Development Programme covers activities planned within the time period 2021-2030 (in addition providing less detailed information for the activities planned beyond 2030), while the national strategy should cover the entire lifecycle of SF and RAW management, in order to support future decommissioning of facilities other than INPP and the planned development and operation of DGR, both continuing beyond 2030. General rules for strategic planning should not prevent preparation of long-term national strategy, e.g. including details of the DGR site selection research programme until 2047.

In 2016 the IRRS mission developed the following observation in relation to the recommendation on interdependencies (R5): *"The long-term management of radioactive waste, including interdependencies between different management steps, construction and operation of disposal facilities, provisions for the needed research and development programmes and the financing of all future waste management activities are issues needing further attention."* The IRRS follow-up mission from 2020 stated, that this recommendation was still open, as the provisions were not fully embedded in the legislative framework and that this issue would be addressed in the Development Programme and in the final version of the Implementing Measures. The ARTEMIS Review Team fully supports the conclusions of the IRRS mission on interdependencies.

Based on the above observations, the ARTEMIS Review Team recommends that the next update of the Development Programme, which will take place in a few years, and the finalized Implementation Measures should:

- cover a timeframe beyond 2030 to capture decommissioning of facilities other than INPP,
- adjust timeframes for different activities to address properly the interdependencies between medium and long-term measures, such as storage of SF and its disposal in DGR in line with IRRS mission Recommendation 5, and
- provide measurable indicators for all planned measures, especially for the development of the DGR at least for the next 25 years.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: *The information provided to the ARTEMIS Review Team in relation to the Development Programme and to the draft of the Implementation Measures does not contain clear guidelines on the management of the spent fuel and radioactive waste after the end of the INPP decommissioning in 2038. Such situation might result in a burden to future generations, which needs to be identified according to available knowledge of the impacts on future generations.*	
(1)	**BASIS: SF-1 Principle 7, para 3.29 states that** *"Radioactive waste must be managed in such a way as to avoid imposing an undue burden on future generations; that is, the generations that produce the waste have to seek and apply safe, practicable and environmentally acceptable solutions for its long-term management. The generation of radioactive waste must be kept to the minimum practicable level by means of appropriate design measures and procedures, such as the recycling and reuse of material*."
(2)	**BASIS: GSR Part 1 (Rev. 1) Requirement 1, para. 2.3 states that** *"National policy and strategy for safety shall express a long-term commitment to safety. The national policy shall be promulgated as a statement of the government's intent. The strategy shall set out the mechanisms for implementing the national policy."*
(3)	**BASIS: GSR Part 1 (Rev. 1) Requirement 10, para. 2.28 states that "***Decommissioning of facilities and the safe management and disposal of radioactive waste shall constitute essential elements of the governmental policy and the corresponding strategy over the lifetime of facilities and the duration of activities […]. The strategy shall include appropriate interim targets and end states. Radioactive waste generated in facilities and activities necessitates special consideration because of the various organizations concerned and the long timescales that may be involved. The government shall enforce continuity of responsibility between successive authorized parties."*
R2	**Recommendation: The Government should ensure that updates of the Development Programme include milestones and schedules contributing to the long-term commitment to safety and to avoiding an undue burden on future generations by considering:** • **decommissioning of remaining facilities after the end of INPP decommissioning, and** • **development of a deep geological disposal facility.**

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: *The Government has established a Working Group on Radioactive Waste Management Monitoring, bringing together different national regulators and the DGR project implementer (INPP). The Working Group serves as a platform for information exchange and canvassing of options (without making binding decisions), and is expected to facilitate the most efficient and effective means of achieving the desired waste safety outcomes.*	
(1)	**BASIS: GSR Part 1 (Rev. 1) Requirement 36 states that** *"The regulatory body shall promote the establishment of appropriate means of informing and consulting interested parties and the public about the possible radiation risks associated with facilities and activities, and about the processes and decisions of the regulatory body."*
(2)	**BASIS: GSR Part 1 (Rev. 1) Requirement 7 states that** "*Where several authorities have responsibilities for safety within the regulatory framework for safety, the government shall make provision for the effective coordination of their regulatory functions, to avoid any omissions or undue duplication and to avoid conflicting requirements being placed on authorized parties."*
GP1	**Good Practice: From the very early stage of DGR development, a working group was involved that serves as a platform for exchange of information and discussion of options between the implementer and the various relevant national regulatory bodies. This approach contributes to improvement of the communication and coordination among different parties, improves efficiency and reduces the risk of significant time delays of the project.**

3. INVENTORY OF SPENT FUEL AND RADIOACTIVE WASTE

Lithuanian position

RAW in the Republic of Lithuania is classified according to the radiological characteristics and disposal principle (see Table 1). The classification system is described in the Nuclear Safety Regulation on the Pre-disposal Management of Radioactive Waste at the Nuclear Facilities (BSR-3.1.2-2017). General (unconditional) clearance levels and clearance (free release) procedure are established by the Nuclear Safety Requirements on Establishment and Application of Clearance Levels of Radionuclides for the Materials and Waste Generated during the Activities in the Area of Nuclear Energy (BSR-1.9.2-2018). Clearance levels set up in the last document correspond to levels established in Council Directive 2013/59/EURATOM of 5 December 2013, laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, and repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom, which uses the values from IAEA GSR Part 3, Schedule 1 (Exemption and Clearance).

Table 1: Comparison of Lithuanian RAW classification with the classification scheme from the IAEA Safety Standard GSG-1 (*table taken from Self-Assessment document*)

Waste Class	**Definition**	**IAEA GSG-1 classification**	**Surface dose rate**	**Conditioning**	**Selected main method for disposal according to the IAEA**	**Management method according to the national requirements**
0	Free release			Not required	As non-radioactive waste	As non-radioactive waste
Short-lived low and intermediate level waste						
A	Very low level waste (VLLW)	VLLW	<0.2mSv/h	Not required	Very low level waste repository (Landfill Facility)	Very low level waste repository (Landfill Facility)
B	Low level waste (LLW-SL)	LLW	0.2–2 mSv/h	Required	Near surface repository	Near surface repository
C	Intermediate level waste (ILW-SL)	ILW	>2 mSv/h	Required	Near surface repository	Near surface repository
Long-lived low and intermediate level waste						
D	Low level waste (LLWLL)	ILW	<10 mSv/h	Required	Deep geological repository	Near surface repository (cavities at intermediate depth)
E	Intermediate level waste (ILW-LL)	ILW	>10 mSv/h	Required	Deep geological repository	Deep geological repository

Waste Class	Definition	IAEA GSG-1 classification	Surface dose rate	Conditioning	Selected main method for disposal according to the IAEA	Management method according to the national requirements
High level waste						
G	High level waste	HLW	-	Required	Deep geological repository	Deep geological repository
Disused sealed radioactive sources (DSRS)						
F	DSRS		-	Required	Deep geological repository	Near surface or deep geological repository

The status of the waste inventory is shown in the Figure 2.

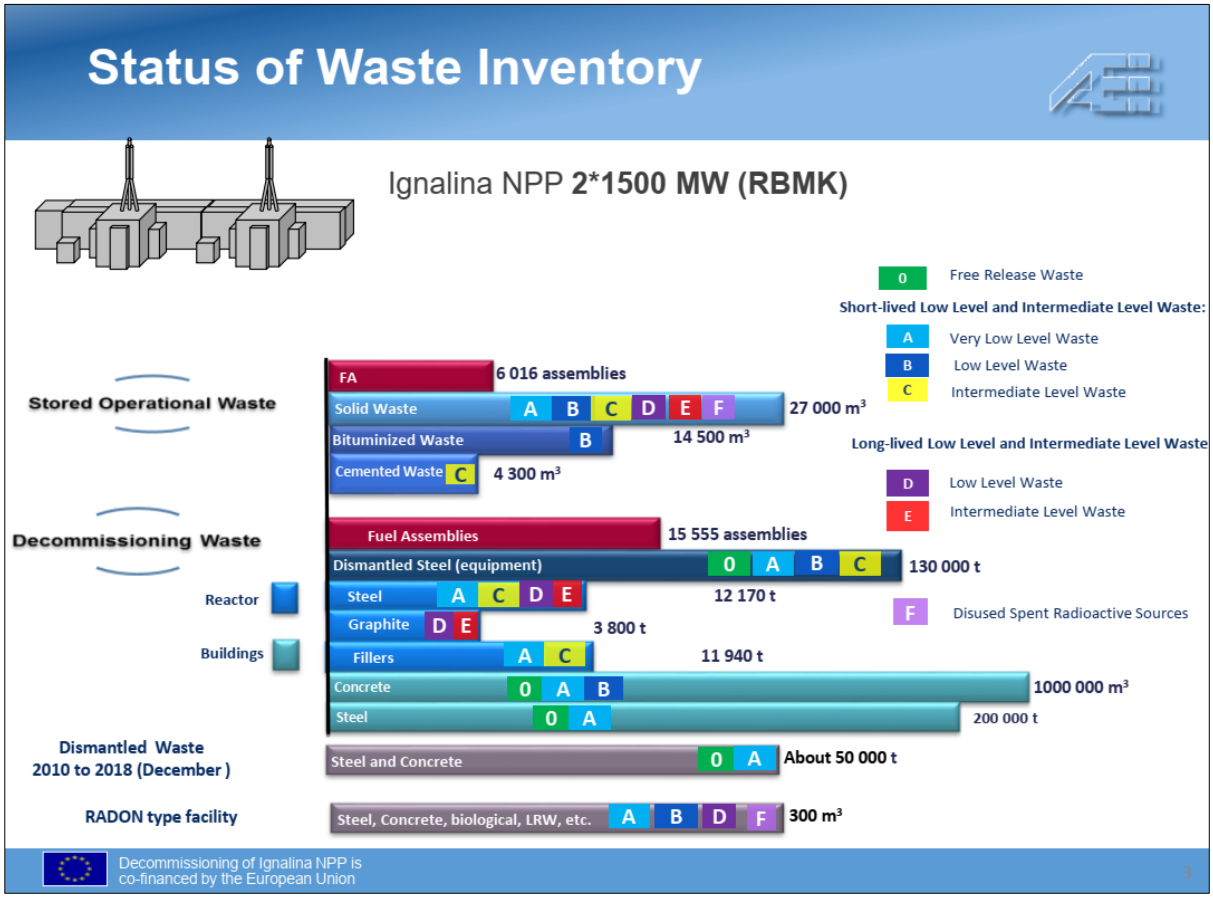

Figure 2: Status of waste inventory

Estimated preliminary amounts of operational and decommissioning RAW according to the waste classification and a description of the respective waste storages and disposal solutions are provided in Table 2 (based on the INPP FDP). The volume of untreated waste (Class D, E, F, G) is given according to the external volume of storage containers. After the final treatment the volume of the waste will change.

Table 2: Estimated preliminary amounts of operational and decommissioning RAW according to the waste classes and a description of the respective waste storages and disposal solutions

Waste class	**Description of waste storage and disposal**	**Waste volume (m^3)**
Class A	Operational and decommissioning waste – up to 60 000 m^3 will be disposed of in a landfill disposal facility (B19/2)	53 900
	"Industrial" waste (without packaging) – the further waste management taking into consideration the possibilities of establishing specific (conditional) clearance levels	30 842
	Contaminated concrete (building demolition waste) – the further waste management taking into consideration the possibilities of establishing specific (conditional) clearance levels	93 000
Class B and Class C	Operational and decommissioning waste – stored in storage facilities of Buildings 158/2 and B4, up to 100 000 m^3 will be disposed of in the near-surface disposal facility (B25)	59 810
	Bituminised RAW – the storage facility is planned to be converted in a disposal facility (Project 1222), or the waste is to be removed and disposed of in another facility	14 422
Class D and Class E	Operational and decommissioning waste – stored in storage facilities of Buildings 158/2 and B4, to be disposed of in a DGR	4 420
Class F	DSRS – stored in the B4 storage facility, to be disposed of in a DGR	180
Class G	SF in two storage facilities, to be disposed of in a DGR	7 936

Figure 3 provides an overview of the fractions of RAW of each waste class with respect to the total amount of expected RAW.

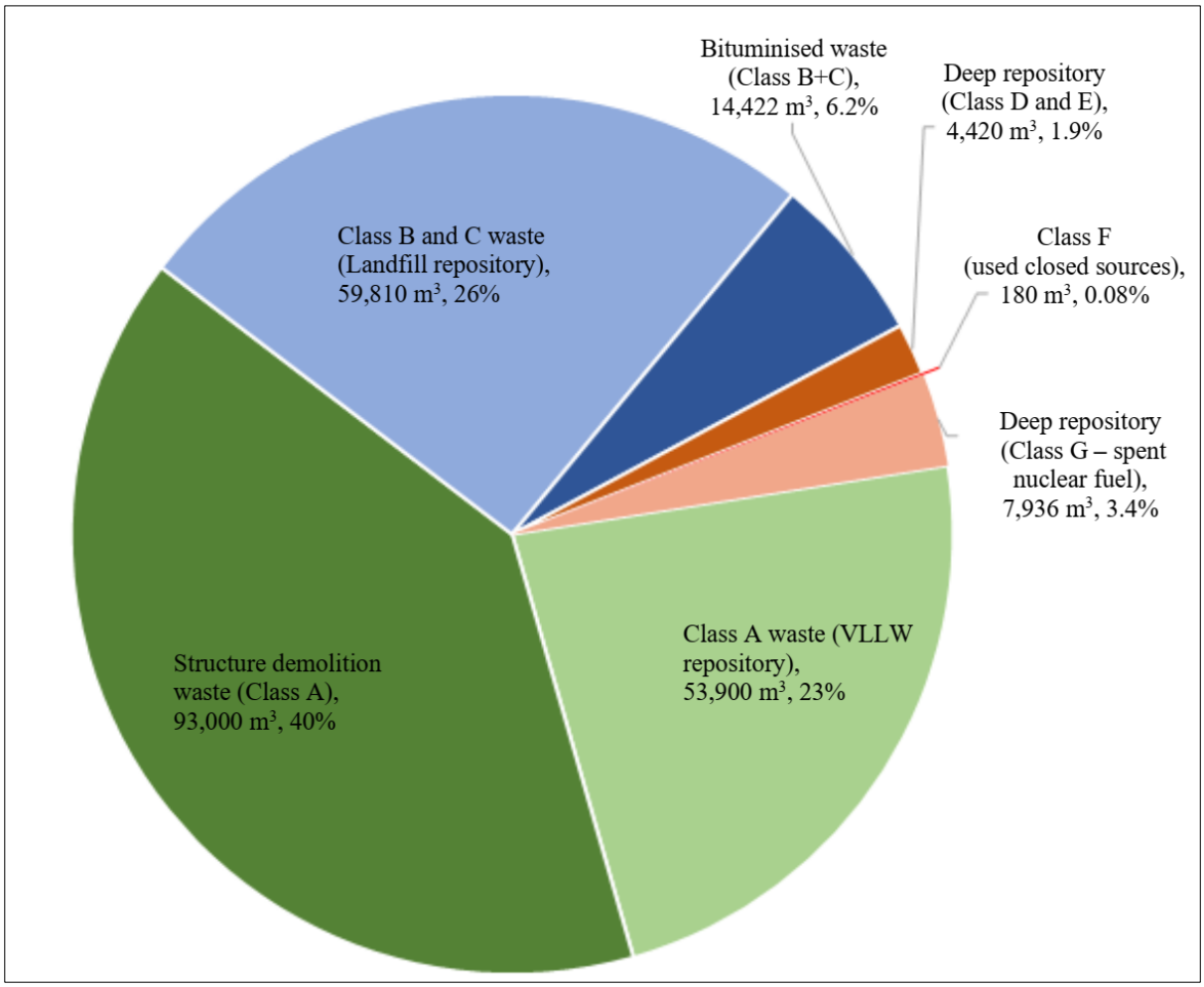

Figure 3: Fractions of RAW of each class with respect to the total amount of expected RAW

Currently an old classification of RAW, which complies with the old regulations of the Soviet Union (SP AS-88), is partly used at INPP for RAW that has been collected and stored during the operation stage of INPP. After retrieval and segregation, the RAW will be classified in accordance with the new classification scheme.

The foreseen waste routes are shown in Figure 4.

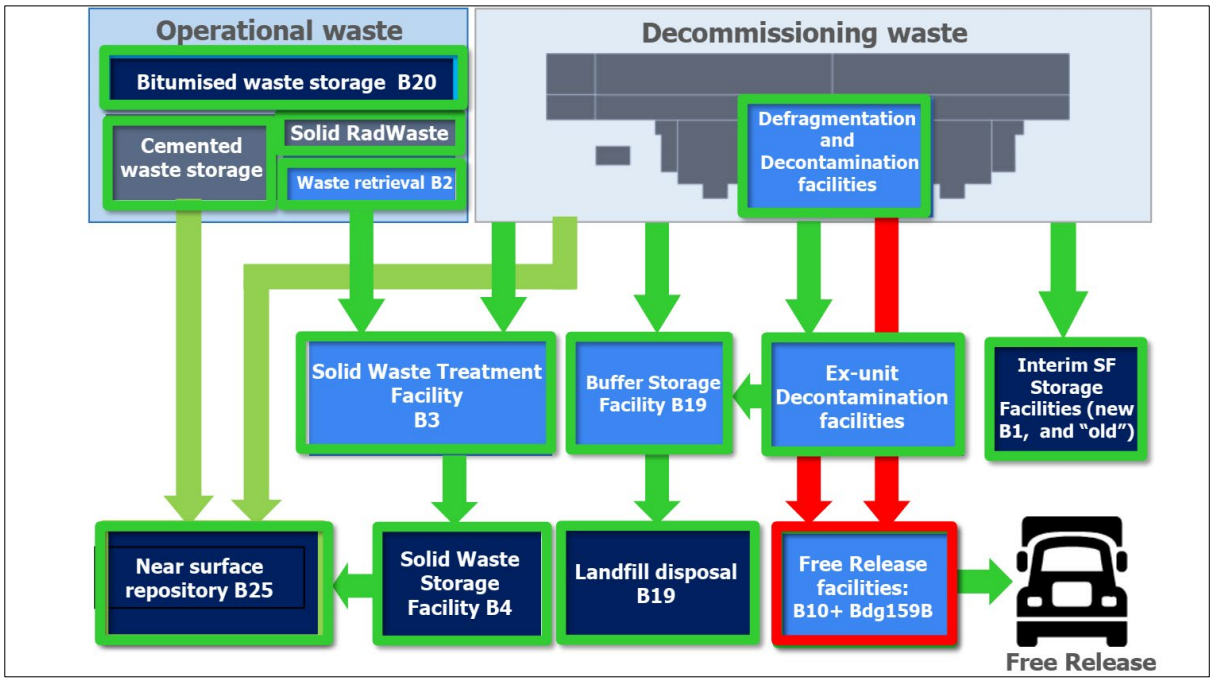

Figure 4: Foreseen routes of waste from INPP

Pursuant to the Law on Radioactive Waste Management, the INPP is appointed as the Lithuanian national RAW management organization and as such plays the main role in developing and maintaining the national SF and RAW inventory in the country.

ARTEMIS observation

Significant progress has been made at the INPP in the evaluation of waste amounts, their distribution over the different waste classes and the needed storage and disposal containers over recent years, providing a sound basis for planning and implementing the RAW management strategy.

A comprehensive presentation of the different waste storage and disposal facilities that are in the stages of construction, hot trial, operation and procurement was given, including the associated waste routes.

In addition, the ARTEMIS Review Team was informed about the procedures in place for handling and re-treatment of waste packages that do not meet the established Waste Acceptance Criteria (WAC) of the foreseen storage or disposal facilities.

It was explained how the fuel fragments, which are still present in the fuel pool of the INPP Unit 2, will be handled and stored in the SF storage facility.

There is no plan for decay storage of some short lived VLLW and LLW streams. The INPP assumes that for this class of RAW, disposal is a cheaper option than clearance. This assumption has been questioned by the ARTEMIS Review Team.

Additional challenges that also have an impact on the timeline of the INPP decommissioning megaproject are:

- The presence of 74 fresh fuel assemblies in transport casks in fresh fuel storage, which could not be returned to the manufacturer. It is foreseen to store them in the new Interim SF Storage Facility B1 and before that to separatly relicence the present fresh

fuel storage facility. VATESI provided an information that a licence application was received from the INPP for relicensing the existing fresh fuel storage facility.

- The fresh fuel storage facility (B165) and the bituminised waste product storage facility (B158g) , which are still covered by the operating licensing of the INPP, will need to operate longer than the projected timeframe of the operating licence of the INPP and/or even after the end of the decommissioning of the INPP. TheINPP informed about an ongoing preparation for licensing applications for these facilities.
- The amount of 1 000 000 m^3 of concrete that needs to be managed during decommissioning of the two INPP units is a challenge.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: *Lithuanian legislation requires that all fuel has to be removed from the facility before a decommissioning license can be granted. This includes not only spent fuel but also fresh fuel.*	
(1)	**BASIS: GSR Part 6 Requirement 8, para. 8.10 states that** *"If operational radioactive waste or nuclear fuel is present in the facility after its permanent shutdown, such material shall be removed prior to the conduct of decommissioning actions and shall be transported to an authorized facility in compliance with the applicable transport regulations [11]. In case such removal is not possible during the period of transition between permanent shutdown and the granting of the authorization for decommissioning, the approved final decommissioning plan shall address the removal of these materials as part of decommissioning (during initial phases of immediate dismantling or during the preparatory phase for safe storage). In both cases, the management of such material shall be carried out in accordance with the relevant requirements [10]."*
S2	**Suggestion: INPP should consider accelerating the solution for the fresh fuel assemblies, so that this prerequisite for granting the decommissioning license is fulfilled.**

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: *The fresh fuel storage facility (B165) and the bituminised waste product storage facility (B158) on the Ignalina NPP site are still covered by the operating license of the INPP. They will need to continue to be licenced during and potentially after the decommissioning of the INPP, needing their own licences (not linked to the decommissioning licence for the INPP).*	
(1)	**BASIS: GSR Part 6 Requirement 8, para. 5.3 states that** *"The licensee shall demonstrate that, under the strategy selected, the facility will be maintained in a safe configuration at all times and will reach the specified decommissioning end state, and that no undue burdens will be imposed on future generations."*
(2)	**BASIS: GSR Part 6 Requirement 10 states that** "*The licensee shall prepare a decommissioning plan and shall maintain it throughout the lifetime of the facility, in accordance with the requirements of the regulatory body, in order to show that decommissioning can be accomplished safely to meet the defined end state."*
(3)	**BASIS: GSR Part 6 Requirement 11, para. 7.10 states that** *"The final decommissioning plan and supporting documents shall cover the following: the selected decommissioning strategy; the schedule, type and sequence of decommissioning actions; the waste management strategy applied, including clearance, the proposed end state and how the licensee will demonstrate that the end state has been achieved; the storage and disposal of the waste from decommissioning; the timeframe for decommissioning; and financing for the completion of decommissioning.*"
(4)	**BASIS: GSR Part 6 Requirement 15, para. 9.5 states that** *"In the case of the release of part of the site from regulatory control, a revised or new, separate authorization for the remainder of the site remaining under regulatory control shall be sought from the regulatory body, as appropriate."*
R3	**Recommendation: The INPP should initiate the licence application for the bituminised waste product storage facility (B158) that is currently covered by the operational licence for the INPP.**

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: *Clearance of concrete from the demolition of buildings is essential to prevent generation of large amount of additional radioactive waste. In Lithuania there are no specific (conditional) clearance levels for such material.*	
(1)	**BASIS: SF-1 Principle 7, para. 3.29 states that** *"… The generation of radioactive waste must be kept to the minimum practicable level by means of appropriate design measures and procedures, such as the recycling and reuse of material."*
(2)	**BASIS: GSR Part 6 Requirement 5, para. 3.3 states that***"The responsibilities of the regulatory body shall include:* *[…]* *— Establishing requirements relating to the criteria for safety, protection of workers and the public, and protection of the environment during the decommissioning of facilities, including criteria for clearance of material from regulatory control in accordance with national policy;* *[…]"*
R4	**Recommendation: INPP should develop a safety evaluation and propose specific (conditional) clearance levels, such as for concrete rubble from the demolition of buildings, for approval by VATESI. This would provide an additional option for clearance of large amounts of material from demolition.**

4. CONCEPTS, PLANS AND TECHNICAL SOLUTIONS FOR SPENT FUEL AND RADIOACTIVE WASTE MANAGEMENT

OPERATIONAL AND PLANNED SOLUTIONS FOR THE MANAGEMENT OF ALL TYPES OF SF AND RAW

Lithuanian position

By the Law on the Management of Radioactive Waste, Ignalina NPP is designated as a manager of all radioactive waste in Lithuania (operational, decommissioning, institutional, DSRS, orphan radioactive sources). VATESI, as the regulatory body, is tasked to define the nuclear safety requirements regulating the classification of RAW and the acceptance criteria for RAW in a storage or disposal facility. The Ministry of Energy is the owner of the Ignalina NPP and is responsible for a broad range of activities: tariffs, the pricing system, organization, and financial audits.

The decommissioning of the two RBMK-1500 water-cooled, graphite-moderated channel-type power reactors is a multi-project activity where, besides technical and administrative issues, financing issues are extremely important and challenging in order to bring the decommissioning of the NPPs to the predefined end state and with respect of projected time schedules. The dismantling of the reactor core (R3 area) is the key project on the critical path for INPP decommissioning.

Main directions in long-term management of SF and RAW are:

- the SF generated within Lithuania is defined as RAW;
- the SF should be stored using the dry cask storage technology until deep geological repository will be available;
- the storage of SF and RAW is only a temporary solution;
- the DGR is presumed to be a most suitable option for durably guaranteed safety in the isolation of high level long-lived RAW (including SF);
- Lithuania's involvement in regional and international projects for the DGR is deemed expedient while the search for international solutions should not jeopardize the current national programme;
- minimization of the RAW generation, reuse and recycling of the waste, and clearance;
- use of approved technologies for RAW processing and conditioning;
- management of DSRS;
- all national RAW will be disposed in dedicated repositories within Lithuanian territory; and
- decommissioning of the Ignalina NPP is based on the immediate dismantling concept until reaching the state of "green field".

Decommissioning of the INPP is scheduled to be completed by the end of 2038.

Pre-disposal management plans and activities

The law on RWM contains requirements to be taken into account for the design, construction, operation and future decommissioning of RAW management facilities (including disposal facilities).

RAW management streams had to be defined and new equipment was required for fragmentation, decontamination, characterization, pre-treatment, treatment, conditioning, storage and disposal, suitable for all the RAW already present on site and to be generated by decommissioning (see Figure 5).

During decommissioning activities, efforts are made to minimize the quantities of generated RAW by applying different decontamination processes/techniques with the objective to either clear the material or to bring it to a lower class.

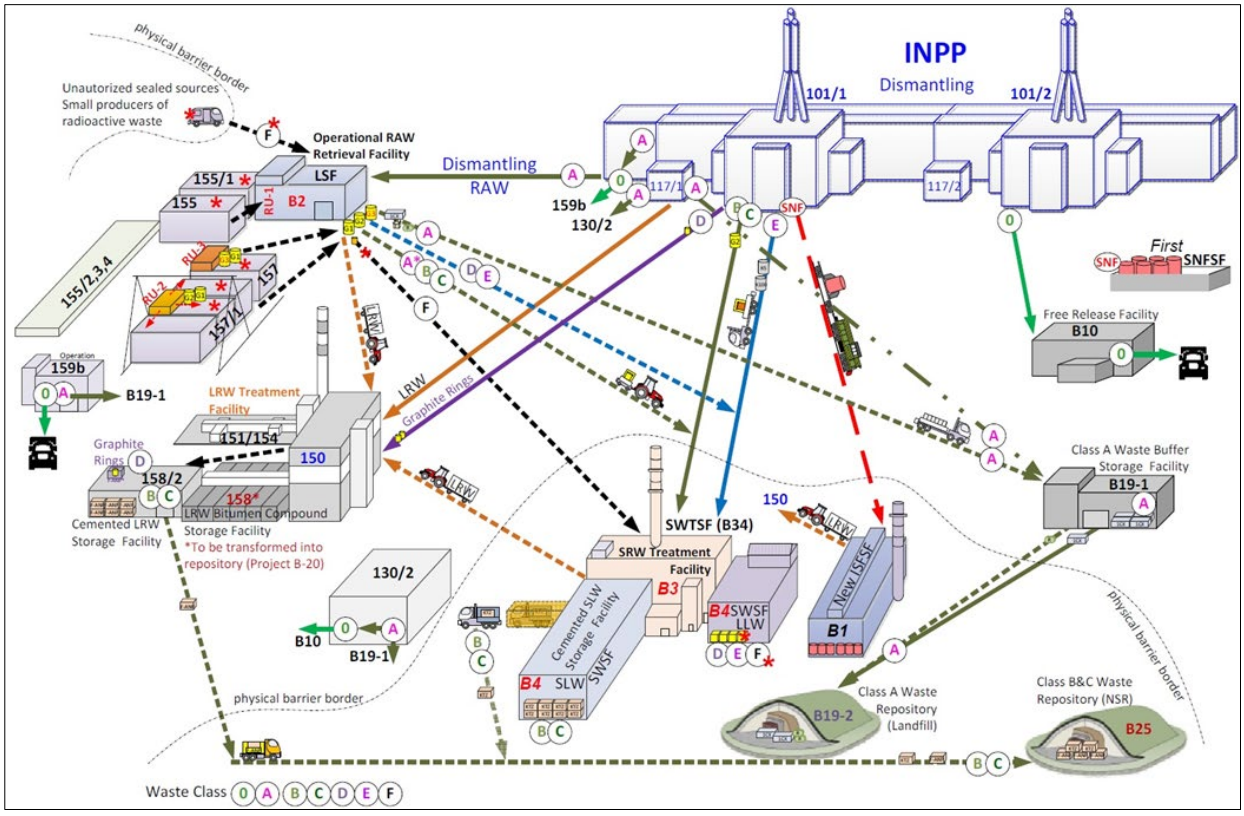

Figure 5: An overview of waste management streams and facilities

(* means that the waste was generated during the operation of the INPP)

VLLW and Clearance

Unconditional clearance levels and free release procedure are established by the Nuclear Safety Requirements on Establishment and Application of Clearance Levels of Radionuclides for the Materials and Waste Generated during the Activities in the Area of Nuclear Energy, BSR-1.9.2-2018. Release limits correspond to the levels in the EU directive 2013/59 and IAEA GSR Part 3. It is expected that the dismantling of INPP's technological equipment after sorting and decontamination of the RAW will lead to a high amount of material to be cleared.

Specific (conditional) clearance of materials is considered an option to further reduce the amount of demolition RAW. Specific clearance levels should be developed based on a safety

evaluation taking into consideration potential exposure scenarios and corresponding to a dose impact of maximum 10 μSv in a year.

Clearance measurements are performed in the B159B and B10 facilities. Waste that does not meet the clearance levels is classified as RAW.

Short-lived LILW

After segregation, treatment, conditioning and packaging in building B3, SL-LILW is sent to the storage facility (B4-SL). Depending on the characteristics of the RAW, existing treatment and conditioning processes comprise compaction, incineration, and immobilization of compacted or non-compacted wastes in reinforced concrete containers for storage.

Liquid Radioactive Waste (LRW) treatment

Liquid Radioactive Waste (LRW) is collected and stored in tanks in buildings 151 or 154. Till 2015, LRW was subject to the process of evaporation and bituminisation in building 150. 14 422 m^3 of bituminized waste product (BWP) was generated and stored in vaults in building 158. Since 2015, evaporator concentrates, ion-exchange resins, perlite and sediments are fed for immobilization to the cementation unit. The so-obtained product is then treated as solid SL-LILW and transferred to the storage facility 158/2, awaiting the availability of the near surface disposal facility for SL-LILW (NSR).

SF and LL-RAW

All SF and other long-lived RAW (from retrieval operations or from dismantling) shall be transferred in specially designed containers to the storage facilities of INPP for their storage before the end of 2023 and 2038, respectively.

At present, all SF elements were already removed from the pools of both Units. In total, 21 571 fuel assemblies (FA, of which a limited amount is damaged) were loaded in dual-purpose casks and transferred for storage to:

- old SFSF-1: CASTOR® RBMK (20 casks) and CONSTOR®RBMK1500 (98 casks) with 6 016 Fuel assemblies (FA);
- SFSF-2: 190 CONSTOR®RBMK1500/M2 (15 555 FA).

The design lifetime for the facilities is 50 years and covers storage of SF until 2050 and 2067, respectively. In case of unavailability of the DGR, actions with respect to further storage will have to be taken. SFSF-2 is equipped with a hot cell that allows for repackaging of CASTOR and CONSTOR casks.

Segregated LL-LILW, metallic waste, and specific wastes such as graphite, DSRS and plastic parts are stored in unconditioned form in B4-LL.

External RAW from "small" RAW producers

Very small quantities of RAW from institutional producers are estimated.

Disposal Options

All RAW generated in Lithuania is to be disposed of within Lithuania. The strategy is to concentrate storage and disposal facilities on, or as close as possible to the INPP site, in order to limit transport activities via public roads.

The selection of sites for the Landfill facility for SL-VLLW and for the NSR was carried out. The safety assessment and the EIAs for the INPP landfill facility and NSR, covering both operational and post closure periods, were developed and approved in compliance with the existing Lithuanian regulations.

Table 3: Existing or planned disposal facilities

Facility	Location	Operation start date (y)	Closure date (y)	Institutional control (y)	Comment
RADON type facility (Maisiagala)	Maisiagala, Bartkuškio forest	1964	1989		Retrieval of waste and decommissioning by 2024
Industrial landfill (VLLW)	INPP site				+/-31 000 m³; decision to leave or retrieve
Bituminised waste product storage (SL-LILW)	INPP site (Building 158)	1987	2015		14 422 m³ of solid waste; convert to disposal facility (project B20) or retrieve waste
VLLW landfill disposal facility	INPP site (project B19)	2022	2038	Active 30+ Passive 70	Capacity 60 000 m³; 3 modules of 20 000 m³ each
NSR	INPP site (project B25)	2026	2038	Active 100+ Passive 200	Capacity 100 000 m³; 3 groups of 12 vaults each (total 36 vaults)
DGR	Not decided	2068	2080	2080-?	Also for specific wastes (eg. DSRS, graphite waste)

Landfill Disposal Facility for VLLW

The landfill facility is recently licensed for use and has a capacity of 60 000 m³ of non-conditioned SL-VLLW. Once filled, active institutional control will be arranged for a period of 30 years, followed by passive institutional controls via restriction on the use of the territory during 70 years. WAC are developed and available. According to the current planning, the disposal facility is scheduled to be closed by 2038.

The existing INPP industrial waste dumps contain about 30 000m³ of slightly contaminated industrial/operational wastes. These are classified as VLLW and could be candidates in future for release, once specific (conditional) clearance levels are established. At present, these wastes are not supposed to be transferred to the VLLW disposal facility.

NSR

Requirements dealing with WAC for the NSR are given in the Nuclear Safety Requirements BSR-3.2.1-2015 Radioactive Waste Acceptance Criteria for Near Surface Disposal Facilities.

The NSR has a modular structure with 3 modules in total, of which two modules will be constructed in the first phase (total of 24 vaults). All wastes are scheduled to be placed in the NSR by 2038. After closure of the facility, there will be an active institutional control for a period of 100 years, followed by a passive institutional control of 200 years (300 years in total). The facility is expected to be operational in 2026.

DGR

All SF, long lived (LL) RAW and specific wastes not acceptable in Landfill and NSR, will be disposed in a DGR.

The preliminary project implementation planning for the DGR includes the following stages / deadlines:

1) Research/studies (including planning, selection of potential sites, concepts, assessment, other studies) pending approval of the site of the DGR (2020-2047),
2) Design (2048-2057),
3) Construction and commissioning (2058-2067),
4) Operation (2068-2074),
5) Decommissioning (2075-2079),
6) Closure and post-closure (from 2080).

Specific wastes

Maišiagala storage facility

Maišiagala RWSF was constructed in 1963 and is a "Radon" type facility (USSR design), in which about 120 m^3 of non-sorted and non-treated RAW (SL-VLLW, SL-LILW and LL waste) was emplaced until closure in 1989. It contains radioactive waste and DSRS from Lithuanian, Belarusian and Russian industrial enterprises, health care institutions, scientific institutions and military units.

Following the installation of additional engineering barriers above the vault in 2006, the decision was made that Maišiagala RWSF shall be decommissioned and RAW contained in it shall be retrieved (by 2024) and transferred to the INPP for storage and subsequent disposal.

Storage of these wastes is planned in the B155/1 (all INPP operational waste will be retrieved before placement of the Maišiagala waste), and in the B4 facilities.

Bituminized waste product storage facility (B158)

From 1987 till 2015, operational liquid RAW was bituminized and stored in B158. The use of bituminization stopped in 2015 and an option under consideration is to convert the storage facility into a disposal facility (project B20). The waste product is considered SL-LILW, suitable to be placed in the NSR. Studies are ongoing (concept, design phase, EIA, engineering documents, …). If authorized, the final conversion of the B158 into a repository, comprising construction of the necessary engineering barriers, is foreseen around 2038.

R&D activities envisaged to support RAW management solutions

The INPP is responsible for management of all Lithuanian RAW and is expected to organize R&D activities related to the management of RAW, as well as for establishing justification and evaluation reports in the frame of licensing.

Various research activities are performed in different projects, or as separate projects or activities (e.g. results of the IAEA project GRAPA are used for planning the irradiated graphite management).

At present, research activities mainly focus on disposal of RAW, decommissioning of the R3 reactor areas and management of graphite waste. INPP is already undertaking activities in order to find a justified technical and optimal reactor decommissioning scenario.

For the NSR, the construction of a mock-up is planned at the near surface low level disposal facility to gain experience for waste placement in the disposal facilities.

Remaining nuclear facilities after decommissioning of the NPP

Besides the surface and near-surface disposal facilities, the following facilities remain on the INPP site after 2038 (as shown on Figure 6):

- LL-RAW storage facilities (B158/2 and B4),
- VLLW storage B19/2,
- Dry SF storage facilities,
- Solid RWM facility B3,
- Bituminized waste product disposal facility (if licensed as such),
- Industrial waste dump.

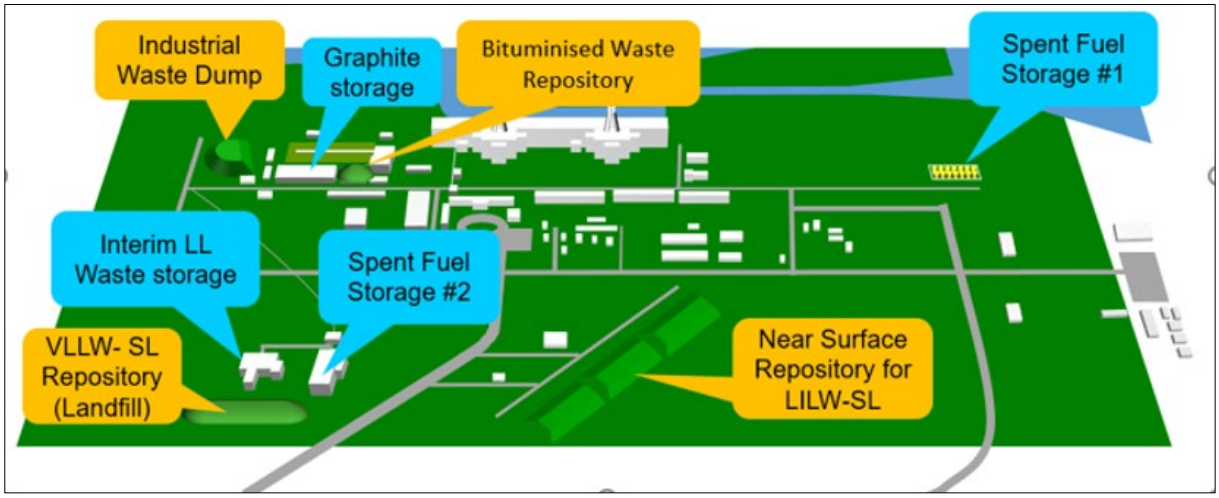

Figure 6: Facilities for storage, treatment and disposal on the INPP site, remaining after 2038

ARTEMIS observation

Pre-disposal management plans and activities

The ARTEMIS Review Team was informed of the actual status of decommissioning, activities with special emphasis on waste generation, treatment and storage of the RAW. No specific problems from an operational point of view were mentioned.

Based on the ARM material and the information provided during discussions, the team noted that since 2015, Lithuania has made serious efforts in updating the regulatory framework, in implementing dismantling activities/processes, in development/operation of facilities for

predisposal management of RAW and that good progress has been made in the process towards developing and implementation of disposal projects.

Main accomplishments include:

- amendments to the legal and regulatory framework (laws, regulations, requirements);
- construction and operation of the new SF storage facility (B1);
- development of the new solid waste retrieval and waste segregation installation (B2), and the treatment facility (B3) and storage facilities for SL-LILW and LLW;
- commissioning of a buffer storage facility for SL-VLLW (B19-1);
- the landfill facility for short lived VLLW (B19-2); capacity 60 000 m³; 3 disposal modules for operational and dismantling waste;
- activities towards developing an NSR (B25): capacity 100 000 m³ and design lifetime of 50 years;
- initiation of justification studies for conversion of the bituminized waste product storage facility (B158) into a near surface disposal facility;
- commissioning of the free release measurement facility (B10);
- ongoing dismantling and RAW management activities;
- start of the decommissioning project for Maišiagala RWSF;
- retrieval of the "old" wastes from storage facilities 155, 155/1, 157 and 157/1, characterization and treatment according to the new classification and with respect to the WAC for treatment/storage/disposal; and
- ongoing R&D for a DGR facility.

The ARTEMIS Review Team was informed of the existence and implementation of ageing management programmes (monitoring and control) for the RAW in storage.

The storage facility for VLLW (B19/1) is full and additionally generated RAW from decommissioning is stored in the Turbine Hall of the INPP Unit 1, awaiting full operation of the VLLW disposal facility.

After decommissioning of the INPP, a new facility for management of institutional RAW may be required if present facilities for management of LILW prove inadequate. A further use of the remaining building B3 could be considered as a potential option for management of institutional RAW.

Two external organizations will be contracted to develop the concept design for dismantling of the reactors (R3 areas) until the end of 2022, with the aim of selecting the optimal solution. The ARTEMIS Review Team was informed about the main project objectives and challenges that consist of developing the dismantling technologies for structures and equipment from INPP reactor shafts, developing the technologies for RAW management generated as a result of graphite stacks dismantling in both units, and the dismantling of the reactor structures and equipment from INPP units. The absence of technical solutions may seriously impact the decommissioning planning, scheduling and costs.

Disposal Options

The ARTEMIS Review Team was informed about the approval to operate the landfill disposal facility for SL-VLLW, and about the delay for the NSR. In view of the production rate of SL-LILW, a delay for the NSR is not crucial from the point of view of storage capacity for SL-LILW. A delay for the reactor dismantling, however, will have consequences for the long term storage of SF and LL-wastes. Indeed, storage facilities B4-LL, SFSF-1 and SFSF-2 have a design lifetime of only 50 years. Beyond that, graphite wastes will be temporarily stored in B158-2, for which it is not yet sure that the building can remain (perhaps to be demolished in process of conversion of B158 into a disposal facility). In such case a new storage facility will have to be created.

The situation with regard to the material in the INPP industrial waste dump ("polygon") was clarified. It contains around 30 000 m³ of slightly contaminated industrial wastes. As a result of the changes made in the clearance regulations in 2002 and 2019, this contaminated material is now classified as SL-VLLW. The ARTEMIS Review Team was informed that in view of the very low activity level, it might be possible in future to leave it at its present location on the basis of an application for specific (conditional) clearance. If such clearance would not be authorized, it would result in an increase of the amount of VLLW for disposal. The ARTEMIS Review Team was informed that there are no present plans to transfer this waste to the new VLLW disposal facility.

The ARTEMIS Review Team was informed about, and agrees with, the views of the INPP counterparts on defining short and long term challenges. Finding an acceptable and safe solution for the bituminized waste product storage facility (B158), and a continued and sufficient financing of the on-going decommissioning project as well as for the DGR 'megaproject' are considered as short term challenges. Whereas in respect of the planning for decommissioning, the development and commissioning of a DGR, the treatment of SF and LL wastes, and the production of packages for disposal are considered as long term challenges. Ensuring retention and transfer of knowledge is to be considered as both a short and long term challenge.

In case a decision is made to convert the B158 facility into a disposal facility (existing bituminized waste remains in place), the facility will have to comply with the safety requirements for a disposal facility. The IAEA Review Team considers that demonstrating compliance with the disposal requirements would be a challenging task. An alternative solution, consisting of retrieval of bituminised RAW from the facility, is also under consideration.

5. SAFETY CASE AND SAFETY ASSESSMENT OF RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT ACTIVITIES AND FACILITIES

5.1. STATUS OF SAFETY CASES FOR THE FACILITIES NEEDED FOR THE SAFE MANAGEMENT, AT ALL STAGES, OF ALL SPENT FUEL AND RADIOACTIVE WASTE

Lithuanian position

According to the ARM, all RAW management facilities for dismantled equipment are being established at the INPP site as part of the decommissioning projects. Safety cases and safety assessments for these facilities have been prepared in the frame of the decommissioning projects. The ARM also mentioned that some additional facilities may be needed for the reactor dismantling projects.

Safety assessments for the following facilities are already completed:

- Cementation facility for liquid RAW (B150; in operation);
- Bituminization facility for liquid RAW (B150; operation stopped); and
- Treatment facility for SL-LILW (B3; in operation).

In addition, the following safety assessments are completed for RAW storage facilities and disposal facilities:

- Storage facility for cemented liquid RAW (B158/2; in operation);
- Storage facility for bituminized liquid RAW (B158; in operation; a research project for converting of bituminized liquid RAW storage facility into a disposal facility is ongoing);
- Storage facility for SL-LILW and LL RAW (B4, in operation);
- Buffer storage for VLLW (B19/1; in operation);
- Disposal facility for VLLW (B19; in operation); and
- NSR (B25; in procurement, preliminary safety assessment finished).

Storages and disposal facilities not having approved safety case and safety assessment:

- A new storage facility for LL LILW is under consideration for the reactor dismantling project. Safety assessment will be performed in the scope of the decommissioning project after technical design is finished;
- The DGR implementation project is at an early stage. Safety assessment has not been initiated.

Facilities that may be required in future:

- Disposal facility for VLLW for contaminated concrete (see also Chapter 4);
- Treatment facility for RAW from small producers.

According to the Law on Nuclear Safety, all stages in the lifetime of nuclear facilities are subject to authorization by VATESI. A decision on authorization is based mainly on design documents and the respective safety assessment report. A nuclear facility siting report shall be prepared by the INPP and its approval is coordinated by VATESI. Safety assessment is being updated in accordance with the following procedure:

- Preliminary safety assessment shall be prepared as part of the design documentation before any construction activities starts;
- Safety assessment shall be updated as part of the commissioning, taking into account construction and commissioning experience;
- Periodical safety assessment reports shall be prepared during operation of RAW management facilities and at the end of operation, to capture all operational experience;
- The decommissioning safety assessment report shall be prepared before decommissioning licence is issued (to support the FDP) and shall be updated during decommissioning, when necessary.

Safety assessment shall consider long-term safety of the disposal facility, both during and after the end of institutional control. During active institutional control of closed disposal facilities, periodic safety analysis reports will be performed by the licensee and approved by the regulator.

ARTEMIS observation

The ARTEMIS Review Team observed that responsibilities in relation to safety assessment and its review are in place with respect to licensing processes. The safe management of SF and RAW in existing facilities is supported by appropriate and, where necessary, updated safety documentation, according to requirements defined by nuclear licensing procedures.

Considering the decommissioning of INPP, the safety case and safety assessment are prepared for particular projects within the overall decomissioning megaproject. The results of the safety assessments are taken into account in subsequent reviews and assessments. The ARTEMIS Review Team notes that this process is in place. Safety case and safety assessment were prepared for the final shutdown phase of the INPP and also for the decommissiong stage (to support the INPP FDP).

Regulatory requirements and processes relating to the role of safety assessment in nuclear facility licensing were reviewed during the IRRS Mission to Lithuania in March 2016 and during the Follow-up IRRS Mission in 2020. The ARTEMIS Review Team noted that the IRRS follow-up mission in 2020 made a recommendation that *"VATESI should revise the regulatory framework and associated procedures to require the prior submission of an updated safety assessment to inform its decision-making on the granting of an authorization for the closure of radioactive waste disposal facilities"*. The ARTEMIS Review Team fully supports this recommendation.

5.2. PROCESS FOR DEVELOPING AND MAINTAINING A SAFETY CASE AND/OR SUPPORTING SAFETY ASSESSMENTS

Lithuanian position

According to the Lithuanian Law on Nuclear Safety, evaluation of nuclear safety (as an overall process) shall comprise two main steps:

1. Analysis and justification of nuclear safety (responsibility of the applicant / licensee);
2. Regulatory review and assessment of nuclear safety (responsibility of VATESI, in coordination with other authorities).

The safety analysis and substantiation of nuclear safety in nuclear power activities, as well as in other activities involving nuclear and/or nuclear fuel cycle materials, shall be carried out by the applicant or the licence holder. The analysis and substantiation of nuclear safety during the evaluation of the construction site of a nuclear power plant shall be carried out by the persons implementing a nuclear installation design. The results of the analysis and substantiation of nuclear safety shall be recorded in the nuclear safety assessment documents. The results of the analysis and substantiation of nuclear safety shall be independently verified.

Reviews and assessments are carried out for licencing and for authorisation of activities performed during various life-stages of a nuclear facility. The following safety analysis and justification shall be performed:

1. Safety analysis and justification of a construction site of a nuclear facility shall be performed prior to starting the preparation of the design of a nuclear facility.
2. A preliminary safety analysis report shall be prepared, alongside with other documents in connection with the license application for construction or combined licence application for construction and operation.
3. For license and permit applications related to delivery of nuclear material, radiation sources and/or RAW for the purpose of commissioning of a facility. Safety analysis shall consider design modifications made during construction and based on testing.
4. In addition to other licence application documents for issuance of a permit for industrial operation, the licence holder shall provide a final safety analysis report.
5. The licensee is required to update the safety analysis report when modifying a nuclear facility, or after a discovery of circumstances that were not evaluated during design, construction and operation of a nuclear facility or in other specified cases.
6. In case of implementation of separate modifications to a nuclear facility, for which testing was not foreseen in the design, or other divergences from the design, and in other spacified cases.
7. Licencees operating nuclear facilities must no less then every 10 years make a periodic safety analysis and associated substantiation and prepare a periodic safety evaluation report, which is subject to evaluation by VATESI.

The INPP conducts safety demonstrations for each major phase of the decommissioning megaproject implementation.

The ARM provided information on the main facilities and activities, for which safety cases are to be prepared in the future:

1. Specific clearance of waste from INPP (see also Chapter 4);
2. Modification of WAC for the VLLW and LLW facilities:
    - Handling of RAW containing DSRS;
    - Handling of RAW with hazardous properties;
3. Incineration of combustible VLLW;
4. Conversion of the storage facility for bituminized waste product into a SL-LILW near surface disposal facility;
5. Dismantling of the RBMK-1500 reactor core, including treatment of all RAW that will be generated.

ARTEMIS observation

The ARTEMIS Review Team considers that the scope of work being undertaken, or planned to be undertaken, in relation to developing, maintaining and examining safety cases and supporting safety assessments is appropriate.

The safety case and safety assessment for the DGR for the LL waste and SF has not been prepared yet, the absence of a safety case being justified by the very early stage of the project. The ARTEMIS Review Team was informed that it is planned to start the safety case development in 2024. The ARTEMIS Review Team recommends the preparation of safety case and safety assessment in early phase of the project. Developing and using safety assessments alongside the development of plans for a DGR is an essential tool for site selection, concept development, setting up the priorties of R&D projects and communication with interested parties. In addition, generic assessments based on general concepts for alternative geological environments, built on assumptions owing to sparse data, need to be undertaken in a way that informs and guides the process. The ARTEMIS Review Team anticipates that safety and performance assessment needs to be undertaken to support DGR concept understanding and development and site selection. Plans for disposal concept development, including their relationship to the safety case and safety assessments development, would be an appropriate basis for commencing early dialogue with interested parties.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: *INPP has not performed a safety case and safety assessment for the deep geological repository yet, justifying the absence of a safety case by the very early stage of the project. The ARTEMIS Review Team was informed that it is planned to start the safety case development in 2024.*	
(1)	**BASIS: SSR-5 Requirement 4 states that** *Importance of safety in the process of development and operation of a disposal facility.* *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."*
(2)	**BASIS: SSR-5 Requirement 11 states that** *Step by step development and evaluation of disposal facilities* *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 of the performance and safety of the disposal system."*
R5	**Recommendation: The INPP should prepare the safety case and safety assessment at the start of the process for the DGR, in order to support the concept development, site selection, setting up research and development priorities, facilitating communication with interested parties, and to provide optimised level of safety for consecutive steps of the DGR project.**

6. COST ESTIMATES AND FINANCING OF RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT

Lithuania position

National legislation sets the responsibilities and duties for financial provisions with regard to SF and RAW management.

According to the Law on Radioactive Waste Management, Article 9, the radioactive waste generator shall pay all expenses incurred during the management of radioactive waste from the moment of its generation to its emplacement in a disposal facility, including the expenses related to the post-closure surveillance of disposal facilities.

In Article 32 of Law on Nuclear Energy, it is stated that "*the operating organization of the nuclear installation shall ensure accumulation of the resources in the fund for decommissioning of the nuclear installation (the Decommissioning fund) required for safe decommissioning of the nuclear installation and management of radioactive waste*".

The Ministry of Energy is responsible for defining Lithuania's national programme for the management of SF and RAW. According to the Methodology on Strategic Planning, all national development programmes shall be composed of two documents: A *Development Programme* approved by Resolution of the Government and *Implementation Measures* of this programme approved by the Ministry of Energy.

On February 3rd 2021, the Government of Lithuania approved by Resolution Nr. 76 the updated national programme: "*Development Programme for Decommissioning of Nuclear Power Facilities and Radioactive Waste Management for 2021–2030*" (hereinafter referred to as the Development Programme).

As already described in Chapter 2, the document Implementation Measures is currently only available in a draft version and will provide additional details on information presented in the Development Programme.

The current version of the Development Programme was prepared based on its previous version issued in 2015 and the INPP FDP (renewed version of 2020). The Development Programme[1] is made of three parts:

- Part I "Purpose of the Development Programme" including the indicators of the National Program Plan objective;
- Part II "Financial Projections";
- Part III "Set of Measures"

Part II provides cost estimates with the financial projections for the following timeframes: 2021-2031; 2031-2038; 2039–2138, as well as the funding sources.

The Development Programme provides estimates of total costs for all steps of decommissioning and waste management activities including disposal, long term monitoring, surveillance and regulatory costs. Where inflation and risks are included in cost estimates, it is indicated.

The INPP FDP is one of the data sources for financial costs of the Development Program. In INPP FDP, cost estimates are based either on "bottom-up" principle or on applying other methodologies, such as parametric, analogy and expert assessment. Inflation is estimated as 3% per year and added

[1] The Development Program includes an annex named "*Justification for the Development Programme on the decommissioning of Nuclear Facilities and Radioactive Waste Management for 2021–2030*"

to the basic costs. The INPP FDP does not provide a quantitative assessment of uncertainties, but provides a chart where estimated costs include a "tolerance corridor", which visually illustrates that there can be quite wide-ranging fluctuations in regard to the estimated costs. Risks for current and future projects are estimated and added to the basic cost.

The financing schemes for the management of SF and RAW are:

1. INPP financing scheme for decommisiong and management of SF and RAW: There are several financing sources: Ignalina Programme, Ignalina International Decommissioning Support Fund, State budget and INPP own financial resources.

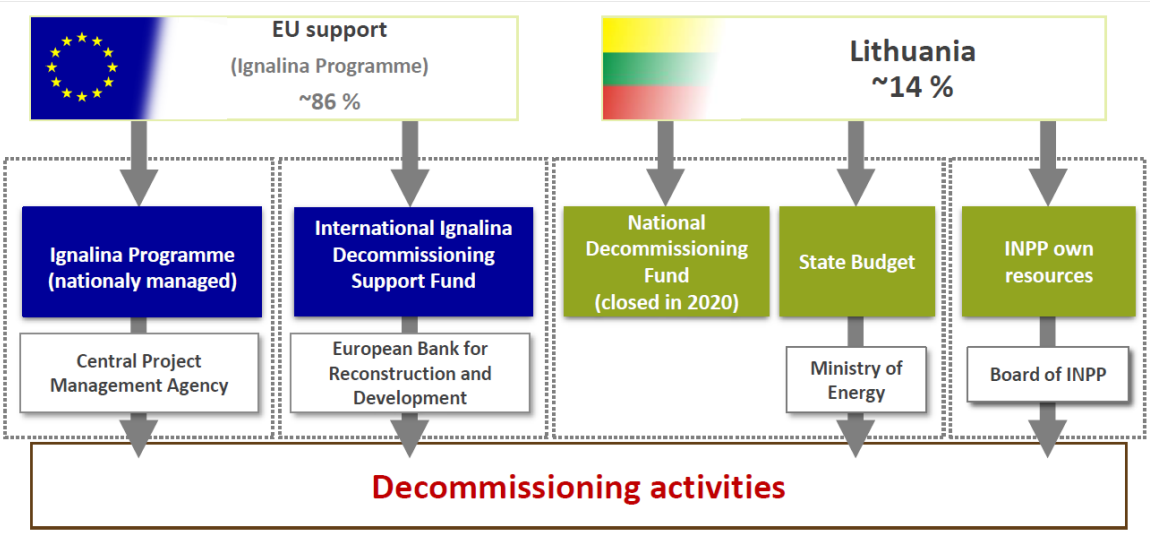

Figure 7. Financing scheme for INPP decommisiong megaproject

As part of the accession process to the European Union (EU), Lithuania agreed to the early closure of its RBMK-1500 reactors: Ignalina Unit 1 in 2004 and Unit 2 in 2009. EU provides funding to support Lithuania in the decommissiong and waste management activities through two channels: Ignalina Programme and Ignalina International Decommissioning Support Fund (IIDSF).

- IIDSF is the fund created by the European Commision (EC) and the Governments of 15 countries (donor funds). The European Bank for Reconstruction and Development (EBRD) is the administrator of the fund and EC is the main contributor.
- The Ignalina Programme is financed by the EU budget and was created under Protocol 4 of the Act of Accession of Lithuania into the EU in order to provide assistance for the decommissioning of INPP (including RAW management), and consequential measures in the energy sector. The fund administrator is the Central Project Management Agency (CPMA) under the Ministry of Finance of the Republic of Lithuania.

Lithuanian state budget funds are allocated to co-finance the INPP decommissioning and RAW management activities. With reference to INPP's own financial resources, available funds are insufficient. No funds were accumulated during INPP operation in the Soviet Union era. After Lithuania's gaining of independence, from 1995 up to the shutdown of INPP Unit 2 in 2009, funds started to be accumulated in the National INPP Decommissioning Fund (the National Fund). Starting in 2014, all INPP revenues earned from sales of redundant assets have been allocated to

the National Fund. On 1 December 2020, the National Fund was liquidated and all INPP revenues earned from sales of redundant assets are now allocated to the Reserve Fund.

Starting from 2000 up to now, most of the funding (around 86% of the total costs) was provided to Lithuania by the EU states (basically through the EU budget), and the Republic of Lithuania's contribution to the financing of the decommissioning process amounted to around 14%. On 25th January 2021, the Council of the EU adopted the Council Regulation on Union Support for the Nuclear Decommissioning Assistance Programme in Lithuania. The financial envelope for the implementation of the Ignalina Programme for the period 2021-2027 was set at EUR 490 million, with Lithuania's contribution of approximately 14% of the funds required for INPP decommissioning. Negotiations with EU for the multiannual financial framework 2028-2034 will commence in the middle of the actual funding period 2021-2027.

Continuity in funding support by EU is crucial to garantee adequate progress of INPP decommissioing and waste management. Lithuania expects that the EU will remain committed to the agreement reached under the Accession Treaty and will continue providing adequate funding.

2. Institutional waste producers pay INPP for their waste collection, transportation, treatment, storage and disposal services according to specific contracts. The fees for these services were approved by the Order of the Minister of Energy No. 1-303 and fee revision is made every two years. INPP collects fees into a separate dedicated account. Management of historical institutional waste (collected before 2003) is funded from the state budget.

3. Article 24 of the Law on Radioactive Waste Management requires a licence holder, importing sealed sources to Lithuania, to:

- obtain a written commitment from the source provider to return the sealed source after its disuse;
- establish a contract with the INPP for the management of the sealed radioactive source in case the sealed radioactive source cannot be returned to its supplier; and
- obtain suretyship insurance or provide to the INPP (the waste management organization) a bank guarantee for the value of the management activities for the sealed sources after their disuse.

4. The management of orphan sources is funded from the state budget or the municipal budget.

5. DGR: In 2020 the Parliament of the Republic of Lithuania approved a financing mechanism by which Lithuania annually allocates at least EUR 3 million to a dedicated account of the Reserve Fund for the DGR. Currently, activities are funded by state budget and by a financial grant from the Norwegian Financial Mechanism under the Environment, Energy and Climate Change Programme. According to the Development Programme, the DGR financing will be provided from the state budget until 2030 and from the Reserve Fund thereafter.

6. The Maišiagala RWSF decommissioning and waste management is financed by the EU Structural Funds and by the national contribution from the State budget.

7. Research and development activities are financed through the budgets of the respective scientific organizations, following state budget contributions.

ARTEMIS observation

The Lithuanian national legal framework defines responsibilities and duties for financial provisions with regard to decommissioning and RAW management activities.

With reference to the Development Programme, the ARTEMIS Review Team noted that it is a very general document and does not provide a complete overall cost assessment of the programme (e.g. DGR works for 2031-2038; Maišiagala RWSF decommissioning, research and development programmes are not included).

In the Development Programme, cost figures are provided without a common basis. Also cost assessment assumptions and hypotheses are not completely detailed: there are different reference years (e.g. at 2004, 2017, 2018, 2019 values), some cost figures include inflation and risks, while for other figures the basis is not fully stated. The ARTEMIS Review Team was informed that additional information on costs and financing will be made available in the Implementation Measures.

The ARTEMIS Review Team noted that INPP FDP cost estimates, covering decommissioning and RAW management, do not include quantitative assessment of uncertainties and only risks are estimated and included in a separate line of cost estimates.

With reference to the DGR, cost figures[2] provided in the Development Programme are not complete. For example, inflation is not accounted for and the cost of the works for the timeframe 2031–2038 is not included. The cost estimates appear to be very preliminary and largely superseded. The Lithuanian counterpart clarified that the cost assessment of DGR will be updated within the preparation of the "Megaproject for a Deep Geological Repository for Radioactive Waste" that is foreseen to be completed by Q4 2023. Such update will detail complete information such as basis for assessment, significant assumption, project cost calculation methods, principles, conditions and cost calculation tool.

The ARTEMIS Review Team recognizes the challenge of developing cost estimates for the DGR, but considers such information as a key element that contributes to providing a full understanding of costs associated with the entire national programme, which is an essential element in assuring collection of necessary funds.

In order to provide a complete overview of costs connected with the entire decommissioning and RAW management programme, the ARTEMIS Review Team considers that the Government should update the Development Programme, assessing the complete scope and implementation of a common approach (e.g. uncertainty, risks, inflation) with more details on cost breakdown, assumptions and hypothesis.

In relation to the INPP decommissioning activities, the counterparts presented the funds available, the total estimated cost and the expenditures (until 2021), see Figure 8.

In 2021, EU funding was agreed for the period 2021-2027 and set at EUR 490 million (EUR 552 million with inflation). The Lithuanian Government financing contribution for the same period amounts to around EUR 80 million (EUR 90 million with inflation). The agreed sum is considered adequate by Lithuania for the implementation of the planned works under the INPP decommissioning megaproject schedule for the 2021-2027 period.

The ARTEMIS Review Team recognizes the financial challenge of INPP decommissioning and RAW management for Lithuania and noted that continued EU financing support is crucial for progress of the project.

[2] At 2004 values.

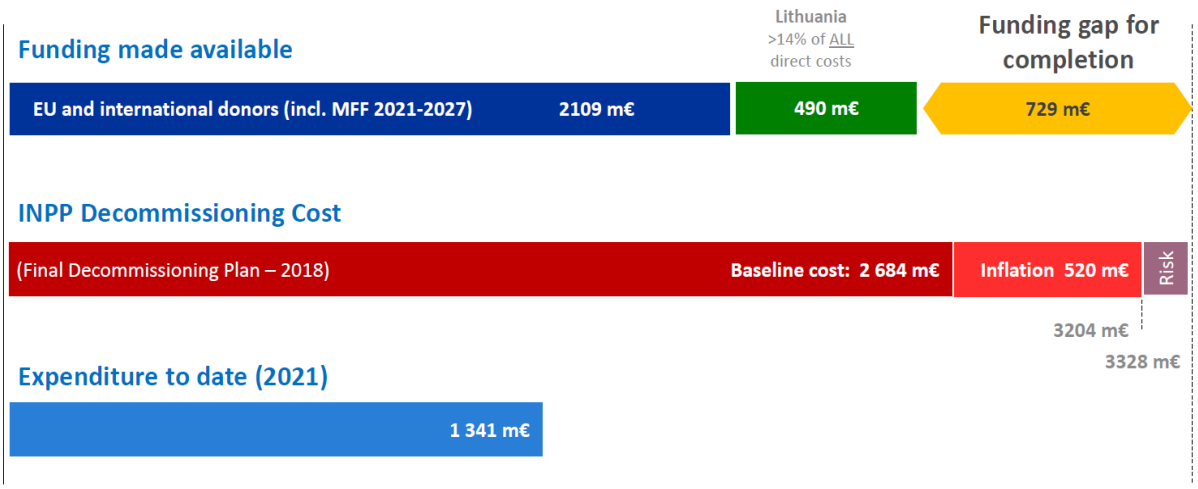

Figure 8. Status of funds available, total estimated cost and expenditures (until 2021) for INPP decommissioning

The funding mechanisms for activities not included in INPP decommissioning, for the period 2031-2038 and 2038-2138, were also discussed. In that regard the counterparts clarified that:

- the DGR project will be financed as following: 2020-2030 [EUR 8,3 million] from the state Budget and [EUR 1,4 million] from Norwegian Financial Mechanisms, 2031-2038 [EUR 103 million][3] and 2038-2138 [EUR 2,5 billion][4] from the Reserve Fund;
- decommissioning of existing facilities and management of the RAW: 2038-2138 [EUR 890 million] from the Reserve Fund;
- the management of RAW generated by small producers from 2038 onwards is not defined yet and therefore not ensured;
- accumulated available financial provisions in the Reserve Fund by the end of 2022 will amount to around EUR 62 million.

The ARTEMIS Review Team noted there is a significant risk that the Reserve Fund will not be sufficient to address future financial resource needs. With reference to the current DGR funding mechanism, according to which Lithuania allocates EUR 3 million per year to the Reserve Fund, the counterpart clarified that the Ministry of Energy will evaluate the adequacy of the accumulation of funds and prepare adjustments of legal acts, if necessary. Adequacy evaluation is foreseen after completion of preparation of the DGR megaproject.

Based on the estimate of funds needed and the current funding scheme, the ARTEMIS Review Team considers that the Lithuanian Government should modify the current funding mechanism in order to guarantee and ensure availability of financial resources when needed, so as not to impose a burden on future generations.

[3]At 2004 values.
[4]At 2004 values.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: *Lithuania's Development Programme does not provide a complete overall cost assessment, such as for DGR works for 2031-2038 and for the research and development programmes. The underlying basis and hypotheses, cost breakdowns and cost estimation approach to the assessment (e.g., uncertainties, risks and inflation) are not completely considered and not documented. The counterparts informed that the missing information will be made available in the Implementation Measures.*	
(1)	**BASIS: GRS Part 1 (Rev. 1) Requirement 10, para. 2.33 states that** *"Appropriate financial provision shall be made for:* *(a) Decommissioning of facilities;* *(b) Management of radioactive waste, including its storage and disposal;* *(c) Management of disused radioactive sources and radiation generators;* *(d) Management of spent fuel."*
(2)	**BASIS: GSR Part 6 Requirement 9, para. 6.2 states that "***The cost estimate for decommissioning shall be updated on the basis of the periodic update of the initial decommissioning plan or on the basis of the final decommissioning plan. The mechanism used to provide financial assurance shall be consistent with the cost estimate for the facility and shall be changed if necessary."*
(3)	**BASIS: SSG-47 para. 6.5 states that** *"The cost estimate for decommissioning should cover all actions required to plan and perform the decommissioning. There will be additional costs for other actions, which might be included as part of the decommissioning, depending on the national legal framework. These typically include financing for the management of waste from operation, pre-decommissioning actions during the transition phase, waste storage and disposal, and spent fuel management."*
(4)	**BASIS: SSG-47 para. 6.8 states that** *"With regard to the accuracy and associated uncertainties of the decommissioning cost estimate, there are typically three types of cost estimate made during the lifetime of the facility:* • *An order of magnitude estimate —....* • *A budgetary estimate — ...* • *A definitive estimate — ..."*
(5)	**BASIS: SSG-47 para 6.10 states that** *"Cost estimates and financial provisions should be reviewed periodically and should be adjusted as necessary to allow for proper consideration of inflation and other factors, such as technological advances, waste management costs or regulatory changes, especially in the case of a deferred dismantling strategy where decommissioning might be completed only decades after shutdown of the facility."*
R6	**Recommendation: The Ministry of Energy should update the Development Programme (Part II – Financial Projections) and the Implementation Measures on the basis of an overall scope of activities and cost estimation approach (e.g. considering inflation, uncertainties and risks evaluation), including the basis and hypotheses for the cost assessment.**

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: *The current funding mechanisms for activities planned after 2030 for the DGR, and after 2038 for decommissioning of existing facilities and for radioactive waste management activities, have significant risks and are not fully consistent with the future financial needs.*	
(1)	**BASIS: GRS Part 1 (Rev. 1) Requirement 10, para. 2.33 states that** *"Appropriate financial provision shall be made for:* *(a) Decommissioning of facilities;* *(b) Management of radioactive waste, including its storage and disposal;* *(c) Management of disused radioactive sources and radiation generators;* *(d) Management of spent fuel."*
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(3)	**BASIS: SSG-47 para. 6.5 states that** *"The cost estimate for decommissioning should cover all actions required to plan and perform the decommissioning. There will be additional costs for other actions, which might be included as part of the decommissioning, depending on the national legal framework. These typically include financing for the management of waste from operation, pre-decommissioning actions during the transition phase, waste storage and disposal, and spent fuel management."*
(4)	**BASIS: SSG-47 para. 6.8 states that** *"With regard to the accuracy and associated uncertainties of the decommissioning cost estimate, there are typically three types of cost estimate made during the lifetime of the facility:* • *An order of magnitude estimate — this type of cost estimate can be utilized prior to receiving the operating licence and is based on the initial decommissioning plan.* • *A budgetary estimate — this type of cost estimate is based on the data provided in revisions of the decommissioning plan.* • *A definitive estimate — this type of cost estimate can be utilized after the completion of detailed planning of the decommissioning actions, and is based on the data provided in the final decommissioning plan and in the associated working level documentation (procedures)."*
R7	**Recommendation: The Government should revise the funding system for activities planned after 2030 (e.g. DGR, radioactive waste management after 2038) in order to ensure that adequate financial resources are available when necessary for safe long-term management of the resulting and currently existing radioactive wastes, including their disposal.**

7. CAPACITY BUILDING FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT – EXPERTISE, TRAINING AND SKILLS

Lithuania position

According to the National Energy Strategy, future use of nuclear energy in Lithuania is not foreseen. The demand of nuclear expertise is not enough for sustaining a separate education and study programme in nuclear energy in the country.

Nuclear Safety Requirements BSR-1.4.3-2017, issued by VATESI, provide requirements on staffing, qualification, training and retraining of staff for nuclear facilities, as well as on improvement of training programmes as a result of training assessments, operational experience, implemented modifications, and other insights described in the licensee documents. The competence management assurance system of an applicant is reviewed by VATESI before a licence is issued and is controlled thereafter, at least once a year, for example by performing inspections. VATESI reviews and approves training programmes and examines questionnaires for evaluating competencies of the INPP safety specialists.

The main employer in the nuclear field is the INPP and its human resources (HR) management is focused on preserving expertise and assuring an adequate number of qualified resources for decommissioning and RAW management activities.

The INPP manages human resources in accordance with the "Human Resources Management Procedure" (DVsta-1411-1). Current needs by type of activities are evaluated annually and staff position lists are prepared for the next year. Each year INPP performs long-term analysis (over a 10-year period) of HR demand taking into consideration the employee retirement age. Last analysis was performed in 2020, assessing the HR needs until 2030.

With reference to personnel "important to safety", INPP developed the "Programme for the Long Term Provision of Personnel who is Important to Safety" (DVSta-1410-1) and "List of Forming the Reserve of Employees who are Important to Safety" (last version 13 November 2020) No. Sr-2930 (11.204E). The INPP also developed "Long Term Plan (10 years) for the Preservation of Competencies of Employees who are Important to Safety", MtDPl-1 (3.254); and the Plan (5 years) of the "Recruitment and Training of Employees who are Important to Safety", MnDPL-570 (11.204).

In order to cover the future demand for new qualified employees, the INPP set up the "Programme of Young Specialist Engaging to INPP". This programme foresees the cooperation of the INPP with educational institutions in Lithuania, organizing 'careers days', lectures, or student practice.

The INPP annually performs planning of needs for young specialists over the next 5 years, in coordination with the "Programme of Young Specialist Engaging to INPP". The last analysis was done in 2020.

Training of the INPP personnel is performed according to the regulations approved by VATESI (Nuclear Safety Requirements BSR-1.4.3-2017, "Human Resources of Organizations Carrying Out Licensed Activities in the Field of Nuclear Energy" and Nuclear Safety Requirements BSR-1.4.1-2016, "Management System") and the INPP management system procedures.

Training is tailored based on a job description. The job description determines the qualification requirement (education and experience) and the training requirements necessary to obtain a permission for independent work. Training of the INPP personnel foresees an initial training and a continuous training in terms of maintenance and enhancement of competences. The

training process comprises five phases, starting from the analysis of training needs and ending with an evaluation of training effectiveness.

There are several types of training (e.g initial, mandatory, periodical certification) depending on the job description, and theoretical and/or practical training sessions are foreseen.

A key element in HR management system of the INPP is the "Procedure and Knowledge Accumulation and Preserving Programme" (DVSed-410-3), prepared on the basis of the IAEA guidelines. The scope of the programme is to preserve the critical knowledge and expertise of the INPP staff. The INPP Critical Employee Identification Methodology was developed, and a list of critical employees is prepared on annual basis. Individual plans for the preservation and transfer of critical knowledge/skills of these employees are developed and implemented.

With reference to VATESI, the requirements of personnel are defined in Article 24 of the Law of Nuclear Energy. The planning of future HR needs is defined in the "Procedure Document of Personnel and Knowledge Management", approved by the Head of VATESI. The training process is performed according to the "Rules of Training of Staff of the State Nuclear Power Safety Inspectorate" (Rules of Training), approved by the Head of VATESI. VATESI implements a systematic approach to competence management, pursuant to Paragraph 4 of the Rules of Training and the following methods are applied: in class training, practical training, independent studies, training on the job.

In order to ensure HR long-term management, VATESI defined a procedure for turnover management, and performed a long-term analysis of existing and future HR needs in 2017, and established a plan for further actions.

Pursuant to the amendment of the "Statute of Training of VATESI Personnel" (Order No. 22.3–197 of 12 December 2016 by the Head of VATESI), (1) inspectors are required to have extended introductory training and pass a test before being allowed to carry out inspections independently, and (2) inspectors are required to attend refresher courses every five years, which are organized internally and include a test afterwards.

With reference to research activities, the Lithuanian Energy Institute (LEI) and the Centre for Physical Sciences and Technology (CPST) are the main institutions conducting research on nuclear safety, RAW management and disposal.

ARTEMIS observation

According to the ARM and the discussions during the meeting, the main institutions and organizations involved in the SF and RAW programme in Lithuania (Ministry of Energy, VATESI, RSC, INPP) have a comprehensive HR managemement plan in place. HR management plans ensure availability of qualified personel, adequate training and expertise. Knowledge management system and periodic assessment of training needs are reconciled together with planning of HR needs for the future.

Based on the discussion during the meeting, the ARTEMIS Review Team noted that the average age of employees is high and could be an issue in the field of RAW management. Therefore, the INPP tries to attract younger workers in various ways. In 2021, 31 out of 75 recruited workers were under 35 years of age.

The ARTEMIS Review Team underlined the importance of the analysis of future HR needs in order to ensure availability of skilled personnel for all activities within the decommissioning and RAW management programme.

The ARTEMIS Review Team noted that the "National Plan for Preparation of the Specialists" was approved in 2011 by the order of the Ministry of Energy and the Ministry of Education and Science. The measures envisaged in the plan were implemented until the end of 2015, and have not been extended. Consequently, the different institutions and organizations involved in SF and RAW management continued addressing capacity building needs through their own plans and activities.

The ARTEMIS Review Team considers that establishment of a platform to facilitate coordination of capacity building activities of different organizations would be useful in that context.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
Observation: *The information provided to the ARTEMIS Review Team has not demonstrated presence of coordination at a national level of activities/measures for capacity building for safe management of radioactive waste and decommissioning. Different institutions and organizations involved (Ministry of Energy, VATESI, RSC, INPP) are addressing capacity building needs through their own plans and activities.*	
(1)	**BASIS: GSR Part 1 (Rev. 1) Requirement 11 states that** *"The government shall make provision for building and maintaining the competence of all parties having responsibilities in relation to the safety of facilities and activities.* **Para. 2.35:** *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. Competence shall be built, in the context of the regulatory framework for safety, by such means as:* • *Technical training;* • *Learning through academic institutions and other learning centres;* • *Research and development work*
(2)	**BASIS: GSR Part 2 Requirement 9, para. 4.27 states that** *"The knowledge and the information of the organization shall be managed as a resource."*
(3)	**BASIS: GSR Part 3 Requirement 4, para. 2.44 states that** *"The relevant principal parties and other parties having specified responsibilities in relation to protection and safety shall ensure that all personnel engaged in activities relevant to protection and safety have appropriate education, training and qualification so that they understand their responsibilities and can perform their duties competently, with appropriate judgement and in accordance with procedures."*
(4)	**BASIS: SSR 5 Requirement 1, para 3.7 states that** *"Matters that have to be considered include:* *(e) 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;..."*
S3	**Suggestion: The Government should consider providing a platform to facilitate coordination of capacity building activities of different organizations involved in radioactive waste management.**

APPENDIX A: TERMS OF REFERENCE

ARTEMIS Review of Lithuania's National Programme on Radioactive Waste and Spent Fuel Management

Terms of Reference

1. Introduction

On 18 December 2018, the Ministry of Energy of the Republic of Lithuania requested the IAEA to organize and carry out, in the second quarter of 2021, the Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) peer review mission in Lithuania, as required of all EU Member States by Article 14.3 of the European 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. Due to the impact of the COVID-19 international situation, specifically travel restrictions, the mission was postponed to 17-27 October 2021 and later to 15-25 May 2022.

2. Objective

The ARTEMIS review will provide an independent international evaluation of Lithuania's radioactive waste and spent fuel management programme.

The review, organized in the IAEA by the Department of Nuclear Safety and Security and the Department of Nuclear Energy, will be 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.

3. Scope

The given ARTEMIS review will evaluate the Lithuanian national programme and the national framework for executing country's obligations for safe and sustainable radioactive waste and spent fuel management.

Special emphasis should be given to the decommisioning of Ignalina NPP. Management of NORM residues and environmental remediation are out of the scope of this review.

Results from the 2016 IRRS mission and 2020 IRRS Follow-up mission to Lithuania will be taken into account as far as possible.

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, with a focus on the national programme, as well as the results of self-assessment, which should be based on the provided questionnaire.

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 Counterpart is the Ministry of Energy of the Republic of Lithuania. The National Counterpart Liaison Officer for the review is Mr Renatas Šumskis.

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

- Self-assessment: questionnaire was made available to Lithuania as of September 2020.
- Preparatory Meeting: 26 November 2020 (WebEx meeting)
- The reference material (in English) and the results of the self-assessment questionnaire will be provided to the IAEA as soon as they are available and not later than 30 March 2021.
- Questions based on the preliminary analysis of the reference material and the self-assessment results will be provided by the Review Team by 22 April 2022 .
- Peer review mission: 15-25 May 2022 (11 days (with site visit))[5]
    - Sunday: arrival of experts and their meeting;
    - Monday to Friday: interviews/exchange/discussion with Counterpart(s) on the basis of preliminary analysis and drafting of recommendations and suggestions
    - Wednesday: site visit to Ignalina NPP. Indicative programme of the site visit will be provided by Counterpart(s) by 1 May 2021 and can be further adapted to facilitate requests by the Review Team.
    - Saturday-Sunday: preparation of the draft mission report (Review Team);
    - Monday noon: Delivery of draft report to the Counterparts for fact checking;
    - Tuesday: discussions between the Review Team and the Counterparts and finalization of draft mission report;
    - Wednesday: exit meeting - delivery of the draft mission report and mission closure.

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 coordinate the mission. The Coordinator of the ARTEMIS review is Mr Vladan Ljubenov from the Waste and Environmental Safety Section of the

[5] 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.

Department of Nuclear Safety and Security. The Deputy Coordinator is Ms Tetiana Kilochytska from the Decommissioning and Environmental Remediation Section of the Department of Nuclear Energy;

- One IAEA staff for administrative support;
- A senior member of IAEA staff from the Department of Nuclear Safety and Security will oversee the closure of the review.

The Review Team will be led by a Team Leader, assisted by a Deputy Team Leader, comprising from the Review Team as defined in the ARTEMIS draft guidelines. The Team Leader will be Mr Geoff Williams from Australia. The IAEA will inform the National Counterpart regarding the composition of the proposed Review Team prior to submission of reference material.

The review mission may include the presence of up to two observers, including the possibility of an observer from the EC. The National Counterparts will be notified of any proposed observers; the presence of any observers must be agreed in advance of the mission, considering the impact of the COVID-19 international situation, specifically travel restrictions.

8. Reporting

The findings of the peer review will be documented in a final report that will summarise 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 Counterpart for fact-checking, being the Ministry of Energy of the Republic of Lithuania.

9. Funding of the peer review

The cost estimate for the ARTEMIS review covers both preparatory meeting and the review mission, and includes travel costs, per diem of the peer Review Team (external experts and IAEA staff) and fees to the external experts in line with IAEA Financial Regulations and Rules.

The total cost is currently estimated to the amount of xxx EUR. The Republic of Lithuania is aware that the review cost includes 7% programme support costs. The Republic of Lithuania agrees with these Terms of Reference by accepting necessary arrangements, including release of funds from the Technical Cooperation Department of the IAEA (TC) to the responsible TC budget Officer of the IAEA.

These Terms of Reference have been agreed between the IAEA and the Ministry of Energy of the Republic of Lithuania during the preparatory meeting 26 November 2020. The Terms of Reference were revised in February 2022 due to postponed date for ARTEMIS review mission to 15-25 May 2022.

APPENDIX B: MISSION PROGRAMME

Time	Sun, 15 May	Mon, 16 May	Tue, 17 May	Wed, 18 May	Thurs, 19 May	Fri, 20 May	Sat, 21 May	Sun, 22 May	Mon, 23 May	Tue 24 May	Wed 25 May
9h00 – 10h00	Arrival of Team Members	**Opening 10h00** General presentation	Inventory *INPP presentation*	Site Visit to Ignalina NPP	Safety case and safety assessment *VATESI, INPP presentations*	Capacity building *MoE, VATESI, RSC, INPP presentations.*	**Presentation of Suggestions and Recommendations to Counterparts**	Drafting of the report	**Draft report to be sent to the Counterparts *by 13h00***	**Internal reflection of comments**	Delivery of final draft report **EXIT MEETING**
		Coffee break 10:30-10:45	Coffee break 10:15-10:35		Coffee break 10:15-10:35	Coffee break 10:15-10:35	Coffee break 10:15-10:35			Coffee break 10:15-10:35	
10h00 - 12h00		National Policy and Framework *MoE, VATESI, RSC presentations*	Inventory *INPP presentation*		Safety case and safety assessment *VATESI, INPP presentations*	Capacity building *MoE, VATESI, RSC, INPP presentations*	**Presentation of Suggestions and Recommendations to Counterparts**			**Discussions with the Counterparts on the draft report**	
12h00 - 13h00		Lunch	Lunch		Lunch	Lunch	Lunch		Lunch	Lunch	Departure of Team Members
13h00 - 16h00		National Strategy *MoE presentation*	Concepts, Plans and technical solutions *INPP presentation*		Cost estimates and financing *MoE presentation*	Session reserved for further discussions if required/ drafting of the report	Drafting of the report		Counterparts review the draft report	Finalising draft report	
		Coffee break 14:15-14:35	Coffee break 14:15-14:35		Coffee break 14:15-14:35	Coffee break 14:15-14:35				19:00 Dinner at "14 Horses" restaurant Dominikonų st. 11, Vilnius	
		National Strategy *INPP presentation on FDP*	Concepts, Plans and technical solutions *INPP presentation*		Cost estimates and financing *MoE presentation*	Session reserved for further discussions if required/ drafting of the report					
16h30 - 17h30	ARTEMIS team meeting	Team meeting Drafting of the report	Team meeting Drafting of the report		Team meeting Drafting of the report	**Finalization of Suggestions and Recommendations**					

APPENDIX C: RECOMMENDATIONS AND SUGGESTIONS

Area		R:Recommendations S: Suggestions G: Good Practices	Recommendations, Suggestions or Good Practices
1.	**NATIONAL POLICY AND FRAMEWORK FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT**	S1	The Ministry of Energy should consider compiling the elements of the national policy in one document for the purpose of clarity.
		R1	The Government should ensure that the overarching environmental impact assessment takes into account the impact of the INPP decommissioning megaproject in its entirety.
2.	**NATIONAL STRATEGY FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT**	R2	The Government should ensure that updates of the Development Programme include milestones and schedules contributing to the long-term commitment to safety and to avoiding an undue burden on future generations by considering: • decommissioning of remaining facilities after the end of INPP decommissioning, and • development of a deep geological disposal facility.
		GP1	From the very early stage of DGR development, a working group was involved that serves as a platform for exchange of information and discussion of options between the implementer and the various relevant national regulatory bodies. This approach contributes to improvement of the communication and coordination among different parties, improves efficiency and reduces the risk of significant time delays of the project.

Area		R:Recommendations S: Suggestions G: Good Practices	Recommendations, Suggestions or Good Practices
3.	**INVENTORY OF SPENT FUEL AND RADIOACTIVE WASTE**	S2	INPP should consider accelerating the solution for the fresh fuel assemblies, so that this prerequisite for granting the decommissioning license is fulfilled.
		R3	The INPP should initiate the licence application for the bituminised waste product storage facility (B158) that is currently covered by the operational licence for the INPP.
		R4	INPP should develop a safety evaluation and propose specific (conditional) clearance levels, such as for concrete rubble from the demolition of buildings, for approval by VATESI. This would provide an additional option for clearance of large amounts of material from demolition.
5.	**SAFETY CASE AND SAFETY ASSESSMENT OF RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT ACTIVITIES AND FACILITIES**	R5	The INPP should prepare the safety case and safety assessment at the start of the process for the DGR, in order to support the concept development, site selection, setting up research and development priorities, facilitating communication with interested parties, and to provide optimised level of safety for consecutive steps of the DGR project.
6.	**COST ESTIMATES AND FINANCING OF RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT**	R6	The Ministry of Energy should update the Development Programme (Part II - Financial Projections) and the Implementation Measures on the basis of an overall scope of activities and cost estimation approach (e.g., considering inflation, uncertainties and risks evaluation), including the basis and hypotheses for the cost assessment.

Area		R:Recommendations S: Suggestions G: Good Practices	Recommendations, Suggestions or Good Practices
		R7	The Government should revise the funding system for activities planned after 2030 (e.g. DGR, radioactive waste management after 2038) in order to ensure that adequate financial resources are available when necessary for safe long-term management of the resulting and currently existing radioactive wastes, including their disposal.
7.	**CAPACITY BUILDING FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT – EXPERTISE, TRAINING AND SKILLS**	S3	The Government should consider providing a platform to facilitate coordination of capacity building activities of different organizations involved in radioactive waste management.

APPENDIX D: LIST OF ACRONYMS USED IN THE TEXT

ARM – Advance Reference Material

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

BWP – Bituminized Waste Product

CPMA – Central Project Management Agency

CPST – Centre for Physical Sciences and Technology

DGR – Deep Geological Repository

DSRS – Disused Sealed Radioactive Sources

EBRD – European Bank for Reconstruction and Development

EC – European Commission

EIA – Environmental Impact Assessment

EU – European Union

FA – Fuel Assemblies

HR – Human Resources

IAEA – International Atomic Energy Agency

ILW – Intermediate Level Waste

INPP – Ignalina Nuclear Power Plant

INPP – FDP – INPP Final Decommissioning Plan

IRRS – Integrated Regulatory Review Service

LEI – Lithuanian Energy Institute

LL – Long Lived

LLW – Low Level Waste

LRW – Liquid Radioactive Waste

LGS – Lithuanian Geological Survey

LEI – Lithuanian Energy Institute

LRW – Liquid Radioactive Waste

NF – Nuclear Facility

NSR – Near Surface Repository

RAW – Radioactive Waste Management

RSC - Radiation Protection Centre

RWSF - Radioactive Waste Storage Facility

SF – Spent Fuel

SL-LILW – Short Lived Low and Intermediate Level RAW

SL-VLLW – Short Lived Very Low Level RAW

VATESI – State Nuclear Power Safety Inspectorate

VLLW - Very Low Level Waste

WAC – Waste Acceptance Criteria

WG – Working Group on RAW Management Monitoring

APPENDIX E: IAEA REFERENCE MATERIAL USED FOR THE REVIEW

[1] INTERNATIONAL ATOMIC ENERGY AGENCY, Fundamental Safety Principles, Safety Fundamentals No. SF-1, Vienna (2006).

[2] INTERNATIONAL ATOMIC ENERGY AGENCY, Governmental, Legal and Regulatory Framework for Safety, General Safety Requirements No. GSR Part 1 (Rev. 1), Vienna (2016).

[3] INTERNATIONAL ATOMIC ENERGY AGENCY, Leadership and Management for Safety, General Safety Requirements No. GSR Part 2, IAEA, Vienna (2016).

[4] INTERNATIONAL ATOMIC ENERGY AGENCY, Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, IAEA Safety Standards Series No. GSR Part 3, IAEA, Vienna (2014).

[5] INTERNATIONAL ATOMIC ENERGY AGENCY, Safety Assessment for Facilities and Activities, IAEA Safety Standards Series No. GSR Part 4, IAEA, Vienna (2009).

[6] INTERNATIONAL ATOMIC ENERGY AGENCY, Predisposal Management of Radioactive Waste, IAEA Safety Standards Series No. GSR Part 5, IAEA, Vienna (2009).

[7] INTERNATIONAL ATOMIC ENERGY AGENCY, Decommissioning of Facilities, IAEA Safety Standards Series No. GSR Part 6, IAEA, Vienna (2014).

[8] INTERNATIONAL ATOMIC ENERGY AGENCY, Disposal of Radioactive Waste, IAEA Safety Standards Series No. SSR 5, IAEA, Vienna (2011).

[9] INTERNATIONAL ATOMIC ENERGY AGENCY, Safety of Nuclear Fuel Cycle Facilities, IAEA Safety Standards Series No. NS-R-5 Rev. 1, IAEA, Vienna (2014).

[10] INTERNATIONAL ATOMIC ENERGY AGENCY, Nuclear Energy Basic Principles, Nuclear Energy Series, NE-BP, Vienna (2008).

[11] INTERNATIONAL ATOMIC ENERGY AGENCY, Radioactive Waste Management and Decommissioning Objectives, Nuclear Energy Series, NW-O, Vienna (2011).

[12] INTERNATIONAL ATOMIC ENERGY AGENCY, Nuclear Fuel Cycle Objectives, Nuclear Energy Series, NF-O, Vienna (2013).

[13] INTERNATIONAL ATOMIC ENERGY AGENCY, Policies and Strategies for Radioactive Waste Management, IAEA Nuclear Energy Series No. NW-G-1.1, IAEA, Vienna (2009).

[14] INTERNATIONAL ATOMIC ENERGY AGENCY, Policies and Strategies for the Decommissioning of Nuclear and Radiological Facilities, IAEA Nuclear Energy Series No. NW-G-2.1, IAEA, Vienna (2012).

[15] INTERNATIONAL ATOMIC ENERGY AGENCY, Policy and Strategies for Environmental Remediation, IAEA Nuclear Energy Series No. NW-G-3.1, IAEA, Vienna (2015).

[16] INTERNATIONAL ATOMIC ENERGY AGENCY, Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, IAEA International Law Series No. 1, IAEA, Vienna (2006).

[17] INTERNATIONAL ATOMIC ENERGY AGENCY, Safety Glossary – Terminology used in Nuclear Safety and Radiological Protection, IAEA, Vienna (2018).

[18] Official Journal of the European Union No. L 199/48 from 2nd Aug 2011, 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, Brussels (2011).