IMPLEMENTATION REPORT OF THE NATIONAL PROGRAMME FOR THE MANAGEMENT OF SNF AND RAW IN THE SR ON 31 DECEMBER, 2021

1. Introduction

The National Programme for the Management of Spent Nuclear Fuel and Radioactive Waste (hereinafter referred to as „National Programme“), approved by the Government of the Slovak Republic by the Decree No. 387 of July 8, 2015, has been sent to the European Commission pursuant to the Directive 2011/70/EURATOM in August 2015. Therefore, it has become a strategic document for the Final Stage of the Peaceful Use of Nuclear Energy in the SR. Pursuant to § 6 section 9 of the Act No. 308/2018 Coll. on the National Nuclear Fund, the Board of the Governors of the NJF shall develop jointly with JAVYS, a. s. (legal entity pursuant to § 3 section. 9 of the Atomic Act) and holders of authorization or permission of the Nuclear Regulatory Authority of the Slovak Republic (§ 5 section. 3 and § 8 section 3 of the Atomic Act) the Report on Implementation of the National Programme for the preceding year annually. The Board shall submit it to the Ministry of Economy of the SR for approval, supplemented by the Opinion of the Nuclear Regulatory Authority of the SR.

The Report reviews implementation period of the National Programme to date 31 December, 2021. The Report is based on contributions provided by JAVYS, a. s., SE, a. s. and NJF, follows on from the Report for the period of 2020 and considers current progress in the area of decommissioning of nuclear installations, management of SNF and RAW and the nuclear and radioactive materials of unknown origin in the SR in 2021. The Report refers to policies, intentions, and objectives specified in individual chapters of the updated National Programme for the years 2016 - 2021.

Progress in the area of meeting short-term and long-term objectives specified in the Chapter 1.2 of the National Programme is given in the Chapter 2 of the Report. The objectives No. 2, 7, 9 ,11, 12, 13 and 15 are not included in the Chapter, as they have been evaluated in the previous reports as met. Overview of inventory of RAW, respectively SNF is updated in the Chapters 3 and 4. Activities in the area of research, development and demonstration activities are summarized in the Chapter 6. Concise balance of existing costs spent for the Final Stage of Nuclear Power Engineering in the SR, as well as current status of total assumed costs including the way of securing of adequately accumulated funds to cover the costs are described in the Chapter 7. Information on National Programme update development is summarized in the Chapter 8.

2. Meeting the objectives of the National Programme for the management of spent nuclear fuel and radioactive waste

Partial objectives of the National Programme are grouped under six categories: infrastructure and legislation, decommissioning of nuclear installations, management of radioactive waste and spent nuclear fuel in general, disposal of radioactive waste and spent nuclear fuel, research and development, transparency. Status of meeting those partial objectives (measures) is described in next sections followed by sequence numbers 1 to 19 dated 31 December, 2021. Some of partial objectives evaluated as met in previous reports are no more the subject of evaluation in the Implementation Report of the National Programme for the year 2021.

Seq. No..	Measure	Deadline	Responsible
In the area of infrastructure and legislation			
1.	To amend the Act on the National Nuclear Fund and other subsequent legislative documents fundamentally with objective: - to guarantee the state will assume responsibility for decommissioning, management of RAW from decommissioning and for the long-term storage of SNF, - to guarantee the amendment to the Act shall establish safe manner of handing over the nuclear installations by operator to organization authorized by state for purposes of decommissioning thereof, - to guarantee, the level of contributions and payments to the NJF shall be determined by independent body (NJF) pursuant to imposed legislative procedures, - to guarantee beneficiary of financial resources of the NJF shall submit eligible cost data to the NJF in scope and terms set by legislation, - to guarantee scope and structure of eligible costs for activities in ZČJE shall be defined in legislation, - to guarantee operator of non-reactor nuclear installations shall make payments to the NJF for the purposes of financing of decommissioning thereof.	2016	MH SR
The Act No. 308/2018 Coll. on the NJF and related implementing rules entered into force in 2019. To this respect the task is evaluated as met. The state responsibility and the way of handing over a nuclear installation for decommissioning became a subject for discussion within the scope of ongoing National Programme update. The topic has not been so far included directly in the Act on NJF. Provisions to the Act related to responsibilities were incorporated into the amendment of the Act No. 541/2004 Coll. in 2019. The manner of handing over a nuclear			

Seq. No..	Measure	Deadline	Responsible
installation for decommissioning has not been so far incorporated into legislation.			
In the area of decommissioning of nuclear installations			
3.	To implement further stages of A1 NPP decommissioning	2033	JAVYS, a. s.
After completion of the Stage II of A1 NPP decommissioning in 2016, execution of the Stage III and IV of A1 NPP decommissioning for planned completion in 2024 started since 1 October 2016. Execution is based on following documents issued: Final Opinion of MŽP SR 2292/2015.3.4/hp, recommending the Stage III and IV of A1 NPP decommissioning by continual execution of planned activities, favorable Opinion of EC No. C(2016) 8461 as of 9 December 2016 pursuant to the Article 37 of Euratom, permission of ÚVZ SR No. OOZPŽ/3942/2016, whereby authorizing practices resulting in exposure to radiation within "the Stage III and IV of A1 NPP nuclear installation decommissioning", permission of NRA SR No. 369/2016, whereby authorizing the Stage III and IV of the nuclear installation A1 NPP decommissioning from operation in scope specified in the document "The Plan of the Stage III and IV of A1 NPP decommissioning " and management of radioactive wastes of the nuclear installation A1 NPP in line with the document "Plan for management and transport of RAW and plan of management of conventional waste from the Stage III and IV of A1 NPP decommissioning" and successful termination of the Stage II of A1 NPP decommissioning. Main subject of the Stage III and IV of A1 NPP decommissioning focuses on decommissioning of technological installations of gas management, management of heavy water, management of cooling water of primary circuit, systems for emergency discharge of steam generators and relief valves of steam generators, 2 pieces of steam generators, oil management of turbocompressors, control system for fuel cladding, systems of dosimetric control, liquid leakage detecting and disconnected air ventilation systems detecting. In parallel with removal of indicated nuclear installation A1 technological devices, process for casings processing (removal and fragmentation) of long-term SNF storage and vitrification of cooling medium for the storage of SNF with high level activity of chrompik III (aqueous solution of chromium and potassium dichromate $K_2Cr_2O_7$) in particularly hazardous areas is under way. Equally important activities include management of contaminated soils and concrete, contaminated ground water remediation, of sludge layers arising from the long-term storage of SNF and sludge layers from outer tanks originally used for storage of liquid RAW during A1 NPP operation. Within the Stage III and IV decommissioning, there were completely decommissioned technological facilities in the gas management object, technological facilities of oil management, relief valves and emergency discharge valves of steam generators in a supporting machine room of the main production unit, air ventilation underground channel within outer objects of A1 NPP, high pressure tanks of heavy water management until the end of 2021. Processing of sludges resulting from the long-term storage of SNF from A1 NPP was also completed. Continuation of pipelines primary circuit decommissioning, sectional fittings of primary circuit, steam generators PG3 and PG4, removal and fragmentation of casings from the long-term storage of SNF of A1 NPP is under way. Vitrification of chrompik III, solidification of sludge layers from outer tanks of A1 NPP, restoration, monitoring and classification of contaminated soils and concrete, as well as other successive activities of A1 NPP decommissioning are taking place as specified in the Plan of the Stage III and IV of A1 NPP decommissioning, approved by state administration. All activities are implemented in accordance with the time schedule specified in the Plan for		

Seq. No..	Measure	Deadline	Responsible
the Stage III and IV of A1 NPP decommissioning. Furthermore, preconditions for completion of all objectives and completing of the Stage III and IV of A1 NPP decommissioning until the end of 2024 are created. In parallel, characterization of spaces and facilities subject to the Stage V of decommissioning is taking place and documentation for authorization of activities for implementation of the Stage V of A1 NPP decommissioning is being developed successively. The Stage is envisaged to start in 2025. Its principal objective will be decommissioning of 4 pieces of remaining steam generators, long-term storage for the spent nuclear fuel from A1 NPP, the reactor and other subsequent technology equipment used in A1 NPP operation. Continual monitoring of overall progress of A1 NPP decommissioning is taking place by management of JAVYS, a. s., which assigns tasks based on achieved results. Performance of tasks is monitored at regular meetings of Project management for A1 NPP decommissioning in the presence of NJF representatives. Based on current state of A1 NPP decommissioning as well as planned future activities state, it may be presumed that ongoing Stage III and IV of A1 NPP decommissioning will be terminated until the end of 2024. The task is under way.			
4.	To implement the Stage II of V1 NPP decommissioning	2025	JAVYS, a. s.
Implementation of the Stage II of V1 NPP decommissioning started on 1 January 2015, based on the Decision of NRA SR 900/2014 issued on 23 December 2014. V1 NPP decommissioning is under way in form of subprojects, embracing all activities necessary for achievement of defined objective – „brown field“, i. e. release of the site for industrial deployment. Original deadline 31 December 2025 was changed to 31 December 2027 due to the time schedule change of the Stage II V1 NPP decommissioning and update of detailed decommissioning plan submitted for the approval also by EC and EBRD -see the text bellow.			

Seq. No..	Measure	Deadline	Responsible

Projects in preparation and implementation in 2021 are listed in the Figure No.1.

Figure No. 1: Projects in preparation and implementation in 2021 in V1 NPP decommissioning

Project No.	Title of the project	Status of the project
A1.11	PMU Consultant (the Phase 11)	implementation
A5-A2a	Correction of Power Supply System	implementation
B6.6A	Decommissioning Support Surveys	implementation
C7-A4	Metallic RAW Melting Facility	implementation
C8-B.02	Temporary Storage of Materials from V1 NPP Decommissioning	preparation
D0	Decommissioning Programme Implementation Using Human Resources Available in Bohunice V1 NPP	implementation
D4.1	Modification of the Plant and Installation of New Equipment	implementation
D4.2	Dismantling of Reactor Coolant System Large Components of primary circuit	implementation
D4.4B	Dismantling of Systems in V1 NPP Controlled Area Part 1	completed
D4.4C.01	Dismantling of systems in V1 NPP Controlled Area Part 2, D4.4C.01 Subproject	implementation
D4.7.01	Merged projects D4.5, D4.6 and D4.7 Decontamination and Demolition of V1 NPP Buildings and Site Restoration, Subproject D4.7.01	preparation

There were 9 projects in total in implementation process in 2021 – A1.11, A5-A2a, D0, B6.6A, C7-A4, D4.1, D4.2, D4.4B, D4.4C.01. The project D4.4B was successfully completed in 2021, other projects continue in implementation in 2022.

The project D4.2 “Dismantling of Reactor Coolant System Large Components of primary circuit” was again a significant project for achieving the end state in 2021 in view of implementation of overall V1 NPP decommissioning project. Primary purpose of the project is dismantling of the most contaminated facilities (reactor pressure vessels of both reactor units, steam generators, main circulation pumps, pipelines of the primary circuit and other technology components) and

Seq. No..	Measure	Deadline	Responsible

linings in spaces of V1 NPP the controlled area of main production unit. Alongside this project, projects D4.4B "Dismantling of Systems in V1 NPP Controlled Area– Part 1" (completed in 2021) and D4.4C.01 "Dismantling of Systems in V1 NPP Controlled Area – Part 2, Subproject D4.4C.01" were implemented successfully. Projects D4.2 and D4.4C.01 will also be significant in next two calendar years, particularly in the view of smooth continuity of V1 NPP decommissioning and the beginning of the final stage of V1 NPP decommissioning, which will correspond to implementation of the project D4.7.01.

Implementation of V1 NPP decommissioning is undertaken in conformity with the approved plan of the Stage II with slight delay in some projects concerning the timetable of 2014. Slight delays in individual project implementation caused by objective factors could not have been foreseen to full extent and thus eliminated in project preparation process.

Works were affected by spread of pandemic disease of new coronavirus COVID-19 and changing measures to prevent spread of pandemic disease of new coronavirus COVID-19 depending on the latest status throughout the year 2021. Contractors continued in dismantling works implementation of V-1 main production unit facilities with partially limited number of workers in regards to "Extraordinary preventive measures to minimize spread of COVID-19 disease under conditions in company JAVYS, a. s.".

In parallel with dismantling activities there is a continual demanding process under way concerning management of radioactive waste originated, their transport and release of materials meeting the criteria for their release into the environment.

Overall progress with individual projects included is monitored continually via monthly and also semiannual reports and meetings of managers of respective projects, representatives of consultant and EBRD, representatives of SIEA, MH SR and NJF and also semiannual monitoring committee meetings have been taken place with the participation of JAVYS, a. s., SIEA, NJF, MH SR, EBRD and the European Commission.

Implementation of the Stage II V1 NPP decommissioning is to a significant degree contingent upon complex financial management of this process. For successful course of decommissioning projects, adequate funding from BIDSF, SIEA and adequate national (i. e. Slovak) financial resources from NJF are expected. Decommissioning termination is dependent on a careful and systematic planning of activities, scope of individual projects and the overall period of procurement process relating to those projects. With regard to revision of critical path for decommissioning, which reviewed external and internal risks for decommissioning, achieved status and especially the higher level of knowledge in 2021, it is necessary to postpone the deadline of decommissioning completion.

Therefore, appropriate steps were performed in 2021 towards approval of the time schedule by the European Commission and related approval of extension of co-financing of V1 NPP decommissioning from EU resources until the end of 2027. With this view, the European Commission set the deadline 31 December 2027 as the latest possible deadline for completion of V1 NPP decommissioning.

It will be necessary to develop a revision of the plan for the Stage II of V1 NPP decommissioning and related documentation in 2022. Principal change in the plan for the Stage II will be adjusted

Seq. No..	Measure	Deadline	Responsible
informative time schedule for decommissioning, in which the planned deadline for decommissioning completion will be postponed to 31 December 2027. The task is under way.			
5.	Maximum use of financial resources from BIDSF for V1 NPP decommissioning projects	2025	JAVYS, a. s.
Effectivity of using BIDSF resources in V1 NPP decommissioning is monitored pursuant to project management procedures for V1 NPP decommissioning and monitored via regular weekly and monthly meetings, from which weekly and monthly reports on decommissioning progress are developed afterwards. Additionally, monitoring report for V1 NPP decommissioning monitoring committee is conducted semiannually. V1 NPP decommissioning financing is comprised of two resources – resources of EU and national resources of the SR. Financial resources of the EU are preferably used in implementation of projects. Out of total number of 73 V1 NPP decommissioning projects, 71 projects were funded predominantly through the EU resources. National resources of the SR are for the most part used for activities connected with incurred supporting costs, associated with implementation of decommissioning projects, considerations of projects and co-financing, for management, maintenance and repairs of objects, management of RAW including disposal and for storage of SNF. 18 Grant agreements between EBRD and JAVYS, a. s. were approved for a guaranteed amount of € 484,9 million to date 31 December 2021 (€ 471,9 million reevaluation) Additionally, 2 Grant agreements between the National Agency SIEA and JAVYS, a. s. were concluded for an amount of € 185,7 mil., thus the total guaranteed number of agreements concluded represents € 657,6 million (after reevaluation). Cumulative amount of € 422,7 million was withdrawn from BIDSF and SIEA funds to date 31 December 2021. Amount of non-guaranteed EU resources in BIDSF fund corresponds to € 14,3 million to date 31 December 2021. Amount of non-guaranteed funds managed by the National Agency SIEA corresponds to € 9,1 million (SIEA administrative costs included). Additional allocation from EU resources within Financial Framework of 2021-2027 amounting to € 55 million is foreseen. Total estimated costs for V1 NPP decommissioning (stated at the price level of 2021) amounting to € **1 220** million, whereby the sum of € **736** million shall be reimbursed by the EU (EBRD and SIEA). This includes additional allocation of resources out of Financial Framework 2021-2027. The task is under way.			
6.	To prepare decommissioning of other NI	permanently	JAVYS, a. s. SE, a. s.
Procedures, timetables and the costs for decommissioning of other NI are given in the conceptual plans for decommissioning of respective nuclear installations from operation, developed by authorization holder for construction or operation of NI, respectively. Subsequently, they are submitted for an approval by NRA SR in line with the requirements under the Act No. 541/2004 Coll. on the Peaceful Use of Nuclear Energy and amending and supplementing			

Seq. No..	Measure	Deadline	Responsible
certain acts and the Decree of NRA SR No. 58/2006 Coll., which stipulates details on scope, content and the manner of documentation development concerning nuclear installations necessary for individual decisions pursuant to wording and amending of the Decree No. 31/2012 and No. 102/2016. Conceptual Decommissioning Plans of NI are updated in line with requirements of the Decree No. 102/2016, § 22, point 2: "Authorization holder pursuant to § 5 section 3 b) and c) of the Act shall update the Conceptual Decommissioning Plan of nuclear installations from operation following changes to nuclear installation or change at locality, progress in technology, amendments to generally binding rules and the National Programme for execution of the National Policy, events, funding changes and present radiological conditions." Conceptual Decommissioning Plan for EMO 3,4 was submitted to the NJF, pursuant to the provisions cited above in 2020 and subsequently, economic part was amended in March 2021, according to requirements set by NJF. Modifications made in above mentioned KPV EMO 3,4 revision were approved by the NRA SR in April 2021. Conceptual Decommissioning Plans of NI TSU RAW, FS LRAW, IS RAW, MSVP have last been updated and subsequently authorized by the NRA SR in 2021 by the Decision of NRA SR No. 291/2021, following on elaboration of the study „Costs for non-reactor nuclear installations TSU RAW, FS LRAW, IS RAW, MSVP decommissioning and stipulating costs for termination of operation of NI NR RAW". The task is under way.		
In the area of the management of radioactive waste and spent nuclear fuel in general			
8.	To build new storage capacities of SNF	2020	JAVYS, a. s.
Construction of new storage capacities of SNF, as a necessary precondition for the safe operation of nuclear units in the SR, is implemented under ongoing investment project „Completion of construction for storage capacities of SNF", implementation of which started in July 2017 after receiving the Final Opinion of MŽP SR to proposed activity No. 1064/2016-3.4/hp. Works in area of replacement of utility network, removal of construction objects in place of interest for construction, as well as design works in scope of development of PSP (project for construction permit) were carried out within project implementation in 2018-2019. As a result of NRA SR demands in the light of recommendations and instructions of IAEA and WENRA for improving seismic resistance of SNF storage capacities building, it was necessary to ensure to revise original construction-technical and technological design of SNF storage capacities. Project activities related to construction of dry storage for SNF continued in 2021 in the following extent:			

Seq. No..	Measure	Deadline	Responsible
	1. Preparation works, which implementation were carried out in a scope of new survey measuring points foundation, foundation engineering, installation of fences, connectors to construction site and examining of foundation engineering proposal through pile testing have been completed. 2. Process on application for Binding Opinion on location decision and construction of NI has been completed. 3. Process on application for approval of change at NI has been completed. 4. Building permit has been issued to the activity: Completion of SNF storage capacities", which entered into force on 5 June 2021. 5. Construction work has commenced under approved time schedule. Assumption for commissioning of completed SNF storage capacities is 114 weeks after building permit will enter into force. The task is under way.		
10.	To construct Facility for remelting of metallic radioactive waste	2018	JAVYS, a. s.
	The decision on construction of the Facility for remelting of metallic RAW at the Bohunice site results from the forecast output of metallic RAW from NPP decommissioning analyses and need for the most effective management of RAW as well as minimizing the volumes of such generated metallic RAW, since without a significant output reduction by remelting, it would be required to disposed them in National Repository for RAW in Mochovce. Implementation of the project "Facility for remelting of metallic RAW" commenced in 2016 after obtaining the Final Opinion of MŽP SR to proposed activity No. 1775/2015-3.4/hp. After the completion of design and assembly works, individual and pre-complex tests were carried out of individual equipment of the Facility for remelting of metallic RAW in 2020. Consequently, non-active complex tests of facility followed by evaluation were carried out successfully in 2021. An application for authorization for commissioning of the Facility for remelting of metallic RAW was submitted, whereby relevant decision of NRA SR entered into force at the end of 2021. With regard to the time delay in legislative procedures due to reasons of delays on the contractor´s side (largely due to pandemic of Covid 19 constraints) and due to reasons of defects occurrence during the tests, expected commissioning date of the facility is in 2022. The task is under way with a delay.		
14.	To adopt decision on continuation or withdrawal of twin approach in development of deep disposal – comprehensive assessment of the idea of joint international deep repository	2020	MH SR
	One of two alternative for addressing the Final Stage of Fuel Cycle in the National Policy for		

Seq. No..	Measure	Deadline	Responsible
the management of SNF and RAW in the SR envisages disposal of SNF in international deep repository. While none of alternatives for solution to deep disposal in the SR has not been researched adequately so far, the decision on twin approach is recommended to be postponed for the next years. Such decision must be preceded by detailed expert analysis of both alternatives. The EC document entitled Taxonomy of the EU was subject to discussion in 2021. Proposal for conditions for nuclear installations was released hereto at the end of the year, including deadline for addressing the question of SNF and RAW disposal in a deep repository. The task is under way.			
16.	To decide on siting of Deep Repository of the SR (in case of termination of twin approach)	2030	JAVYS, a. s.
Staged time schedule of deep geological repository preparation was elaborated in JAVYS, a. s. in 2019 and approved by the management of the company in December 2019, based on MH SR requirement. This time schedule includes the Strategy for communication to the public and setting key project milestones as a basis for planned update of the "National Policy and the National Programme for the management of spent nuclear fuel and radioactive waste in SR" and also in a compliance with item B.3 of the Government of SR Resolution No. 402 as of 5 September 2018. The aforesaid document was forwarded to MH SR for a review at the beginning of 2020. Deadlines of the time schedule were incorporated into update of the National Programme for the management of spent fuel and radioactive waste in SR in 2021. Works on project "Development of deep repository the Stage II – part 2" of HU development in SR are proceeding at present by Concept development for public relations and general vendor selection. Next steps in preparation and implementation of the project are further elaborated within the update of respective part of the National Programme. The task is under way.			
17.	To commission Deep Repository	≈ 2065	JAVYS, a. s.
Implementation of the project „Deep Repository – locality selection the Stage 2 – part I" was in progress in 2017-2018 and completed in December 2018. Basic conditions to define steps for preliminary selection of locality for construction of HU in the SR were ensured in this project. Thus, in case of termination of twin approach it will help to ensure construction and commissioning of HU in the SR until 2065. With exception to „Project of geological task", following tasks are implemented within the project „Deep Repository – locality selection, Stage 2 Part I" • Framework Programme for development and research in the area of deep disposal for all stages and for all areas of HU development,			

Seq. No..	Measure	Deadline	Responsible
• Development and preparation for implementation of system for economic stimulation of localities affected by development and operation of repositories. Currently works on continuation of the project „Development of Deep Repository the Stage 2 – Part II“ of development of HU in the SR are ongoing, namely concept development for public relations and supporting documents preparations for supplier selection for the next stage (see evaluation of the measure No. 16). Next steps were further elaborated in 2021, within the update of relevant part of the National Programme for the Management of Spent Nuclear Fuel and Radioactive Waste in the SR, approval of which can be expected in the course of 2022. The task is under way.			
In the area of research and development			
18.	To develop Framework Programme for development and research in the area of deep disposal and set internal conditions for its implementation.	2018	JAVYS, a. s.
Document B.2 Framework Programme for development and research in the area of deep disposal was elaborated by suppliers (DECOM, ÚJV Řež) within implementation of the project „Deep Repository – locality selection the Stage 2 - part I“, which was in progress during 2017 – 2018. **Framework Programme for development and research** was described in detail for all stages and areas of development of HU. Whole process until the stage of repository closure is planned for at least 100 years, practically. Therefore, it was possible to describe in detail especially activities for the next 15 - 20 years (locality selection stage). The task concerning development of Framework Programme for development and research is **completed**, the part concerning setting of internal conditions for implementation of this framework programme forms part of the update proposal of the National Programme, as well as procedure described in the item 5 of this Report.			
In the area of transparency			
19.	To develop and prepare implementation of system for economic stimulation of localities affected by development and operation of repositories To focus exclusively on economic stimulation of localities is not adequate. A comprehensive system for information and public relations for the long-term should be established.	2018	MH SR, JAVYS, a. s. National Nuclear Fund
Document **B.3 Proposal for implementation of the System for economic stimulation of localities affected by development and operation of Deep Repository** was developed. The document is described in the Reports on implementation of the National Programme for the years 2019 and 2020. This document was developed within implementation of the project			

Seq. No..	Measure	Deadline	Responsible
„Deep Repository – locality selection the Stage 2 – part I“ in 2017 - 2018. Development of comprehensive system for information and public relations for the long-term is part of the present update proposal of the National Programme (status as of 31 December 2021) and also procedure described in the item 5 of this report.			

3. Management of RAW

Overview data of RAW for previous evaluation included in the Implementation Report of the National Programme for the period until 31 December 20121 are indicated in division under individual areas of management of RAW.

3.1 Overview of generation and recording of RAW

Following quantities of RAW from implemented activities of decommissioning and operation of individual NI were transferred to company JAVYS, a. s. for processing for the period from previous evaluation of implementation of the National Programme for the management of the spent nuclear fuel and radioactive waste i. e. for 2021.

3.1.1 Decommissioning of A1 NPP:

- liquid radioactive waste: 466,33 m^3,
- combustible solid radioactive waste: 19,45 t
- compressible solid radioactive waste:189,19 t,
- metallic RAW: 149,15 t,
- other solid radioactive waste (fixed ra-sludges in matrix, etc.):282,01 t,
- contaminated used filtration cartridges of air-technical systems: 1,84 t.

3.1.2 Decommissioning of V1 NPP:

- liquid radioactive waste-concentrates: 69,20 m^3,
- combustible solid radioactive waste:15,59 t,
- compressible solid radioactive waste: 338,56 t,
- metallic RAW and metallic contaminated material: 1632,03 t,
- contaminated used filtration cartridges of air-technical systems:5,26 t.

3.1.3 Following quantities of RAW from operation of V2 NPP and NPP EMO 1, 2 were transferred by company SE, a. s. for further management in JAVYS, a. s.:

- liquid radioactive waste – concentrates:206,43 m^3,
- liquid radioactive waste – exchange resins:4,67 m^3,
- solid radioactive waste – combustible:15,74 t,
- solid radioactive waste – compressible: 20,30 t,
- contaminated used filtration cartridges of air-technical systems: 11,77 t,

- solid RAW for classification: 0,98 t.

RAW generated in A1 NPP decommissioning process were continuously processed at TSU RAW processing lines and soils and contaminated concrete at designed work places in conformity with the plan for RAW flows for 2021. Final product-filled VBK and filled high-volume bags and drums of VLLW were continuously disposed in NR RAW. Temporary storage for compressible RAW and contaminated metallic materials intended for remelting was provided.

3.2 Storage and conditioning of RAW

3.2.1 Following activities of RAW management were carried out in NI TSU RAW

- Incineration of RAW – by incineration was processed:
  - 16,86 t of SRAW from decommissioning of NI (A1, V1),
  - 19,22 t of SRAW and 0,39 m^3 of combustible LRAW and spent sorbents from operation of NI (V2, EMO 1,2).
- high compressed compacting of solid RAW – by high compressed compacting was processed:
  - 364,58 t of compressible SRAW from decommissioning in NI (A1, V1),
  - 29,20 t of compressible SRAW from operation in NI (V2, EMO 1,2).

- cementation of RAW – by cementation into VBK was conditioned:
  - 365,51 m^3 SRAW from NI (A1, V1) decommissioning,
  - 21,56 m^3 SRAW from NI (V2, EMO 1,2) operation,
  - 97,38 m^3 LRAW from (A1, V1) decommissioning,
  - 151,49 m^3 LRAW from NI (V2, EMO 1,2) operation.

- by fragmentation was processed:
  - 349,55 t metallic RAW from NI (A1, V1) decommissioning,
  - 10,75 t metallic RAW from NI (V2, EMO 1,2) operation.

- by decontamination was processed:
  - 347,14 t metallic RAW from NI (A1, V1) decommissioning,
  - 10,75 t metallic RAW from NI (V2, EMO 1,2) operation.

3.2.2 Following quantities of RAW from A1 NPP decommissioning were used in specialized technology facilities of JAVYS, a. s.:

- vitrification of chrompik:
  - 2 m^3 of chrompik III were processed.
- handling with contaminated soils and concrete:
  - 1887,10 m^3 of contaminated soils and concrete were processed.
- fragmentation of casings of the Long-term storage:
  - 30 pieces of PDS were processed.

- fixation of sludges:
  - 71,39 m^3 ra-sludges from tanks of outer objects were fixed into cement matrix in ZFK facility, 4,57 m^3 ra-sludges of A1 NPP HVB were fixed in SUZA II facility.

3.2.3 In NI FS LRAW in JAVYS, a. s. in Mochovce was processed

By cementation of RAW into VBK conditioned:

- 97,63 m^3 RAW from A1 NPP and V1 NPP decommissioning,
- 126,75 m^3 LRAW from NI NPP EMO 1,2 operation.

Processing of RAW at technology lines of TSU RAW and FS LRAW was implemented in line with the plan of RAW flows in 2021. Most widely used technologies connected to management of RAW generated in the SR were applied in the fields of high compressed compacting, fragmentation and decontamination of metallic RAW. Coordination of individual processes and relations including transports and disposal in NR RAW were in conformity with JAVYS, a. s. plan. Processing of RAW from SE, a. s. was executed in conformity with the contract.

Special kinds of RAW, e. g. chrompik, sludges from DS, casings of DS and other specific RAW from A1 NPP were processed in line with the scheduled plan and flows of RAW in conformity with the time table of A1 NPP decommissioning project. It is assumed, these quantities will be continuously processed within the expected terms.

3.3 Management of radioactive material of unknown origin

8 interceptions of RMNP were executed in 2021. 156 drums with radioactive material were stored in IRAW and RMNP storage in Mochovce. 0,2760 m^3 of IRAW and RMNP containing nuclear material were stored in NI MSVP.

3.4 Storage of RAW

3.4.1 Storage in NI TSU RAW JAVYS, a. s.

Following quantities of RAW were stored in certified storages of RAW, located at NI TSU RAW JAVYS, a. s. site to date 31 December 2021:

Object	**Room number**	**Number (200 dm^3 drum)**	**Filling status (%)**	**Storage capacity (200 dm^3 drum)**
32	30/54	3326	89,6	3724
32	97	1632	79,6	2050
32	106	1252	84,6	1480
34	1	2819	98,6	2860
723	-	691	86,3	800

641	-	1901*	75,9	2506**
810	-	3058,95***	22,8	13400****

** 2878 drums of 200 dm^3 of RAW, 2785 drums of 220 dm^3 of RAW, 19 drums of 400 dm^3 of RAW, 189 containers 2EM-01 of RAW covering site of 1901 m^2.*

*** Maximum area coverage, i. e. combination of package forms of RAW and freely disposed radioactive materials in relation to number of layers of stacking of individual package forms*

**** 5868 of 200 dm^3 drums of RAW in 1467 pallets PS 15/4AT, 216 fence pallets of RAW, 6 ISO´ 20 containers of RAW, 11 VBK of RAW in TK150, 1 VBK and 19 VBK of RAW in TK080, 5 VBK of RAW.*

*****Maximum used volume, i. e. combination of package forms of RAW in relation to authorized number of layers of stacking of individual package forms.*

3.4.2 Storage in SE, a. s.

In V2 NPP storages following quantities were stored to date 31 December 2021:

- 54,9 t of SRAW,
- 1306 m^3 of concentrates,
- 88,8 m^3 of ion exchangers.

In NPP EMO 1,2 storages following quantities were stored to date 31 December 2021:

- 29,5 t of SRAW,
- 1116 m^3 of concentrates,
- 3,6 m^3 of ion exchangers.

Storage capacities of SE, a. s. are adequate in regard to continuous transfer of RAW for processing.

Pre-complex test (PKV) of technology for selective separation of radionuclides from liquid concentrates in NPP EMO was performed in February 2019. After authorization by NRA, KV active tests are planned consisting of active tests and in service experience. After expected termination and evaluation of KV in November 2022, an application will be submitted to NRA SR for permanent operation authorization. Date foreseen for obtaining authorization is in March 2023.

As filling status in certified storages in TSU RAW installation in JAVYS, a. s. demonstrates, available capacity indicates a need for metallic RAW processing in facility designed for remelting. On the other hand, coordination of handling process with materials from A1 NPP and V1 NPP decommissioning is necessary to avoid overload in storages.

3.5 Disposal of RAW

3.5.1 Disposal of VBK in NI NR RAW Mochovce

- to date 31 December 2021 in total of 6 614 pieces of VBK from decommissioning and from operation of NI were disposed in the National Repository for RAW, section for LLW disposal (the first and second double row), whereby 408 pieces of VBK from decommissioning and operation of NI in SR were transported and subsequently disposed into the second double row of disposal structures in this installation for the year 2021.

3.5.2 Disposal to VLLW repository

- quantity of 2 140,60 m^3 of VLLW was transported and subsequently disposed in the second and the third disposal module in NI NR RAW, section for VLLW disposal for the year 2021. Out of this number 2 076,49 m^3 VLLW resulted from the A1 NPP decommissioning and 64,11 m^3 of VLLW from the V1 NPP decommissioning. To date 31 December 2021 amount of 16 403,30 m^3 of VLLW was disposed in total in two disposal modules (the first disposal module – 7 361,5 m^3 of VLLW, the second disposal module – 8 359 m^3 of VLLW and the third disposal module - 682,80 m^3 of VLLW).

4. Management of SNF

Activities connected with SNF management are assessed from the period of previous review of the National Programme implementation until 31 December 2021.

4.1 Transfer of SNF for storage

Following quantities of SNF from the V2 NPP and NPP EMO 1, 2 operation, were transferred by the company SE, a. s. for the long-term storage in NI MSVP for the period from the previous review of the National Programme implementation, thus for the year 2021:

- the spent nuclear fuel from V2 NPP operation: 156 pieces,
- the spent nuclear fuel from NPP EMO 1, 2 operation: 144 pieces.

4.2 Storage of SNF

- To date 31 December 2021, 13 008 pieces of fuel assemblies of SNF were stored in NI MSVP out of which:
- 5143 pieces from the V1 nuclear power plant,
- 5669 pieces from the V2 nuclear power plant,
- 2496 pieces from the nuclear power plant EMO 1, 2.

5. Development of Deep Repository

The document „*B.4.2 Plan of works for the years 2019 - 2024 in the area of HU development in the SR", elaborated in 2018 (see text of the task No. 16),* describes plan of works for a given period of time in different areas of the Programme for Development of Deep Repository for RAW. It concerns specifically following sections:

- Section 1: Coordination of the Programme for HU RAW
- Section 2: Surveying geological works for a locality selection
- Section 3: Public participation in the Programme for HU development
- Section 4: Demonstration of safety
- Section 5: Feasibility study

Report for the year 2018 indicates „In subsequent period JAVYS, a. s. will implement, based on the abovementioned documents, a selection procedure for general contractor for implementation of activities in locality selection (geological activities, terrain and surveying works in selected localities, safety demonstration, support for public relations etc.), so the final decision on siting of Deep Repository in the SR will be possible to adopt until the end of 2030".

No funds of NJF were spent for the development of HU in 2021.

6. Evaluation concerning Chapter 5 of the National Programme the Demand for the research, development and demonstration activities

As far as research, development and demonstration activities are concerned, activities of research and development were implemented in 2021, what is highlighted in the following figure, respectively projects indicated in the Report for 2020 continued:

Figure No. 2: Project/tasks focused on research and development activities in 2020

Title and content of task/project	Competent organization in SR	User of outcomes	Financial arrangement
Development of fixation matrix for sludges from chrompik	VUJE, a. s. in decommissioning outputs of A1 NPP	JAVYS, a. s.	NJF resources within costs for decommissioning of A1 NPP
EURAD - European Joint Programme on Radioactive Waste Management, work package ROUTES ("Waste management routes in Europe from cradle to grave")	NJF, VUJE, FEI STU	European Commission, user of partial outcomes NJF, MH SR, JAVYS, a. s.	European Commission, H2020 Euratom Programme
Covering model in the site of NR RAW Mochovce monitoring	VUJE, a. s.	JAVYS, a. s.	NJF within costs for NR RAW Mochovce operation

On one hand fixation matrix development for sludges from chrompik is executed in framework of tasks for the Stages III and IV of A1 NPP decommissioning, but on the other

hand implemented activity is of development and scientific nature, although it is in principle specific and restricted solely to the field of A1 NPP.

Project EURAD is a joint framework project of the European Commission covering priority key problems of RAW and SNF management, focused mainly on development of deep repositories in Europe. The purpose of the work package ROUTES is an exchange of experience and knowledge on methods of RAW management among participating organizations and identification of need for research and development int the field of RAW management. The programme addresses topics relevant also to Slovakia such as management of problematic waste or sharing capacities for RAW management.

In-situ demonstration model for final covering of Low-level waste Repository in Mochovce was developed in 2005 and is serving for validation of mathematical models and demonstrating material long-term quality, stability of surface and structures of proposed final covering of Low-level waste Repository in Mochovce.

7. Evaluation to Chapter 7 Plan of costs

Considering evaluation of status of financial resources necessary for the coverage of costs for the Final Stage of Nuclear Power Engineering in relation to the Chapter 7 of the National Programme containing data on assumed total costs at the price level of 2014 (€ 8 000 million), data on 31 December 2021 are as follows:

- total sum of accumulated financial resources on NJF accounts: € 1 947, 431 mil.,
- the sum of financial resources spent for the coverage of costs on A1 NPP: sub-account: € 810,9 mil.,
- the sum of financial resources spent for the coverage of costs on V1 NPP: sub-account: € 260,6 mil. (including SNF storage),
- the sum of costs incurred for RAW disposal from A1 NPP and from V1 NPP in NR RAW: € 43,3 mil.,
- the sum of financial resources incurred for Deep Repository development: € 3,07 mil.

Overall, financial resources were incurred to A1 NPP and V1 NPP decommissioning (including SNF storage and disposal of RAW in NR RAW in Mochovce) in amount of € 1 114,87 million of NJF resources and € 429 million of EU resources to date 31 December 2021 (at the price level of 2014).

Compulsory contributions and compulsory payments to NJF are collected for securing financial resources for the coverage of costs for the Final stage of operating installations. The level of resources is based on approved methodology. The levels of compulsory contributions and payments to NJF are to be found at the Government Decree No. 22/2019 Coll. on compulsory contributions and compulsory payments to NJF. The level of assumed costs for Deep Repository amounts to the sum of **€ 3 573,4 mil.** stated at the price level of 2016.

Transfer from MH SR from resources in form of a delivery is collected by the operators of distribution systems and transmission system and is included in payments of end users for electricity delivered. This serves for financing of A1 NPP and V1 NPP decommissioning. The level of this delivery is determined in the Government Decree

No. 21/2019 Coll. on the level of annual delivery determined for the reimbursement of the historical deficit from the delivered electricity to its end users.

Decommissioning costs for individual NI have been continuously updated. Expected costs for operating installations decommissioning are contained in regularly (updated) conceptual decommissioning plans. Expected costs for V1 NPP decommissioning including BIDSF projects and related costs are the subject of updated detailed plan for V1 NPP decommissioning. Economic section of the document was reviewed by the NJF as a result of submitted application for amendment of the document at the end of 2019. Update of V1 NPP decommissioning plan on account of extension of the deadline until 2027 was not concluded to date 31 December 2021 and also analysis on impact of this extension of the deadline on total costs including impact on the historical V1 deficit was not conducted. Expected costs for Stage III and IV of NPP A1 decommissioning are indicated in plans for Stage III and IV of NPP A1 decommissioning. Update of costs for the Stage V of A1 NPP decommissioning was in progress during 2021 within preparatory analyses for the Stage V of A1 NPP decommissioning. In this context an Intention pursuant to the Act No. 24/2006 Coll of the National Council of the SR on environmental impact assessment entitled "A1 NPP decommissioning - the Stage V and release of the A1 NPP site after the termination of the Stage V" was developed. This document contains assessment of costs for the Stage V and the Stage "release of the site" following the Stage V. Updated costs are integrated into updated National Programme for the management of SNF and RAW in the SR.

8. Update of the National Programme

The National Programme for the Management of SNF and RAW in the SR as strategy document in the area of the Final Stage of Peaceful Use of Nuclear Energy in the SR has been updated. Meetings of Task force on update of the National Programme were organized since September 2020. Its role was to analyze in detail currently applicable National Programme, to compile texts of individual chapters of the proposal of the National Programme update and to develop necessary input documents and data. Completed proposal of the text of the document was forwarded to all participating organizations for comments in 2021. Final version of the document will be released after comments incorporation in the course of 2022. Then it will be forwarded to approval process including assessment of changes to strategic document of a national scope pursuant to the Act No. 24/2006 Coll. on environmental impact assessment. Updated document has modified structure and besides updated technical and financial data contains also objectives and tasks for future period in the area of infrastructure, strategy for management of SNF and RAW and preparation and locality selection for HU.

In the light of the Directive EURATOM 2011/70 establishing Community Framework for responsible and safe management of spent fuel and radioactive waste, a peer review mission ARTEMIS was scheduled at the beginning of 2021. Documentation required by IAEA including a self-assessment questionnaire was completed in January 2021. After having taken into account the possibilities on the side of IAEA and SR and the overall situation of COVID-19 pandemic, it has been mutually agreed, ARTEMIS mission in the SR shall take place only after the execution of IRRS mission scheduled for the fall 2022. February-March 2023 was set as a new deadline for the ARTEMIS mission. It is assumed that updated National Programme will form one of the basic documents for the mission execution.

9. Conclusion

Update of the National Programme for the Management of SNF and RAW in the SR was in progress in 2021, after providing input documents by the Board of the Governors of NJF. With regard to situation concerning COVID 19 pandemic, meetings took place in on-line form also in 2021. Document processing was also affected by restrictions in execution of home office working scheme.

The most of 19 established partial objectives in currently applicable National Programme are achieved or is in implementation stage respectively, as they are long-term objectives exceeding partial 6 years period of the National Programme implementation. 3 partial objectives have been performed with delays. Significant progress has been reported in the area of nuclear power plants (A1 NPP and V1 NPP) decommissioning and management of SNF and RAW, as main activities of the Final Stage of Peaceful Use of Nuclear Energy in the SR. These activities were in progress in conformity with project time tables and financial plans and in line with the National Programme.

Several on-line meetings concerning the preparation of the ARTEMIS review mission also took place in 2021.

Reimbursements of compulsory contributions and compulsory payments to NJF pursuant to the Act on NJF were still ongoing in 2021. They are accumulated for the purpose of the coverage of future costs for the Final stage of reactor and non-reactor nuclear installations.

Only preparation of documents for selection of contractors for the next stage of HU development, data processing and proposal of measures within the text of updated National Programme were in progress in the area of deep repository development in the SR throughout 2021. No financial resources for the coverage of costs in this field were withdrawn from NJF in 2021.

On the basis of the aforementioned facts, it may be possible to conclude that the National Policy in the SR was executed in conformity with the Directive 2011/70/EURATOM, and management of RAW and SNF was implemented in consistency with the National Programme for the management of SNF and RAW in the SR and with international good practice in 2021.

List of Acronyms

BIDSF	- Bohunice International Decommissioning Support Fund
DS	- Long-term storage
EBRD	- The European Bank for Reconstruction and Development
EC	- The European Commission
EMO	- Nuclear Power Plants Mochovce
EU	- The European Union
EURATOM	- The European Atomic Energy Community
FEI	- The Faculty of Electrical Engineering and Information Technology of Slovak University of Technology in Bratislava
FS LRAW	- nuclear installation: „The Final Treatment Centre for Liquid RAW“
HU	- The Deep repository
HVB	- Main production unit
IAEA	- International Atomic Energy Agency
IRAW	- Institutional Radioactive Waste
IS RAW	- Integral storage of RAW
JAVYS, a. s.	- Nuclear and Decommissioning Company, joint stock company
KPV	- Conceptual Decommissioning Plan
KV	- Complex test
LLW	- Low-Level Radioactive Waste
LRAW	- Liquid Radioactive Waste
MH SR	- The Ministry of Economy of the Slovak Republic
MSVP	- Interim Spent Fuel Storage Facility
MŽP SR	- The Ministry of Environment of the Slovak Republic
NI	- Nuclear Installation
NJF	- The National Nuclear Fund
NPP	- nuclear power plant
NR RAW	- The National Repository for Radioactive Waste
NRA SR	- The Nuclear Regulatory Authority of the Slovak Republic

PDS	- casings of Long-term storage
PHA SR	- The Public Health Authority of the Slovak Republic
PKV	- Precomplex test
PMU	- The Project Management Unit
RAW	- Radioactive Waste
RMNP	- Radioactive material of unknown origin
SE, a. s.	- Slovak Power Plants, joint stock company
SIEA	- The Slovak Innovation and Energy Agency
SNF	- spent nuclear fuel
SR	- The Slovak Republic
SRAW	- Solid Radioactive Waste
STU	- The Slovak University of Technology
THERAMIN	- project entitled „Thermal Treatment for Radioactive Waste Minimization and Hazard Reduction"
TK	- Transport Container
TSU RAW	- nuclear installation: „Technology for Treatment and Conditioning of RAW"
ÚJV	- The Institute for Nuclear Research, Czech Republic
VBK	- Fiber concrete container
VLLW	- Very Low-Level Radioactive Waste
ZČJE	- Final Stage of Nuclear Power Engineering
ZFK	- Facility for fixation of sludges