

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

**MISSION  
TO  
SLOVAKIA**

*Bratislava, Slovakia*

*12-22 February 2023*

DEPARTMENT OF NUCLEAR SAFETY AND SECURITY  
DEPARTMENT OF NUCLEAR ENERGY



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

**ARTEMIS**



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INTEGRATED REVIEW SERVICE FOR RADIOACTIVE WASTE AND  
SPENT FUEL MANAGEMENT, DECOMMISSIONING AND  
REMEDICATION (ARTEMIS) MISSION  
TO  
SLOVAKIA**

**Mission dates:** *12-22 February 2023*

**Location:** *Bratislava, Slovakia*

**Organized by:** *IAEA*

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IAEA-2023

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

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## EXECUTIVE SUMMARY

On 19 November 2019, the Nuclear Regulatory Authority of the Slovak Republic requested the IAEA to organize and carry out, in 2021, the Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) peer review mission in Slovakia, based upon the IAEA Safety Standards and technical guidance as well as international good practice.

The ARTEMIS mission is also intended to fulfil the obligations of the Slovak Republic under 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.

The review was performed by a team of senior international experts in the field of decommissioning, 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 from Germany, Lithuania, South Africa, Sweden, Switzerland and the United Kingdom.

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.

At the request of the Slovakian Government, the following specific topics were included:

- management of radioactive waste from decommissioning of nuclear installations;
- siting of a deep geological repository.

A preparatory meeting was organized in August 2020. The ARTEMIS mission had initially been planned for the first quarter of 2021 but was postponed to September 2021 and then further to the first quarter of 2023 due to the impact of the COVID-19 pandemic.

The Advanced Reference Material (ARM) was originally received in December 2021 and updated in December 2022. The ARM included a self-assessment conducted by the Slovak Republic, applicable legal acts and other supporting documents.

The ARTEMIS Review Team examined the ARM in January 2023 and sent a list of questions to the Slovakian counterparts for additional information and clarifications.

The mission took place from 13th to 22nd February 2023 in Bratislava. The ARTEMIS Review Team performed the review according to the mission programme given in Appendix B, evaluating the Slovak Republic 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 the Slovak Republic with recommendations and suggestions for improvement.

The ARTEMIS mission was organized back-to-back with an IRRS mission. The conduct of the ARTEMIS mission and the preparation of the associated mission report have been carried out in due consideration of the IRRS mission, including the IRRS mission report, conducted from 5 to 16 September 2022.

During the ARTEMIS mission, presentations were made by the Slovakian organizations involved in radioactive waste management, spent fuel management and decommissioning activities. The ARTEMIS Review Team and the Slovak Counterparts engaged in discussions on the ARTEMIS topics. The ARTEMIS mission included a one-day visit to the JAVYS, a.s. facilities at the Jaslovské Bohunice site, which was organized on 16th February. The visit included technical tours to the decommissioned V1 NPP and the radioactive waste treatment centre.

The ARTEMIS Review Team noted the strong commitment of the Government of the Slovak Republic to ensure a safe implementation of the radioactive waste and spent fuel management activities in the country, in accordance with applicable legal and regulatory system, international conventions and IAEA safety standards.

The ARTEMIS Review Team recognized the constructive manner in which the counterparts engaged throughout the mission and the detailed information provided on their activities.

The ARTEMIS Review Team concluded that:

- the Slovak Republic has established a good basis for the safe and responsible management of radioactive waste and spent fuel as well as for decommissioning;
- the current arrangements for the management of radioactive waste from decommissioning of nuclear installations are of a high standard;
- there is a considerable work to be done in preparation for geological disposal.
- The application of an immediate dismantling strategy combined with the treatment of all materials arising was considered to be outstanding and recognised as a good practice.

The ARTEMIS Review Team commended the Slovak Republic on its work to ensure that waste arisings are managed in a timely manner and that the significant efforts to minimise the waste volumes through effective segregation and conditioning.

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

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



## I. INTRODUCTION

On 19 November 2019, the Nuclear Regulatory Authority of the Slovak Republic requested the IAEA to organize and carry out, in 2021, the Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) peer review mission in Slovakia, based upon the IAEA Safety Standards and technical guidance as well as international good practice.

The ARTEMIS mission is also intended to fulfil the obligations of the Slovak Republic under 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.

On 20 September 2021, in the national Statement on the occasion of the 65th Session of the IAEA General Conference, the Slovak Republic further requested the IAEA to organize the IRRS and the ARTEMIS missions in a back-to-back format.

The ARTEMIS 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 preparatory meeting in August 2020, and the receipt and review of Advanced Reference Material in February of 2021 and December 2022, in February 2023, the ARTEMIS Review Team evaluated the overall Slovakian strategy for the management of all types of radioactive waste and spent fuel, including the specific topics of management of radioactive waste from decommissioning of nuclear installations and siting of a geological disposal facility.

## II. OBJECTIVE AND SCOPE

The ARTEMIS review provided an independent international evaluation of the Radioactive Waste and Spent Fuel Management Strategy of the Slovak Republic, based upon the IAEA Safety Standards and technical guidance as well as international good practice. The ARTEMIS mission is also intended to fulfil the obligations of the *Waste Directive*.

The ARTEMIS review, organized by the Department of Nuclear Safety and Security and the Department of Nuclear Energy of the IAEA, was performed against 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.

The ARTEMIS review assessed the overall strategy for the management of all types of radioactive waste and spent nuclear fuel in the Slovak Republic. As requested in the Terms of Reference for the ARTEMIS mission, specific focus was given to the topics of management of radioactive waste from decommissioning of nuclear installations and siting of a geological disposal facility.

### III. BASIS FOR THE REVIEW

#### A) PREPARATORY WORK AND IAEA REVIEW TEAM

At the request of the Government of Slovakia, a preparatory meeting for the ARTEMIS Review mission, was conducted on 20 of August 2020. The preparatory meeting was carried out by the appointed Team Leader Mr Thiagan Pather, the IAEA coordinator and deputy coordinator Ms Joanne Brown and Ms Tetiana Kilochytska, and the team of National Counterparts led by Mr Miroslav Kövér from the National Nuclear Fund, with participation of representatives of the Nuclear Regulatory Authority of the Slovak Republic, the Public Health Authority of the Slovak Republic, the Ministry of Environment of the Slovak Republic, the Ministry of Economy of the Slovak Republic, the Ministry of Transport of the Slovak Republic, JAVYS, a. s. and Slovenské elektrárne, a. s.

The ARTEMIS mission preparatory team had discussions regarding:

- the Terms of Reference for the ARTEMIS review of the Slovakian strategy to fulfil obligations from article 14(3) of the 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 Slovakia in February 2023<sup>1</sup>.

Mr Miroslav Kövér was appointed as the National Counterpart for the ARTEMIS mission and designated IAEA point of contact.

Slovakia provided the IAEA with the Advance Reference Material (ARM) in December 2021 on the timescale agreed for the original date of the ARTEMIS review mission in February 2021. Due to the postponement of the mission<sup>1</sup>, the ARM was updated in December 2022.

#### B) REFERENCES FOR THE REVIEW

The guidelines for the ARTEMIS review service, the articles of the *Waste Directive*, 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 Review Team meeting took place on Sunday, 12 February 2023 in Bratislava, directed by the ARTEMIS Team Leader Mr Thiagan Pather, the ARTEMIS Team Coordinator Ms Joanne Brown and the Deputy Team Coordinator, Ms Tetiana Kilochytska.

The National Counterpart Mr Miroslav Kövér was present at the initial 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, 13 February 2023, with the participation of the National Nuclear Fund, the Nuclear Regulatory Authority of the Slovak Republic, the Public Health Authority of the Slovak Republic, the Ministry of Environment of the Slovak Republic, the Ministry of Economy of the Slovak Republic, the Ministry of Transport of the

<sup>1</sup> The planned ARTEMIS review in February 2021 was postponed to September 2021 and then to February 2023 due to the COVID-19 pandemic and restrictions affecting the conduct of the mission.

Slovak Republic, the Ministry of Health of the Slovak Republic, JAVYS, a. s. and Slovenské elektrárne, a. s. senior management and staff. Opening remarks were made by Mr Peter Gerhart, State Secretary, Ministry of Economy of the Slovak Republic and Mr Metke, Nuclear Regulatory Authority of the Slovak Republic, and Mr Thiagan Pather, ARTEMIS Team Leader.

During the ARTEMIS mission, a review was conducted for all review topics within the agreed scope with specific focus given to the topics of management of radioactive waste from decommissioning of nuclear installations and siting of a geological disposal facility. The overall objective was to provide the authorities in the Slovak Republic with recommendations and suggestions for improvement and, where appropriate, identify good practice.

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

The ARTEMIS Exit Meeting was held on Wednesday, 22 February 2023. Opening remarks were made by Mr Ladislav Ěhn, chairman of the Board of Governors of the National Nuclear Fund. A presentation of the results of the Review Mission was given by the ARTEMIS Team Leader Mr Thiagan Pather. Closing remarks were made on behalf of the IAEA by Ms Anna Clark, Section Head, Waste and Environmental Safety Section, 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**

### **Slovak position**

The establishment of a National Policy and Programme for radioactive waste and spent nuclear fuel management is required in terms of the provisions of the Act No. 308/ 2018 Coll. on the National Nuclear Fund. Act 308/2018 Coll. further requires that the National Policy and Programme be updated every six years.

The first national strategy for radioactive waste and spent nuclear fuel management (document “Strategy of back-end part of nuclear power engineering”) was approved by the Slovak Government in 2008. The Strategy was amended and issued as the National Policy and Programme which was approved by the Slovak Government in 2015. A draft update of the National Policy and National Programme was developed in September 2022. The ARTEMIS Review Team was informed that this latest draft of the National Policy and Programme will be subjected to a Strategic Environmental Assessment (SEA) and inter-ministerial review prior to it being approved by the Government.

The National Policy affirms the Slovak Government’s commitment to the safe and secure management of radioactive waste and spent nuclear fuel. The National Policy:

- (a) elaborates the principles for management of radioactive waste and spent nuclear fuel;
- (b) reaffirms the application of an open fuel cycle in the Slovak Republic;
- (c) confirms disposal at the National Radioactive Waste Repository (NRAWR), in Mochovce as the ultimate endpoint for low-level and very low-level radioactive waste;
- (d) confirms geological disposal as the ultimate end point for spent nuclear fuel and radioactive waste not suitable to be disposed in the NRAWR, while recognising that storage is a necessary intermediate step in the process;
- (e) sets out the roles and responsibilities of the waste producers as well as JAVYS, a.s. as waste treatment and disposal facility operator.

### **ARTEMIS observation**

The principles embodied in the updated National Policy provided as part of the ARM for the ARTEMIS mission are consistent with the principles in the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention). The policy principles are consistent with IAEA Safety Fundamentals (SF-1) and requirements in the IAEA Safety Standards, with due consideration to the principles of:

- (a) minimisation of radioactive waste produced;
- (b) optimisation and accounting for interdependences of the steps in radioactive waste management;
- (c) safety of radioactive waste management;
- (d) application of a graded approach;
- (e) polluter pays;
- (f) documented and fact based decision making and;
- (g) commitment to transparency in the decision making process.

The ARTEMIS Review Team was informed that there is a need for broader inter-ministerial consultation prior to Government taking a decision to progress work on geological disposal. There is no active progressing of the JAVYS, a.s. plan in support of geological disposal.

<b>RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES</b>	
<b>Observation:</b> <i>Progress of the geological disposal is delayed due to lack of Government decision on undertaking further work in this regard.</i>	
<b>(1)</b>	<b>BASIS: GSR Part 1 (Rev. 1) Requirement 1 states that</b> <i>“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.”</i>
<b>(2)</b>	<b>BASIS: SSR - 5 Requirement 1 states that</b> <i>“The government is required to establish and maintain an appropriate governmental, legal and regulatory framework for safety within which responsibilities shall be clearly allocated for disposal facilities for radioactive waste to be sited, designed, constructed, operated and closed. This shall include: confirmation at a national level of the need for disposal facilities of different types; specification of the steps in development and licensing of facilities of different types; and clear allocation of responsibilities, securing of financial and other resources, and provision of independent regulatory functions relating to a planned disposal facility.”</i>
<b>R1</b>	<b>Recommendation:</b> <b>The Government should expedite the decision for the undertaking of further work on geological disposal.</b>

Further, the ARTEMIS Review Team observed that the delays in the finalisation and approval of the updated National Policy and Programme for radioactive waste and spent fuel management has led to uncertainty and consequent lack of action on the part of implementing organisations. This may potentially result in significant delays in the realisation of the programme objectives. In order to avoid similar delays in future updates of the National Policy and Programme the ARTEMIS Review Team was of the view that the National Nuclear Fund should establish documented processes for the review and update of the National Policy and Programme.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** *The National Programme for Management of Spent Nuclear Fuel and Radioactive Waste in the Slovak Republic is required to be updated every six years but finalisation of the latest draft of the National Programme has been delayed with the last formal approval having been granted in 2015.*

(1)	<p><b>BASIS: GSR Part 1 (Rev. 1) Requirement 1 states that</b> <i>“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.”</i></p>
(2)	<p><b>BASIS: SSR-5 Requirement 1 states that</b> <i>“The government is required to establish and maintain an appropriate governmental, legal and regulatory framework for safety within which responsibilities shall be clearly allocated for disposal facilities for radioactive waste to be sited, designed, constructed, operated and closed. This shall include: confirmation at a national level of the need for disposal facilities of different types; specification of the steps in development and licensing of facilities of different types; and clear allocation of responsibilities, securing of financial and other resources, and provision of independent regulatory functions relating to a planned disposal facility.”</i></p>
(3)	<p><b>BASIS: GSR Part 5 Requirement 2 states that</b> <i>“To ensure the effective management and control of radioactive waste, the government shall ensure that a national policy and a strategy for radioactive waste management are established. The policy and strategy shall be appropriate for the nature and the amount of the radioactive waste in the State, shall indicate the regulatory control required, and shall consider relevant societal factors. The policy and strategy shall be compatible with the fundamental safety principles [2] and with international instruments, conventions and codes that have been ratified by the State. The national policy and strategy shall form the basis for decision making with respect to the management of radioactive waste.”</i></p>
(4)	<p><b>BASIS: GSR Part 6 Requirement 4 states that</b> <i>“The government shall establish and maintain a governmental, legal and regulatory framework within which all aspects of decommissioning, including management of the resulting radioactive waste, can be planned and carried out safely. This framework shall include a clear allocation of responsibilities, provision of independent regulatory functions, and requirements in respect of financial assurance for decommissioning”.</i></p>
R2	<p><b>Recommendation:</b> <b>The National Nuclear Fund should establish documented procedures for the timely and regular updating of the National Programme for spent fuel and radioactive waste management.</b></p>

The ARTEMIS Review Team noted that within the National Policy, the Slovak Republic has committed to the principles of transparency and proactive engagement of interested parties (stakeholders), including the public, in matters relating to radioactive waste and spent nuclear management. The ARTEMIS Review Team observed very limited evidence of engagement with interested parties (stakeholders), including the public, particularly regarding decision making in the siting of the geological disposal facility (GDF).

<b>RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES</b>	
<b>Observation:</b> <i>Transparency is listed as a key principle in the draft National Programme but the ARTEMIS Review Team saw little evidence of proactive engagement with interested parties, including the general public, on radioactive waste management, especially around the siting of disposal facilities.</i>	
<b>(1)</b>	<p><b>BASIS: SSR 5 Requirement 1 states that</b> <i>“The government is required to establish and maintain an appropriate governmental, legal and regulatory framework for safety within which responsibilities shall be clearly allocated for disposal facilities for radioactive waste to be sited, designed, constructed, operated and closed [...]</i></p> <p><i>Paragraph 3.7. Matters that have to be considered include:</i></p> <p><i>d) Defining the overall process for the development, operation and closure of disposal facilities, including the legal and regulatory requirements (e.g.licence conditions) at each step, and the processes for decision making and the involvement of interested parties; [...]</i></p>
<b>R3</b>	<p><b>Recommendation:</b> <b>The Government should establish a programme of proactive involvement of interested parties, including the public, regarding radioactive waste and spent fuel management, particularly in the siting of a geological disposal facility and its planned evolution.</b></p>



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

### **Slovak position**

The current regulatory framework within the Slovak Republic comprises multiple regulators each with mandates defined in the law.

Regulation of nuclear safety, management of radioactive waste and spent nuclear fuel is performed by the Nuclear Regulatory Authority (ÚJD SR). The regulatory functions of ÚJD SR, are prescribed in the law on the peaceful use of nuclear energy, Act No. 541/2004 Coll. (Atomic Act) as amended. ÚJD SR also carries out supervision over nuclear installations under the Act No. 50/1976 Coll. on Spatial Planning and Construction (Building Act) as a special building authority with the competence to issue decisions for permitting siting of nuclear installations which was replaced by Acts 200/2022 Coll. and 201/2022 Coll. which will come fully in force since 1. April 2024.

Regulation of radiation protection in nuclear installations and radiation facilities, management of radioactive waste and spent nuclear fuel from radiation protection perspective and security of sources of ionizing radiation is performed by the Public Health Authority of the Slovak Republic (ÚVZ SR) in accordance with the provisions of Act No. 87/2018 Coll. on Radiation Protection.

Regulation of radiation protection during the shipments of radioactive and nuclear materials is performed by Ministry of Transport (MD SR), in accordance with the provisions of Act No. 87/2018 Coll.

Inspections related to occupational health and safety at nuclear installation are performed by the Labour Inspectorate pursuant to Act No.125/2006 Coll.

Verifying compliance with safety requirements of classified technical equipment and technical equipment is performed by authorized legal entities in accordance with the Act No. 124/2006 Coll. on occupational health and safety.

Environmental impact assessment (hereinafter referred to as “EIA”) of nuclear installations is regulated by the Ministry of Environment of SR (hereinafter referred to as “MŽP SR”) and it is conducted in compliance with the Act No. 24/2006 Coll. on Environmental Impact Assessment.

Legal obligations regarding establishment, management of financial resources (contributions, payments and extractions of funds) for decommissioning, radioactive waste management and spent fuel management are detailed in Act No. 308/2018 Coll. on the National Nuclear Fund.

### **ARTEMIS observation**

The legal, regulatory, and organisational framework for nuclear and radiation safety was evaluated during the IRRS mission to the Slovak Republic in 2022. The ARTEMIS Review Team only reviewed the regulatory framework with specific focus on radioactive waste management, spent fuel management, decommissioning and environmental remediation.

Consistent with the findings from the IRRS mission to the Slovak Republic in 2022, the ARTEMIS Review Team recognised that the Government has established and implemented a national framework for regulation of nuclear and radiation safety that is aligned with the requirements and guidance in the IAEA safety Standards.

This framework comprises multiple regulatory bodies (ÚJD SR, ÚVZ SR, MD SR, MŽP SR, National Labour Inspectorate, Main mining office) with detailing of individual regulatory responsibilities in the relevant Acts. From discussions during the mission the ARTEMIS Review Team observed challenges regarding clarity on how these regulators work together in the field of spent fuel management, radioactive waste management, decommissioning and environmental remediation. There is no clear evidence of processes to guide coordination of their various responsibilities.

The ARTEMIS Review Team was of the view that the Slovak Republic would realise significant benefit from a formalisation of the arrangements of coordination of regulatory functions undertaken by the multiple regulators. These benefits would include:

- (a) realisation of synergies and efficiencies with regard to utilisation of resources;
- (b) avoidance of potential undue duplication and omissions of regulatory functions as well as conflicting requirements and;
- (c) provision of better clarity of what is expected from operators and implementing organisations.

<b>RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES</b>	
<b>Observation:</b> <i>The responsibilities of the various regulators are described in their respective laws and decrees; however, there is a lack of clarity on how these regulators work together in the field of spent fuel management, radioactive waste management, decommissioning and environmental remediation.</i>	
<b>(1)</b>	<b>BASIS: GSR Part 1 (Rev. 1) Requirement 7 states that</b> “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”.
<b>(2)</b>	<b>BASIS: GSR Part 1 (Rev. 1) Requirement 7, para 2.18 states that</b> “Where several authorities have responsibilities for safety within the regulatory framework for safety, the responsibilities and functions of each authority shall be clearly specified in the relevant legislation. The government shall ensure that there is appropriate coordination of and liaison between the various authorities concerned in areas such as:  (1) Safety of workers and the public; (2) Protection of the environment; ...  (5) Management of radioactive waste (including government policy making and the strategy for the implementation of policy);...”
<b>R4</b>	<b>Recommendation:</b> The Government should establish formal arrangements for the effective coordination of regulatory functions in cases where multiple regulatory organizations have responsibilities for spent fuel management, radioactive waste management, decommissioning and environmental remediation.

## **2. NATIONAL STRATEGY FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT**

### **2.1. SCOPE**

#### **Slovak position**

The National Programme of the Slovak Republic presents the strategy for the management of radioactive waste and spent nuclear fuel, including waste generated during the decommissioning of the A1 and V1 nuclear power plants.

The preferred option for decommissioning is immediate dismantling, which is implemented for A1 and V1.

Waste minimization is given high priority and effective procedures for clearance (free release) of materials are implemented.

Processing technologies are available for all waste streams, for example, incineration, melting, compaction, solidification and grouting using cement.

Low level waste (LLW) and very low level waste (VLLW) are disposed of in separate parts of the NRAWR at Mochovce. The NRAWR has sufficient capacity for all envisaged waste that will be generated.

There are storage facilities in operation for radioactive waste, which is not suitable for disposal in the NRAWR. This radioactive waste includes institutional waste and radioactive materials of unknown origin. There are limited amounts of waste (for example core components) that are stored at the nuclear power plants until a GDF is available.

Spent nuclear fuel is cooled at the reactors for about 3-5 years prior to transfer to the Interim Spent Fuel Storage (ISFS). After finalization of the ongoing extension of ISFS, the total capacity will be sufficiently in line with planned operations of NPPs as specified in the National Programme.

A major undertaking for the next several decades is the siting, construction and commissioning of the GDF.

#### **ARTEMIS observation**

The ARTEMIS Review Team was of the view that the Slovak Republic has established a comprehensive strategy for management of radioactive waste and spent nuclear fuel (including waste arising from decommissioning) up to the end point of disposal.

The ARTEMIS Review Team considered that spent fuel storage provisions are aligned with the current nuclear power programme and subsequent geological disposal of spent fuel.

The ARTEMIS Review Team noted that waste minimization has been very effective, in particular for liquid waste. The use of proven technologies for waste treatment is a sound approach. There is sufficient capacity for treatment of all waste streams, which contributes to the implementation of the effective waste management in Slovakia.

The erection of a separate part of NRAWR for VLLW is a safe and cost-effective solution, which also saves space in the part for LLW. This is an effective application of the graded approach.

## **2.2. MILESTONES AND TIMEFRAMES**

### **Slovak position**

The National Programme for Management of Spent Nuclear Fuel and Radioactive Waste presents milestones and timeframes at a rather high level. Some of the major milestones are:

- Completion of A1 decommissioning in 2039;
- Completion of V1 decommissioning in 2027;
- Implementation of the DGR;
  - Site selection in 2030;
  - Permit for construction in 2045;
  - Commissioning in 2065;
  - Closure in 2115.

There are detailed project plans for the decommissioning of A1 and V1 and implementation has progressed without any significant delays.

In 2020 JAVYS, a.s., prepared a plan, regarding disposal in a DGR, describing planned activities for the next five years. This plan has not yet been approved; however the high level milestones have been incorporated in the update of the National Programme.

### **ARTEMIS observation**

The ARTEMIS Review Team recognized a good progress in the implementation of the decommissioning projects. Effective implementation of the programme is supported by the structured reporting framework and detailed implementation plans.

The ARTEMIS Review Team considered that the milestones for geological disposal implementation appear challenging, particularly in the initial stages, given the current state of preparation. It is therefore recommended that the JAVYS, a.s. implementation plan is updated. This should be supplemented by an associated reporting framework on achievement of goals, tasks and timelines. Further substantiation of how the implementation plan would aid future monitoring of progress is included in chapter 2.3.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** *The JAVYS, a.s. implementation plan was developed in 2020 but has not been approved. This requires to be updated.*

(1)	<p><b>BASIS: GSR Part 2 Requirement 4 states that</b> <i>“Senior management shall establish goals, strategies, plans and objectives for the organization that are consistent with the organization’s safety policy.”</i></p> <p><i>4.3. Goals, strategies, plans and objectives for the organization shall be developed in such a manner that safety is not compromised by other priorities. 4.4. Senior management shall ensure that measurable safety goals that are in line with these strategies, plans and objectives are established at various levels in the organization. 4.5. Senior management shall ensure that goals, strategies and plans are periodically reviewed against the safety objectives, and that actions are taken where necessary to address any deviations.”</i></p>
(2)	<p><b>BASIS: GSR Part 2 Requirement 4 para 4.4 states that</b> <i>“Senior management shall ensure that measurable safety goals that are in line with these strategies, plans and objectives are established at various levels in the organization.”</i></p>
<b>R5</b>	<p><b>Recommendation:</b> JAVYS, a.s., as implementing organization for geological disposal, should update the existing implementation plan with interim targets and timelines in support of the National Programme milestones.</p>

## **2.3. PROGRESS INDICATORS**

### **Slovak position**

The National Nuclear Fund prepares annual reports on progress made with implementation of the National Programme for spent nuclear fuel and radioactive waste management. The programme progress is reported against key performance areas, which are representative of significant milestones and their timeframes for achievement. The annual progress reports are submitted to the Ministry of Economy.

The draft of the update of the National Programme (September 2022) introduced new Key Indicators for Monitoring Progress (KIP) in addition to the defined key performance areas.

In addition to the National Programme there are four separate Key Performance Indicators for the decommissioning of V1 that are defined according to Council Regulation (Euratom) 2021/100, which establishes EU's financial contribution to the decommissioning of V1 nuclear power plant.

### **ARTEMIS observation**

Based on the ARM and discussions during the review mission the ARTEMIS Review Team noted that National Programme presents high level and long term milestones for delivery and realisation of the programme objectives. Furthermore the key performance areas (KPA) are reflective of high level actions and are primarily associated with the dates of major milestones for long-running decommissioning and radioactive waste management projects, some of which have only been partially achieved.

Since the report is high level there is no detail of corrective actions implemented. For ongoing decommissioning projects corrective actions are described at the implementing level.

The ARTEMIS Review Team did not see a similar process for monitoring progress related to geological disposal, in terms of monitoring the percentage achievement of predefined project specific deliverables, overall performance against estimated costs, or in terms of updates to the programme to reflect evolving circumstances. JAVYS, a.s. as the implementing organization should establish an implementation plan with interim targets and timelines in support of the defined National Programme milestones. This implementation plan should be used for monitoring and reporting on progress made.

### **3. INVENTORY OF SPENT FUEL AND RADIOACTIVE WASTE**

#### **Slovak position**

In the Slovak Republic (Act No. 541/2004 Coll.) radioactive waste is defined as being any unusable materials in gaseous, liquid or solid form, which, due to the content of radionuclides in them or due to the level of their contamination with radionuclides, do not meet requirements for clearance (release into the environment). This includes NORM waste.

The division of radioactive waste into classes is defined in Section 5 of ÚJD SR Decree No. 30/2012 Coll. According to this Decree, RAW is divided into the following classes:

- 1) transient radioactive wastes;
- 2) very low-activity radioactive waste;
- 3) low-activity radioactive waste;
- 4) medium-activity radioactive waste and;
- 5) highly-active radioactive waste.

Clearance levels enabling release into the environment for individual radionuclides are given in Annex 5 to the Act No. 87/2018 Coll. on radiation protection.

The operators of nuclear facilities (SE and JAVYS, a.s.) are responsible for collecting data and maintaining the inventory of spent nuclear fuel and radioactive waste in their facilities. The operators of nuclear facilities maintain the traceability of all the SNF and RAW streams according to legislation (ÚJD SR Decree No. 30/2012 Coll.) and their integral management systems. This information is regularly reported to the regulatory body.

Before transfer of radioactive waste to JAVYS, a.s. for storage, treatment, conditioning and disposal, waste producers have to prepare RAW composition records. These records include information on physical composition, activity and isotopic concentration, type of materials, surface dose rate, unique identification, date of transfer, transport details including name of receiving information. Information about the non-radiological content of the waste package, such as confirmation that the waste package is free from prohibited materials, is also included.

For radioactive sources the Public Health Authority of the Slovak Republic maintains national central registers, detailing information on all radioactive sources in Slovakia including all imports and exports. The regular reports of institutional radioactive waste production, submitted by the operators to the radiation protection regulatory authorities, are used for inspections of facility operations. Radioactive material of unknown origin and radioactive sources that cannot be returned to manufacturer are transferred to JAVYS, a.s. for storage and available details are captured in JAVYS, a.s. database.

#### **ARTEMIS observation**

The ARTEMIS Review Team noted that the definition and classification of radioactive waste is in line with the IAEA Safety Standards.

The regular reports of waste quantities, submitted by the operators to the regulatory authority, are used by the regulatory authority during their inspections of facility operations. In addition, periodically information is requested from all operators to aid reporting of radioactive waste and spent nuclear fuel inventories within the framework of national and international obligations.

The ARTEMIS Review Team noted that the National Programme mandates JAVYS, a.s. to maintain the national inventory of radioactive waste and spent nuclear fuel. During discussions, the ARTEMIS Review Team was informed that JAVYS, a.s. was not able to deliver on this mandate due to the fact that it has no authority to obtain the necessary information from the waste producers.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
<b>Observation:</b> <i>Currently there is no comprehensive national database for all radioactive waste and spent nuclear fuel in Slovakia.</i>	
(1)	<b>BASIS: GSR Part 5 Requirement 2, para. 3.5 states that</b> <i>“The national policy on radioactive waste management has to set out the preferred options for radioactive waste management. It has to reflect national priorities and available resources and has to be based on knowledge of the waste to be managed (e.g. knowledge of the inventory and of waste streams) now and in the future.”</i>
(2)	<b>BASIS: SSG -45, para. 3.18 states that</b> <i>“In order to facilitate the establishment of a national policy and strategy, the government should establish a national inventory of radioactive waste (both current waste and anticipated waste, including waste generated during the decommissioning and dismantling of facilities) and should update it at regular intervals. This inventory should take into account the guidance provided in GSG-1.”</i>
<b>R6</b>	<b>Recommendation:</b> <b>The Government should make arrangements for the establishment and maintenance of a comprehensive national inventory for radioactive waste and spent nuclear fuel.</b>

During the site visit, the ARTEMIS Review Team observed the systems implemented by JAVYS, a.s. for the monitoring, recording and tracking of waste in their facilities and noted that they are of a high quality.

The ARTEMIS Review Team was informed that the Public Health Authority of the Slovak Republic has initiated the project of transforming the existing partially paper based records for tracking radioactive sources to an electronic system.



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

### **Slovak position**

Slovakia operates its nuclear power plants applying an open once through fuel cycle. Spent fuel is stored waiting for the availability of a GDF. According to the most recent programme this facility shall be in operation by the year 2065.

Operational and decommissioning waste, which cannot be cleared (released to the environment) from regulatory control, is conditioned and subsequently disposed of in the NRAWR. VLLW is disposed of in drums or big bags in a dedicated section of the NRAWR. LLW is disposed of in fibre concrete containers. Waste which does not comply with the acceptance criteria of the NRAWR is stored at Jaroslavské Bohunice in a dedicated integral storage facility (ISF) awaiting availability of the GDF.

### Spent fuel Management

Following removal from the reactor, spent fuel is cooled in spent fuel pools on the reactor sites prior to transfer to a central wet storage facility at Jaroslavské Bohunice. The facility has a total capacity of 14112 assemblies of which more than 12000 positions are already loaded. To accommodate future spent fuel arisings from the operating and planned future units an additional dry storage unit is under construction. This additional capacity will accommodate further 18600 fuel assemblies. According to the National Programme, both the wet and dry storage of spent fuel is planned to be in operation until well beyond 2100. The spent fuel assemblies are owned by the power plants operator (except for 5143 spent fuel assemblies from the V1 NPP, which are owned by the state) while the storage facility is owned and operated by JAVYS, a. s.

### Management of operational waste

Management schemes for metallic solids, non metallic solids and liquids have been established. In a first priority, material suitable for clearance from regulatory control is released. All remaining operational waste streams are conditioned for disposal as LLW.

Optimization efforts over the last two decades have resulted in a significant reduction of annual liquid arisings by 75 % as well as a moderate reduction of solid arisings. The averaged total annual amounts over the last five years was 28 m<sup>3</sup> for liquid and 35 t for solid unconditioned waste. These are amongst the lowest values worldwide for comparable plant designs.

Very limited amounts of activated materials are stored in specific areas in the reactor buildings and will be treated with similar waste during decommissioning.

### Decommissioning and management of decommissioning waste

For the management of some waste arising from the dismantling of the A1 reactor, which was shut down in 1977 following two major accidents involving rupture of fuel elements several specific waste products were developed. Some of these wastes are not suitable for the near surface disposal facility and are currently being stored.

For all other decommissioning activities related to A1 as well as all planned decommissioning activities of V1 waste management streams were evaluated and conditioning techniques were specified in the decommissioning plans. Some activated components and other specific

materials from the decommissioning of A1 and V1 as well as from future decommissioning projects after planned shutdown will have to be disposed of in the GDF. Such materials will either be stored in dedicated positions at the reactor sites (activated core components) or in a form suitable for storage in the ISF.

The internals of the two pressurised water reactors of V1 NPP (the WWER-440) design have now been fully dismantled and their components decontaminated for safe storage and recycling. This is the first time when reactors of this type were decommissioned and disassembled directly on site.

A specific task of the project was the removal of twelve 160-tonne steam generators from the power plant turbine hall. This allowed the construction of two large, 1250 m<sup>3</sup>, pools to enable the safe underwater disassembly and sectioning of the two reactor pressure vessels. Dismantling the internals of the two reactors, which commenced in May 2020 and April 2021, took 18 and 11 months respectively.

This knowledge is transferrable to other WWER decommissioning projects.

A large volume of decommissioning waste with very low activity is disposed of as VLLW. Remaining waste is disposed of as LLW. The disposal capacity of the NRAWR has been designed to meet the anticipated waste volumes from operation and decommissioning of all existing NIs (including NPP currently under construction).

#### Management of institutional waste

Institutional waste from licensed activities which cannot be released from regulatory control within 12 months must be delivered to JAVYS, a. s. and is managed in a dedicated facility at Jaslovské Bohunice. In some cases the regulator allows for longer decay times to facilitate clearance. Similarly orphan sources and other material of unknown origin are secured and delivered to JAVYS, a. s. for safe management.

In the case where there is no confirmed contract for the return of high active radioactive sources to supplier, the owners of these radioactive sources are required to make a contribution to the National Nuclear Fund. This contribution is determined as being equal to the anticipated waste management costs for the respective source. The deposit will only be returned after the source has been returned back to respective manufacturer or distributor. For other radioactive sources the owners make payments directly to JAVYS, a.s. for the safe and secure management of the sources.

#### Development of geological disposal facility

The GDF project is still in an early phase. The current stage of the project, planned timeline and associated financial provisions are described in the National Programme.

Some preparatory activities for siting of geological disposal have been undertaken by JAVYS, a.s. and its contractors in the last 10 years. During the first stage (years 2013 – 2016) the earlier feasibility study on geological disposal in the Slovak Republic was updated. In 2017 – 2018 proposals were developed for geological tasks and the research and development programme for investigation of host environment. Proposals for economic stimulation of potential host communities was also developed.

#### Research and development activities

With the exception of the R&D work related capping of the near surface disposal facility no additional R&D activities related to near surface disposal are planned. Nevertheless, there is ongoing monitoring of international developments. If technical developments which could have beneficial effect for existing practices are identified they are evaluated and after approval of their suitability introduced.

R&D activities in support of the GDF development are envisaged. The National Programme includes financial provisions for such research.

## **ARTEMIS observation**

### Spent Fuel Management

The ARTEMIS Review Team noted that there are sufficient provisions in place to ensure the required storage capacity for spent nuclear fuel for the current foreseen nuclear programme. Commissioning of the dry storage extension is planned for 2023.

The ARTEMIS Review Team was informed that periodic maintenance and inspection programmes for safety-classified and other systems, structures and components of the SF are continuously executed. Regular inspections of spent fuel assemblies are tailored to monitor time dependent effects whilst another part of the programme includes visual and integrity checks of randomly selected fuel assemblies. For the dry storage facility under construction a separate programme is planned which will account for the specific differences in storage design. The ARTEMIS Review Team concluded that the ageing management programme implemented by JAVYS, a.s. is suitable to ensure the safe operation of the SF for the anticipated operational period.

### Management of operational waste

The ARTEMIS Review Team recognizes the achieved reduction in operational liquid waste as being commendable.

The ARTEMIS Review Team noted that approved management routes are in place for all operational waste streams ensuring their timely processing into qualified waste packages suitable for near surface disposal. Hence no unconditioned operational waste suitable for disposal at NRAWR is accumulated.

### Decommissioning and management of decommissioning waste

The ARTEMIS Review Team recognized that ongoing decommissioning projects at A1 and V1 reactors apply a strategy of immediate decommissioning. This includes segmentation and subsequent processing of all waste items including the heaviest components such as pressure vessels and steam generators. Where necessary, specific segmentation and treatment techniques have been developed. Other waste streams are treated according to procedures already established for operational waste. Only waste which after treatment does not comply with the acceptance of the NRAWR is stored thus minimizing the burden on future generations.

As the two V1 reactors are representing a greater fleet of comparable VVER-440-V230 reactors JAVYS, a.s, in collaboration with the IAEA, has made available their experience to interested parties in a training course (2022). JAVYS, a.s. informed the ARTEMIS Review Team of their readiness to make their specific technologies available to other decommissioning projects upon request.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** *Project planning and control, development of necessary technologies, execution of dismantling activities and comprehensive management of associated material as it is generated were combined in a highly integrated manner. This allowed for the timely conduct of the V1 decommissioning project within the planned budget. Experience and lessons learned as well as newly developed technologies are openly communicated and made available to comparable projects internationally.*

(1)	<b>BASIS: GSR Part 6 Requirement 7, para. 4.1 states that</b> “An integrated management system shall provide a single framework for the arrangements and processes necessary to address all the goals of the operating organization [9], including goals relevant to decommissioning. These goals shall include safety, health, security, environmental, quality and economic elements.
(2)	<b>BASIS: GSR Part 6 Requirement 6 states that</b> “The licensee shall select a decommissioning strategy that will form the basis for the planning for decommissioning. The strategy shall be consistent with the national policy on the management of radioactive waste.”
(3)	<b>BASIS: GSR Part 6 Requirement 14, para. 6.2 states that</b> “Radioactive waste shall be managed for all waste streams in decommissioning.”
(4)	<b>BASIS: SSG 47, para. 7.29 states that</b> “When preparing the decommissioning plan, experience from ongoing or completed decommissioning projects of similar facilities should be utilized. [...]”
(5)	<b>BASIS: GSR Part 6 Requirement 9, para. 6.2 states that</b> “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.”
<b>GP1</b>	<b>Good Practice: The application of an immediate dismantling strategy combined with the treatment of all materials arising was considered to be outstanding. The integrated approach of JAVYS, a.s. and other participating organizations to the decommissioning project V1 effectively supported optimized execution of all technical activities in a timely and cost effective manner. Furthermore the openness of JAVYS, a.s in sharing their experience can be highly beneficial to a number of comparable present and future decommissioning projects.</b>

### Management of institutional waste

The ARTEMIS Review Team were of the view that appropriate arrangements for the management of institutional waste are in place. In addition the waste management deposit for newly introduced sources is a valuable tool to ensure the safe management of disused high active radioactive sources.

### Development of the geological disposal facility

The ARTEMIS Review Team noted the preliminary work undertaken by JAVYS, a.s. together with previous consultants. The ARTEMIS Review Team recognizes that considerably more work is needed. The detailed tasks related to work to be undertaken should be included in the implementation plan recommended in chapter 1.2. Recognizing the milestone for siting planned to be completed in 2030 the ARTEMIS Review Team was of the view that the activities to support siting need to be expedited and include conceptual facility layout and plans for engineered barrier system etc.

Research and development activities

The ARTEMIS Review Team noted the position of Slovakia that there is no obvious need for any systematic R&D activity for existing waste management activities. From the point of continuous improvement the team encourages Slovakia to continue in following international R&D activities and market developments in the field of waste management activities.

The timely delivery of research and development in support implementation of the geological disposal is crucial to the overall success of the project. Timeframe and financial provisions for such R&D activities are specified in the National Programme. The ARTEMIS Review Team noted that at present there is no clearly defined programme with topical areas, milestones, links to decision steps, etc. for the undertaking of the required research and development.

<b>RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES</b>	
<b>Observation:</b> <i>The National Programme for radioactive waste management and spent fuel management recognises the need for research and development to support the implementation of geological disposal. However, there is no evidence of a clearly elaborated plan and resources for the undertaking of the necessary research activities at present.</i>	
<b>(1)</b>	<b>BASIS:</b> GSR Part 1 (Rev. 1) Requirement 10, para. 2.32 states that “The government shall make provision for appropriate research and development programmes in relation to the disposal of radioactive waste, in particular programmes for verifying safety in the long term”.
<b>R7</b>	<b>Recommendation:</b> The Government should ensure that a programme is established for the research and development activities to be undertaken in support of the implementation of the geological disposal programme. The research programme should establish clear priorities with defined timeframes, responsibilities and the associated resources for its timely execution.

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

### **Slovak position**

The safety of spent nuclear fuel handling and storage facilities, radioactive waste management facilities including disposal facilities is regulated through the Atomic Act, Act on Radiation Protection, decree no. 99/2018 Coll. on radiation protection and decrees of ÚJD SR. These requirements specify the safety objectives for each stage of development of spent fuel and radioactive waste management facilities, as well as the documentation necessary to support authorisation decisions in the different stages including post closure phase. These facilities are also subject to the national environmental laws.

The operator is obliged to regularly evaluate, verify and, where reasonably practicable, continuously increase level of nuclear safety of performed activities and facilities. Periodic safety reviews aim to ensure that current design basis is maintained and to increase safety level, considering aging of nuclear installation and operational experience, implement corrective measures to eliminate identified deficiencies and their occurrences as well.

General requirements on radiation protection for the operation and decommissioning of nuclear installations, handling of spent nuclear fuel, radioactive waste management including disused source management, clearance (free release of radioactive materials to the environment) and discharges, are defined in Act on Radiation Protection No. 87/2018 Coll. The applicant for the above-mentioned authorizations inter alia shall include a description and justification of activities leading to exposure, characterization of radioactive waste and spent nuclear fuel, description of facilities and technologies, radiation protection programme, plan for optimization of radiation protection, monitoring plans, emergency plans, etc.

Regulation of the transportation of radioactive waste and spent nuclear fuel is undertaken by the MD SR, ÚJD SR and ÚVZ SR.

### **ARTEMIS observation**

The ARTEMIS Review Team noted that for authorisation by regulatory body, JAVYS, a. s. provided a safety assessment for each authorised facility and activity. The information presented in the ARM and during the ARTEMIS mission illustrates that the safety demonstration covers all facility life-cycle stages of development, construction, operation and decommissioning, and in specific case of disposal facilities, the post-closure phase. The safety reports specify operational limits and conditions.

The ARTEMIS Review Team acknowledged that safety assessments are also produced in support of modifications to spent fuel storage, radioactive waste management, and disposal facilities. A notable example was the work done for the establishment of VLLW disposal at the NRAWR.

To confirm assumptions in the safety assessment of the NRAWR a model of the final capping was constructed and number of parameters important to integrity of safety barriers are being measured.

The ARTEMIS Review Team noted that JAVYS, a. s. is appointed to develop a geological disposal facility for HLW and spent nuclear fuel. It was noted that investigations on geological structures suitable for such a disposal facility have been carried out by the Geological Service of SR in the past and now is to be continued by JAVYS, a.s..

The ARTEMIS Review Team was informed that from the five candidate sites, chosen based on the preliminary geological assessment, two have been selected which will be a subject to further investigations regarding the host environment. The remaining three sites are nevertheless still kept as potential future candidate sites. The ARTEMIS Review Team was not provided with clear evidence that an understanding of the features of the GDF and its host environment that influence safety nor a comprehensive set of site selection criteria is available to support these early stages of site selection and its justification.

<b>RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES</b>	
<b>Observation:</b> <i>There is no evidence of information on safety to support the early stages for siting process for geological disposal.</i>	
<b>(1)</b>	<b>BASIS: SSR - 5 Requirement 6 states that</b> <i>“The operator of a disposal facility shall develop an adequate understanding of the features of the facility and its host environment and of the factors that influence its safety after closure over suitably long time periods, so that a sufficient level of confidence in safety can be achieved.”</i>
<b>R8</b>	<b>Recommendation:</b> <b>JAVYS, a.s. should initiate development of an understanding of the features of the geological disposal facility and its host environment that influence safety, to support the siting decision making process.</b>

The ARTEMIS Review Team was in the view that to facilitate a robust site selection and decision-making process engagement of interested parties (stakeholders), including the public, should be enhanced. Those aspects should be considered when preparing the action plan for siting of a geological disposal facility. Recommendation relating to engagement with interested parties (stakeholders) is included in chapter 1 (see Recommendation 2).

ÚJD SR affirmed to the ARTEMIS Review Team that the general requirements on siting of nuclear installations are equally applicable to the siting of geological facilities. Nevertheless, the ARTEMIS Review Team recommended that the involved regulatory bodies need to provide detailed guidance on how to carry out necessary activities for site selection, design, construction, and consideration of safety features in the process of development of GDF. Further, the regulatory bodies are encouraged to review their existing requirements for applicability, recognizing the very long-time scales involved.

## RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES

**Observation:** *There is a need for additional guidance on siting of the geological disposal facility and the development of the geological disposal programme.*

(1)	<b>BASIS: GSR Part 1 Requirement 2 states that</b> <i>“The regulatory body shall establish regulatory requirements for the development of different types of disposal facility for radioactive waste and shall set out the procedures for meeting the requirements for the various stages of the licensing process. It shall also set conditions for the development, operation and closure of each individual disposal facility and shall carry out such activities as are necessary to ensure that the conditions are met.”</i>
R9	<b>Recommendation:</b> The regulatory bodies should develop comprehensive guidance for demonstrating compliance with the requirements on siting of the geological disposal facility and subsequent steps in implementation of the geological disposal programme.
S1	<b>Suggestion:</b> The regulatory bodies should consider undertaking a detailed review of existing requirements and confirm their applicability to the geological disposal programme.



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

### **Slovak position**

The build up of financial resources for the management of radioactive waste and spent nuclear fuel is based on a national fund model. A first fund for this purpose was established in 1995. The current legal and organizational background was established by the Nuclear Fund Act 308/2018 Coll.

The fund contributions are based on cost estimations for:

- 1) decommissioning and disposal of RAW and SF from the nuclear installations; the primary technical basis for these estimates are the conceptual decommissioning plans of the nuclear installations;
- 2) the management of legacies from the A1 reactor;
- 3) the management of institutional radioactive waste and radioactive materials and nuclear materials of unknown origin;
- 4) provisions for the GDF project; which are based on the available information and experience gained from the process of preparation and development of repositories for RAW in other countries with comparable projects. With respect to GDF project, costs for both crystalline and sedimentary host rock have been estimated. The National Nuclear Fund has adopted the higher estimates related to crystalline rock.

The cost contributions are prescribed in the National Nuclear Fund Act 308/2018 Coll and in the respective Government ordinance no. 478/2022 Coll.

Standardized procedures for extracting financial resources from the fund were established and are used to finance ongoing decommissioning projects at the A1 and V1 facilities. For the planning and controlling of decommissioning activities the internationally accepted ISDC methodology is systematically applied.

Decommissioning of V1 facility is co-financed by contributions from the EU.

### **ARTEMIS observation**

The ARTEMIS Review Team noted that for calculating the annual fund contributions consideration of the periodically updated conceptual decommissioning plans is adequate. Operating experience from ongoing storage of SF and RAW not suited for near surface disposal, as well as from disposal of LLW and VLLW in the NRAWR provides a sound basis for planning the future development of these cost elements and collection of corresponding provisions. The generic approach for GDF cost calculations seems to be appropriate considering the very early stage of the project and as it follows a conservative approach.

The ARTEMIS Review Team noted that the consequent application of the ISDC methodology in combination with the mechanisms of extraction established in the Nuclear Fund Act have enabled JAVYS, a. s. to deliver high quality, timely and cost effective decommissioning services according to the timeline of the projects. Effective controlling and reporting of the adequate expenses is continuously executed. The regular active experience feedback from JAVYS, a. s. to OECD/NEA includes proposals for identified improvements of the ISDC methodology (e.g. cost structure). JAVYS, a. s. considers the methodology very beneficial and spontaneously stated that they will continue to rely on this tool for planning and executing their future decommissioning projects.

The ARTEMIS Review Team concludes that a comprehensive and effective system is applied for collection as well as for extraction of financial provisions for decommissioning, radioactive waste and spent fuel management and disposal activities. The performance of financing confirms the suitability of this system at least for those projects which are already in the realization stage. The ARTEMIS Review Team encouraged JAVYS, a. s. to continue in being an active partner in their various international experience feedback collaborations on technical and financial aspects in the field.

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

### **Slovak position**

JAVYS, a. s. currently has 775 employees, more than 300 of these have a university education. About half of the employees are involved in radioactive waste management. The majority are over 30 years in age and the average age is around 40 years. Almost all employees are nationals of Slovakia.

The professional competence requirements for the employees' activities of JAVYS, a. s. are defined in the regulatory framework. Training is provided to all employees on recruitment, periodically during their career as a refresher, and when an employee changes position within the company. Professional training is completed by verification of professional competence in front of the Committee of experts, followed by obtaining a "Mandate for the performance of work activities". Completion of professional training is one of the conditions for working at a nuclear facility. For transferable competence such as leadership, line management and project management is also provided by specialist contractors or through the use of online courses.

There is a dedicated unit within the JAVYS, a. s. which records the details of all employees, including their education and training records. This department also carries out strategic workforce planning, to anticipate the changes in numbers of personnel and their competencies that will be required for each project to be delivered over the coming years and to ensure that appropriate recruitment and training arrangements are in place. There is a preference to fill vacancies internally and only if this is not possible to look to external sources. JAVYS, a. s. illustrated their approach to resource planning with the example of reactor decommissioning over the last 20 years.

JAVYS, a.s. has also developed resource plans for the geological disposal project. However, due to the current hiatus in the project implementation thereof is currently suspended.

JAVYS, a. s. makes significant use of contractors to deliver its work programme. Contractors are required to undergo safety training and must complete e-learning to obtain, or maintain general competence, for entry, safe movement and performance of work in the premises of JAVYS, a.s. Supplier organizations are also required to ensure specific training of their own employees in accordance with the requirements of the implemented contract.

The nuclear regulator, ÚJD SR has 22 employees in radioactive waste and spent fuel management. These employees have an age profile around 42 years. The various regulatory bodies in Slovakia are part of the Civil Service and so are subject to recruitment and training requirements for civil servants set out in law. ÚJD SR has implemented a systematic approach to training (SAT), periodically prepares competence analysis of employees, and based on SARCON, identifies nuclear-specific training needs. This training is formal and mandatory on recruitment and during the career. The human resources are planned and negotiated based on the State budget on a yearly basis, plus a forecast for the following 3 years in advance. The regulator does not maintain all the specialist competencies needed. Technical support organizations are contracted to address the competencies gaps at the regulator.

In ÚVZ SR, the radiation protection department currently forms part of the Section of Protection and Promotion of Health but a change in the organizational structure will be made on 1st March to establish Radiation protection as a separate Section within the organization. There are ambitious plans to increase the numbers of staff in this activity. A resource plan to increase the capacity by around 50% by the year 2025 has recently been approved within

Government and the necessary funding has been approved. There are mandatory requirements for competence and training within the organization which are defined in law.

The organization, VUJE provides professional theoretical and practical training for nuclear and non-nuclear energy industry specialists through its team of 25 lecturers and instructors and 10 software engineers. The organization was originally established as a government research centre but is now a commercial organization.

Two universities provide courses with a strong element in nuclear technologies; the Comenius University focuses on competencies in natural sciences and mathematics and the Slovak University of Technology specialises in engineering and technology. Both institutions report that there is a challenge in attracting students to their courses and the number of graduates has declined markedly in recent years. This has been attributed to the public attitude to nuclear and the financial rewards for graduates in the nuclear sector compared with other industries and services such as finance. Efforts are being made by the various organizations to increase awareness of their work, through initiatives such as outreach to schools and visits to the sites.

In JAVYS, a. s., project completion reports, including lessons learned, are routinely uploaded to the organization's knowledge, management hub and are then available as a resource for similar projects in the future in JAVYS, a. s. or elsewhere in Europe. Learning from experience is also captured through an employee suggestion scheme.

ÚJD SR has introduced and implemented comprehensive knowledge management system and risks which are recorded where the numbers of employees with the appropriate competencies is low or a gap is anticipated through, for example, retirement, so that appropriate mitigating arrangements can be put in place.

### **ARTEMIS observation**

The ARTEMIS Review Team considered that there are good arrangements for the training of employees for current activities across all the organisations with responsibilities in decommissioning and radioactive waste management. The processes appear to be comprehensive, clearly defined and well implemented. The ARTEMIS Review Team was encouraged to see that the approach of first seeking to fill any vacancies by internal recruitment as the induction process is then shorter.

The ARTEMIS Review Team noted that most of the vacancies are filled without difficulty and acknowledged the challenge in recruiting specialist technical staff, which is common throughout the world.

The potential risk to the provision of safety-related training was discussed by the review team as the training is provided by an external commercial organization. Such arrangements are considered less robust as the supplier is subject to market forces. However, it was explained by the Counterparts that this is not an issue as the costs for the training are incorporated into the cost for activities executed by JAVYS, a. s. Further, the ARTEMIS Review Team was aware of other suppliers of these services in Europe, who could provide an alternative route, in the unlikely event of this training not being available via VUJE.

The use of contractors to fulfil specific specialist skills requirements or to help with peaks in activity was considered by the review team to be an effective route to providing the necessary resources. However, the ARTEMIS Review Team cautioned that there was a need within the procurement organization to maintain sufficient capability to specify work effectively, and to be able to interpret the results of the work for its safety significance.

The ARTEMIS Review Team noted that some strategic resource planning is carried out by the various organizations. However, the ARTEMIS Review Team identified a shortcoming in the current arrangements at JAVYS, a. s. for personnel with skills and experience in geological disposal. Given the responsibilities assigned to JAVYS, a. s. in the most recent draft of the National Programme, as the implementer of geological disposal, it is recommended that a strategic resource plan for this area is updated. Capacity building for this project is considered to be particularly important as there will be a need for significantly different competencies at various stages of implementation of geological disposal and some competencies are known to be in short supply across the world. For example, characterisation of the geological environment and underground construction will be unique to this project. Competencies in post closure safety will also be needed.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
<b>Observation:</b> <i>JAVYS has been allocated responsibility for the implementation of geological disposal but does not currently have the necessary skilled staff to deliver this mandate.</i>	
(1)	<b>BASIS: GSR Part 2 Requirement 9: states that</b> “Senior management shall determine the competences and resources necessary to carry out the activities of the organization safely and shall provide them.”
R10	<b>Recommendation:</b> JAVYS should develop and maintain the competence and resources necessary for the implementation of the geological disposal programme.

The ARTEMIS Review Team also noted that there are competence gaps across all the regulatory bodies in the area of regulation of geological disposal. It is recommended that this gap be addressed urgently, as important decisions on facility siting will be required in the near term (6 years) and significant preparatory work is needed.

RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES	
<b>Observation:</b> <i>The regulatory bodies currently do not have all the necessary skills and competencies for regulation of the planned geological disposal programme.</i>	
(1)	<b>BASIS: GSR Part 1 (Rev. 1) Requirement 16 states that</b> “The regulatory body shall structure its organization and manage its resources so as to discharge its responsibilities and perform its functions effectively; this shall be accomplished in a manner commensurate with the radiation risks associated with facilities and activities.”
R11	<b>Recommendation:</b> The regulatory bodies should develop and implement a plan to establish and maintain the competence and resources necessary for the regulation of the geological disposal programme.

The planning horizon within the regulatory bodies was shorter, as the budget planning horizon within the Civil Service is only a few years, due to the process of budget allocation. Nevertheless, the ARTEMIS Review Team commends ÚVZ SR for its ambitious plan to increase its workforce in the period up to 2025, noting that a shortfall in personnel in the organisation was a finding from the recent IRRS mission. However, the ARTEMIS Review Team cautioned that the onboarding and training of a significant number of new recruits necessarily placed an increased burden in the short term on current employees.

The ARTEMIS Review Team observed that the draft National Programme only addresses human resource planning up to 2029 and there is an absence of longer-term planning. The ARTEMIS Review Team considered that the planning horizon in the National Programme was too short to enable robust arrangements to ensure that the necessary competent personnel would be available and recommended that a longer-term planning horizon should be used.

<b>RECOMMENDATIONS, SUGGESTIONS AND GOOD PRACTICES</b>	
<b>Observation:</b> <i>Resource planning in the National Programme is limited to the period up to 2029, and does not consider the full time scale of the National Programme.</i>	
<b>(1)</b>	<b>BASIS: GSR Part 1 (Rev. 1) Requirement 11 states that</b> <i>“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.”</i>
<b>S2</b>	<b>Suggestion:</b> <b>The Government should consider compiling information about the competence and availability of resources necessary for all aspects of the implementation of the National Programme through to the closure of all facilities and to provide a better planning basis for resource needs.</b>

## **APPENDIX A: TERMS OF REFERENCE**

# **ARTEMIS Review of Slovakia's National Programme on Radioactive Waste and Spent Fuel Management**

## **Terms of Reference**

**V2.0 19 July 2022**

### **1. Introduction**

On 19 November 2019, the Nuclear Regulatory Authority of the Slovak Republic requested the IAEA to organize and carry out, in 2021, the Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) peer review mission in Slovakia, 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.

On 20 September 2021, in the national Statement on the occasion of the 65th Session of the IAEA General Conference, the Slovak Republic further requested the IAEA to organize the IRRS and the ARTEMIS missions in a back-to-back format. In line with the request, the ARTEMIS review will be carried out in February 2023 in a coordinated manner with the IRRS mission, scheduled in September 2022.

These revised Terms of Reference complete and update the previous version signed in October 2020 including the Annex 1.

### **2. Objective**

The ARTEMIS review will provide an independent international peer assessment of Slovakia'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 consider the Slovakian national programme and the national framework for executing the country's obligations for safe and sustainable radioactive waste and spent fuel management.

Special emphasis should be given to the following topics:

- Management of radioactive waste from decommissioning of nuclear installations

- Siting of a Deep Geological Repository

The outcomes from the 2022 IRRS mission to Slovakia will be taken into account, as appropriate, to avoid unnecessary duplication. This is in line with the Supplementary Guidelines on the Preparation and Conduct of IRRS-ARTEMIS back-to-back Missions, applicable for situations when an IRRS mission is conducted before an ARTEMIS mission. These Supplementary Guidelines do not substitute the ARTEMIS Guidelines but supplement them with the specific provisions that need to be taken into account when conducting IRRS-ARTEMIS back-to-back missions.

#### **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 the lead National Counterpart, the National Nuclear Fund 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.

For IRRS-ARTEMIS back-to-back missions, the National Counterpart will include the sections of the IRRS Reference material relevant to the ARTEMIS review in the reference material (e.g. parts of the IRRS self-assessment report dealing with radioactive waste and spent fuel management) as soon as they are available as well as the IRRS final draft mission report.

For IRRS-ARTEMIS back-to-back missions, identified areas of possible overlap will be addressed only by one mission, either IRRS or ARTEMIS, depending on the scope and nature of the reviews. The National Counterpart will be able to bypass certain questions in each self-assessment to avoid addressing the same issues twice. Namely, questions dealing with the General Safety Requirements (GSR) Part 1 Requirement 10 in Module 1 of eSARIS Self-assessment will be covered in the ARTEMIS mission and certain questions of topics 1, 3, 5 and 7 of ARTEMIS self-assessment questionnaire dealing with legal and regulatory framework will be covered by IRRS mission.

The provisional list of reference material is provided in the Annex 1; the list is subject to updates.

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 National Nuclear Fund. The National Counterpart Liaison Officer for the review is Mr Miroslav Kövér. The National Counterpart Team consists of



representatives of organisations involved into the Slovakia's National Programme on Radioactive Waste and Spent Fuel Management: National Nuclear Fund; Nuclear Regulatory Authority; Public Health Authority; Ministry of Environment; Ministry of Economy; Ministry of Transport and Construction; Nuclear and Decommissioning Company; Slovenské elektrárne.

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

- Self-assessment: questionnaire was made available to Slovakia as of March 2020.
- Preparatory Meeting: 20 August 2020 and discussion on ARTEMIS organised back-to-back to the IRRS mission: 2 June 2022.
- 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 1 December 2022.
- Questions based on the preliminary analysis of the reference material and the self-assessment results will be provided by the review team by 29 January 2023.
- Peer review mission: 12-22 February 2023 (10 days)<sup>2</sup>
  - 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
  - Saturday-Sunday morning: drafting and delivering of the draft recommendations to the Counterparts (Review Team);
  - Monday: Delivery of draft report to the Counterparts for fact checking and Site visits;
  - Tuesday: discussions between the Review Team and the Counterparts and finalization of draft report;
  - Wednesday: delivery of the draft mission report and 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. Among the experts, the IAEA will identify one expert with enough knowledge and

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<sup>2</sup> The delivery of the Peer Review Mission will be reviewed by IAEA and NNF 12 weeks before the scheduled dates to consider the impact of the COVID-19 international situation, specifically travel restrictions.

experience in the regulatory field as well as in the radioactive waste and spent nuclear fuel management, decommissioning and remediation field to participate in both the IRRS and ARTEMIS missions. This Expert will cover IRRS Modules 5 to 9 on aspects for waste and spent fuel management facilities and will ensure that the ARTEMIS mission is informed on the IRRS review findings and mission.

- Two IAEA staff, to coordinate the mission. The Coordinator of the ARTEMIS review is Ms Joanne Brown from the Waste and Environmental Safety Section of the 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 peer 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 Thiagan Pather from the National Nuclear Regulator, South Africa. 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.

## **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 of the IAEA.

Prior to its finalization, the ARTEMIS Review Report will be delivered to the National Counterpart for fact-checking, being the National Nuclear Fund.

## **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 cost of the ARTEMIS peer review is currently estimated to the amount of Euro 33,000 to be paid by the National Nuclear Fund to the IAEA as voluntary contribution before the start of the mission. Slovakia is aware that the currently estimated cost of the mission includes 7% programme support costs.

The Slovak Republic agrees with these Terms of Reference by accepting necessary arrangements.

## APPENDIX B: MISSION PROGRAMME

### ARTEMIS MISSION PROGRAMME IN SLOVAKIA, FEBRUARY 2023 (Draft 19/12/2022)

Clarion Congress hotel, Bratislava, Žabotova 2, [ClarionCongressHotelBratislava.com](http://ClarionCongressHotelBratislava.com)

Time	Sun 12 Feb	Mon 13 Feb	Tue 14 Feb	Wed 15 Feb	Thurs 16 Feb	Fri 17 Feb	Sat 18 Feb	Sun 19 Feb	Mon 20 Feb	Tue 21 Feb	Wed 22 Feb
09:00 - 11:00		Opening Meeting (all): 1. Initial words, greeting -Liaison officer SK, 2. Greetings, speech official representative SK, 3. Opening presentation	Concepts, plans and technical solutions	Safety Case and Safety Assessment		Capacity Building				ARTEMIS team meeting	
11:00 - 12:00		National Policy and Framework			Site Visit 07:35 - 17:15 JAVYS Jaslovske	ARTEMIS Team finalize draft Suggest./Recomm.		Report drafting and delivery of draft report to Counterparts		Discussion of draft report with Counterparts	Closure meeting
12:00 - 13:00		Lunch break	Lunch break	Lunch break	Bohunice 6 experts, 2 repr. IAEA, 1-2 observers TSÚ	Lunch break					
13:00 - 18:00		National Policy and Framework (continued)	Waste and Spent Fuel Inventory	Cost and Financing	RAO + decommissioning V1 JAVYS/Beták, Kukan	ARTEMIS Team finalize draft Suggestion and Recommendations	Report drafting		Review of draft report by Counterparts/ free time for experts	Finalizing draft report (ARTEMIS team)	
	16:00 Initial Team Meeting at hotel	National Program and Strategies				16:30 Presentation of draft Suggestions and Recommendations to Counterparts		Review of draft report by Counterparts/ free time for experts			
18:00 - 21:00		ARTEMIS team meeting	ARTEMIS team meeting	ARTEMIS team meeting	ARTEMIS team meeting	ARTEMIS team meeting				17h00 Dinner, restaurant hotel Clarion (all)	

## APPENDIX C: RECOMMENDATIONS AND SUGGESTIONS

Area		R: Recommendations S: Suggestions G: Good Practices	Recommendations, Suggestions or Good Practices
1.	<b>NATIONAL POLICY AND FRAMEWORK FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT</b>	R1	The Government should expedite the decision for the undertaking of further work on geological disposal.
		R2	The National Nuclear Fund should establish documented procedures for the timely and regular updating of the National Programme for spent fuel and radioactive waste management.
		R3	The Government should establish a programme of proactive involvement of interested parties including the public regarding radioactive waste and spent fuel management, particularly in the siting of a geological disposal facility and its planned evolution.
		R4	The Government should establish formal arrangements for the effective coordination of regulatory functions in cases where multiple regulatory organizations have responsibilities for spent fuel management, radioactive waste management, decommissioning and environmental remediation.
2.	<b>NATIONAL STRATEGY FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT</b>	R5	JAVYS, a.s., as implementing organization for geological disposal, should update the existing implementation plan with interim targets and timelines in support of the National Programme milestones.

Area		R:Recommendations S: Suggestions G: Good Practices	Recommendations, Suggestions or Good Practices
3.	<b>INVENTORY OF SPENT FUEL AND RADIOACTIVE WASTE</b>	R6	The Government should make arrangements for the establishment and maintenance of a comprehensive national inventory for radioactive waste and spent nuclear fuel.
4.	<b>CONCEPTS, PLANS AND TECHNICAL SOLUTIONS FOR SPENT FUEL AND RADIOACTIVE WASTE MANAGEMENT</b>	R7	The Government should ensure that a programme is established for the research and development activities to be undertaken in support of the implementation of the geological disposal programme. The research programme should establish clear priorities with defined timeframes, responsibilities and the associated resources for its timely execution.
		GP1	The application of an immediate dismantling strategy combined with the treatment of all materials arising was considered to be outstanding. The integrated approach of JAVYS, a.s. and other participating organizations to the decommissioning project V1 effectively supported optimized execution of all technical activities in a timely and cost effective manner. Furthermore the openness of JAVYS, a.s. in sharing their experience can be highly beneficial to a number of comparable present and future decommissioning projects.
5.	<b>SAFETY CASE AND SAFETY ASSESSMENT OF RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT ACTIVITIES AND FACILITIES</b>	R8	JAVYS, a.s. should initiate development of an understanding of the features of the geological disposal facility and its host environment that influence safety, to support the siting decision making process.
		R9	The regulatory bodies should develop comprehensive guidance for demonstrating compliance with the requirements on siting of the geological disposal facility and subsequent steps in implementation of the geological disposal programme.

Area		R: Recommendations S: Suggestions G: Good Practices	Recommendations, Suggestions or Good Practices
		S1	The regulatory bodies should consider undertaking a detailed review of existing requirements and confirm their applicability to the geological disposal programme.
7.	<b>CAPACITY BUILDING FOR RADIOACTIVE WASTE AND SPENT FUEL MANAGEMENT – EXPERTISE, TRAINING AND SKILLS</b>	R10	JAVYS, a.s. should develop and maintain the competence and resources necessary for the implementation of the geological disposal programme.
		R11	The regulatory bodies should develop and implement a plan to establish and maintain the competence and resources necessary for the regulation of the geological disposal programme.
		S2	The Government should consider compiling information about the competence and availability of resources necessary for all aspects of the implementation of the National Programme through to the closure of all facilities and to provide a better planning basis for resource needs.

## APPENDIX D: LIST OF ACRONYMS USED IN THE TEXT

ARM – Advance Reference Material  
GDF – geological disposal facility  
NRAWR – National Radioactive Waste Repository  
VLLW – Very low level waste  
IAEA – International Atomic Energy Agency  
IRRS – Integrated Regulatory Review Service  
ISF – Integral storage facility for radioactive waste  
ISFS – interim spent fuel storage facility  
JAVYS, a. s. – Nuclear and Decommissioning Company  
LLW – low level waste  
NJF – National Nuclear Fund  
MD SR – Ministry of Transport of the Slovak Republic  
MH SR – Ministry of Economy of the Slovak Republic  
MŽP SR – Ministry of Environment of the Slovak Republic  
MZ SR – Ministry of Health of the Slovak Republic  
RAW – radioactive waste  
SAT – Systematic Approach to Training  
SARCON – Systematic Assessment of Regulatory Competence Needs  
SF – spent nuclear fuel  
Slovenské elektrárne – Slovak electricity  
ÚJD SR – Nuclear Regulatory Authority of the Slovak Republic  
ÚVZ SR – Public Health Authority of the Slovak Republic  
VLLW – very low level waste  
WWER – water, water, energy reactor

## **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).



## APPENDIX F: SITE VISIT

On Thursday, 16th February 2023, the ARTEMIS Review Team was hosted by JAVYS, a.s. on a visit to their Jaslovské Bohunice site, about 70 km northeast of Bratislava.

On arrival at the site, the ARTEMIS Review Team received a presentation on the database system for recording detailed information on the characteristics of each individual radioactive waste package and tracking its journey through all stages up to and including final disposal.

The remainder of the morning was devoted to a technical tour of the V1 NPP, which is currently in stage IV of decommissioning - decommissioning of the low and intermediate contaminated parts of the main reactor building. During the tour, the ARTEMIS Review Team was able to observe ongoing decommissioning activities and see the results of the extensive work already completed.



Decommissioning of the V1 NPP (*courtesy of JAVYS, a.s.*)

The afternoon began with a tour of the RAW treatment and conditioning facility and the ARTEMIS Review Team were able to observe the different processes implemented for metal, non-metal, liquid and gaseous wastes within the facility.



RAW treatment and conditioning facility (*courtesy of JAVYS, a.s.*)

There was also an opportunity for discussions with JAVYS on the details of their ageing management programme for the spent fuel storage facility and stored spent fuel elements.

The visit concluded with a presentation on the Mochovce National Radwaste Repository for LLW and VLLW.

The ARTEMIS Review Team was impressed with the overall progress made with decommissioning of the V1 NPP and the effective treatment of radioactive waste.

They would like to thank the members of the JAVYS staff who hosted the various technical tours for providing such an interesting and informative commentary on their activities.