Report on the Implementation of the National Programme for Handling of Spent Nuclear Fuel and Radioactive Waste in Slovak Republic for the Year 2017

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List of abbreviations

AKOBOJE	Physical Area Protections and Barriers System
BIDSF	Bohunice International Decommissioning Support Fund
BM	Board meeting
Chrompik	aqueous solution of chromium and potassium dichromate $K_2Cr_2O_7$
ČR	The Czech Republic
EBO	Power plant Bohunice
EBRD	European Bank for Reconstruction and development
EC	The European Commission
EIA	Environmental Impact Assessment
EMO	Power plant Mochovce
EU	The European Union
EURATOM	European Atomic Energy Community
FCC	Fibre-concrete container
FS LRAW	Facility for Final Treatment and Conditioning of Liquid Radioactive Waste
HÚ	Deep Repository
IAEA	International Atomic Energy Agency
ILW	Intermediate-level Radioactive waste
IRAW	Institutional Radioactive Wastes
IS RAW	Integral Storage Facility for Radioactive Waste
ISDC	International Structure for Decommissioning Costing
ISFSF	Interim Spent Fuel Storage Facility
JAVYS, a. s.	Nuclear and Decommissioning Company/Jadrová a vyraďovacia spoločnosť
JOPRAD	project Joint Programme on Radioactive Waste Disposal
LLW	Low-level Radioactive Waste
LRAW	Liquid Radioactive Waste
MH SR	Ministry of Economy of the Slovak Republic
MŽP SR	Ministry of Environment of the Slovak Republic
NI	Nuclear Installation
NNF	National Nuclear Fund
NPP	Nuclear Powerplant
NR RAW	National Repository for RAW
NRA SR	National Regulatory Authority of the Slovak Republic
PDS	casings for long-term storage of RAW
PHA SR	Public Health Authority of the Slovak Republic
PMU	Project Management Unit
PO	Primary circuit
RAW	Radioactive Waste
SE, a. s.	Slovenské Elektrárne, /Slovak Power Plants, joint stock company
SIEA	Slovak Innovation and Energy Agency
SNF	Spent nuclear fuel
SNUS	Slovak Nuclear Society
SR	The Slovak Republic
STU	Slovak University of Technology
THERAMIN	project Thermal Treatment for Radioactive Waste Minimization and Hazard Reduction

TSÚ RAW	Nuclear installation: Technology of Treatment and Conditioning of RAW
ÚJV	Institute for Nuclear Research
VLLW	Very Low-Level radioactive waste
VUJE, a. s.	Research Institute of nuclear power engineering joint stock company
WWER	Water-water power reactor
ZMOS	Associations of Local Authorities

1 Introduction

The National Programme for implementation of the National Policy for handling of the spent nuclear fuel and radioactive waste [1] approved by the Government of the Slovak Republic by the Resolution No. 387 of July 8, 2015, was implemented in the second year of its existence in 2017. Pursuant to § 3a section 7 of the Act No. 238/2006 Coll. on the National Nuclear Fund , the Board of Governors of the Nuclear Fund 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 annually during the preceeding year and shall submit it to the Ministry of Economy of SR for approval supplemented by the Opinion of the Nuclear Regulatory Authority of SR.

The First Report [2] was developed to date December 31, 2016 and was submitted to the MH SR in March 2017 and subsequently authorized by MH SR. Submitted Report reviews to date December 31, 2017 implementation period of the National Programme [1]. The Report is based on information provided by MH SR, JAVYS, a. s., SE, a. s. and NNF follows on from the Report [2] for the period up to December 31, 2016 considering current progress in the area of the Final Stage of the Nuclear Power Engineering in SR during the year 2017 related to policies, intention and objectives specified in individual chapters of updated National Programme [1] for years 2015 – 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. Assessment of progress in NPP A1 and NPP V1 decommissioning and current status in progress in preparation of other NI decommissioning in SR is summarized in this chapter. In the context of partial objectives also process of preparation and approval of the new Act on NNF and text of government decree concerning new method for compulsory contributions and compulsory payments calculations for NI is assessed. Overview of inventory of RAW respectively SNF is updated in Chapters 3 and 4. Progress made in the area of development of deep repository is described in the Chapter 5 and 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 SR as well as current status of total assumed costs and way of securing of adequately accumulated funds to cover the costs are described in the Chapter 7. Recommendations for further period of implementation of the National Programme monitoring and initiatives for the next following update of the National Programme planned for 2020 – 2021 are summarized in the Chapter 8.

2 Meeting the objectives of the National Programme for handling of the spent fuel and radioactive wastes

Partial objectives of the National Programme [1] are grouped under six categories: infrastructure and legislation, decommissioning of nuclear installations, handling of radioactive wastes and the spent nuclear fuel in general, disposal of radioactive wastes and the spent nuclear fuel, research and development, transparency. Status of meeting those partial objectives to date December 31, 2017 is described in next sections followed by sequence numbers 2.1 to 2.19.

The area of infrastructure and legislation

2.1 To amend fundamentally the Act on the National Nuclear Fund and other subsequent documents until the end of 2016

Proposal of new Act on the National Nuclear Fund was submitted to Board Meeting (PV) of Ministry of Economy of SR in April 2017. Based on comments of the Union of Employers of Power Industry in

Slovakia specified in the letter of the Federation of employers´ associations of the Slovak Republic dated May 25, 2017 concerning the amount of levies of obliged entities payable to the National Nuclear Fund pursuant to proposal of the new Act on NNF and related proposal of the Government Decree and to baseline data for their determining, the approval of the Act was interrupted after preliminary comments proceedings. Therefore, working group was renewed consisting of representatives of all interested parties in order to approve jointly input parameters and procedure for fixing of the amount of compulsory contributions and compulsory payments to NNF.

In light of complicated negotiations, preparation and the fact that input data update threatened original term for submission of proposal of the act for Government negotiations until September 30, 2017, the MH SR asked the Prime Minister of SR for consent with change of term for submission of concerned document until September 30, 2018. By letter of the Prime Minister dated September 4, 2017 change of term for the task was approved until September 30, 2018.

At the meeting of working group in October 27, 2017 timetable for progress in preparation of Government Decree, establishing details on the amount, methods of collection and payment of compulsory contribution and compulsory payment to NNF and the Act on NNF approval process with the purpose to approve the act in the course of 2018 with effect from January 1, 2019 was discussed and adopted.

To date December 31, 2017 key input parameters namely costs for deep repository, operating period of NPP, as well as macroeconomic parameters were adopted by mutual agreement and methodology for determining the amount of compulsory contributions and compulsory payments to NNF was elaborated.

The Act is included in the Plan of legislative tasks of the Government of SR for 2018 with the term for submission to Government negotiations until September 30, 2018.

The task is underway

In area of decommissioning of nuclear installations

2.2 To complete the Stage II of NPP A1 decommissioning

Detailed evaluation was described in the Report for period to date December 31, 2016 [2]. The Stage III of NPP A1 decommissioning is in implementation from January 1, 2017 (see the task 2.3 bellow for details).

The task is completed.

2.3 To implement further stages of NPP A1 decommissioning until the end of 2033

In implementation of continual process of NPP A1 decommissioning and Stage III and IV of decommissioning is executed from January 1, 2017 with the planned date of completion in 2024, based on Decision of NRA of SR No. 369/2016, which issued permission for implementation of the Stage III and IV in scope specified in document "The Plan of the Stage III and IV for NPP A1 decommissioning" [3] and in relation to document "The Plan for handling and transport of RAW and the plan for handling of conventional waste from the Stage III and IV from NPP A1 decommissioning" [4]. Subsequent Stage V of decommissioning is planned for the period 2025 – 2033.

Main subject of the Stage III and IV is decommissioning of technological facilities and rooms of objects 30 – reactor building, 32 – supporting engine room, 34 engine room and main reactor building, outside objects such as object 28 – gas management, tanks of object 44/10 and processing of liquid RAW predominantly chrompik (aqueous solution of chromium and potassium dichromate $K_2Cr_2O_7$) and sludges including handling of contaminated soils and concrete in following categories:

- The Stage III of decommissioning (2017 – 2020):
    - Remaining smaller equipment of original operation sets of transport-technology equipment not substantially contaminated,
    - Remaining equipment of supporting systems for D_2O and CO_2 management,
    - Remaining equipment for fuel transport,
    - Equipment for preparation of manipulated fuel for transport,
    - Equipment for preparation of manipulated fuel for transport, conditioned for preparation of nonmanipulated fuel,
    - Equipment for preparation of nonmanipulated fuel for transport. In addition to standard dismantling by rooms specific dismantling by technology assemblies for bigger construction components to significant extent will be applied. For equipment of this kind especially for facilities for preparation of fuel for transport specific decommissioning project need to be developed.
- The Stage IV of decommissioning (2021 – 2024):
    - Facilities of primary circuit in object No. 30 (Reactor building) – pipeline of primary circuit, sectional fitting,
    - Facilities of primary circuit in object 32 (supporting engine room) – pipeline of primary circuit, turbo compressors,
    - Other equipment with higher contamination.

PHA SR successively authorized developed programmes for required services in individual rooms of given objects according to timetable until the end of 2017. Pre-dismantling decontamination and dismantling of technology facilities in objects 30, 32 and 28 and handling of material including classification, monitoring and handling of RAW were gradually implemented. Sludges from tanks of object 44/10 and sludges of long-term storage were continually processed. Contaminated soils and concrete were taken out, classified and packaged. Throughout ten campaigns of vitrification 2 000 litres out of total volume of 13 m^3 of transparent phase of chrompik III were processed. Processing of casings for long-term storage of SNF took place, supporting and development works for handling of sludges after chrompik treatment, monitoring of characteristics of fixed product and radiation monitoring were implemented.

Works were executed and coordinated in accordance with the document "Plan for the Stage III and IV of NPP A1 decommissioning" with breakdown of technical and time implementation of individual tasks and subtasks of project including timetable. Continuous monitoring of progress in decommissioning project took place at the technical level in the context of individual tasks and also via monthly reports submitted by contractor and approved by JAVYS, a. s. These reports were presented at regular monthly meetings of project management.

The task is underway.

2.4 To implement the Stage II of NPP V1 decommissioning until the end of 2025

Implementation of the Stage II of NPP V1 decommissioning started in January 1, 2015 based on the Decision of NRA SR 900/2014 issued in December 23, 2014. Implementation of the Stage II of NPP V1 decommissioning is underway in accordance with approved plan for the Stage II and is scheduled up to December 31, 2025. NPP V1 decommissioning is implemented in form of subprojects.

In 2017 following projects were implemented:

Table No. 1: Projects implemented in 2017 within NPP V1 decommissioning

Project number	Title of the project
A1.8	PMU Consultant (the Stage 8)
A5-A2	Change of electrical supply system of JAVYS after final shutdown of NPP V1
A5-A3	Optimization of electrical scheme
B6.6A	Underpinning research for decommissioning
C7-A4	Facility for remelting of metallic RAW
C8	Integral Storage Facility for RAW in Bohunice locality
C9.4	Proposal for building of new disposal structures for LLW and VLLW from NPP V1 decommissioning in NR RAW Mochovce
C15-A	Integrated computer system for NPP V1 decommissioning logistics
D0	Implementation of decommissioning programme using human resources available in NPP V1 Bohunice
D2-A	Decontamination of PO (primary circuit) – the Stage II
D2.1	Decontamination of storage pools and other contaminated tanks of NPP V1 – the 1. part
D3.1B	Dismantling and demolition of cooling towers of NPP V1
D4.1	Modification of powerplant and installation of new facilities
D4.2	Dismantling of large system components of primary circuit
D4.3A	Dismantling of insulations of NPP V1 controlled area
D4.4A	Dismantling of systems of auxiliary building – the Stage I
D4.4A1	Modification of facilities in Physical Area Protections and Barriers System (AKOBOJE)
D4.4B	Dismantling of systems in controlled area of NPP V1 – the 1. part
D4.4C	Dismantling of systems in controlled area of NPP V1 –the 2. part
D19	Innovation and completion of hardware equipment of PMU
D4.7	Merged activities D4.5, D4.6 and D4.7 Decontamination of buildings, Demolition of objects and backfilling pits, restoration of NPP V1 area
DMS	Management system of documentation

Among the most important activities of 2017 are completion of construction of Integral Storage, Facility, beginning of demolition of cooling towers, completion of the Stage II of primary circuit decontamination, continuation in construction of new disposal structure in NR RAW and signing of the contract, and also beginning of project preparation for dismantling of large systems components of primary circuit.

Current state of NPP V1 decommissioning to date December 31, 2017 is in accordance with planned timetable for decommissioning with some delay in some projects concerning timetable of 2014. Nevertheless, these is an assumption that principle objective of NPP V1 decommissioning will be achieved until the end of 2025. Progress in overall implementation and in individual projects is continuously monitored via monthly and semiannually reports and meeting of managers of individual BIDSF projects, representatives of the consultant and EBRD and also via meetings of monitoring committee at biannual meetings with participation of JAVYS, a. s., SIEA, NNF, MH SR, representative of EBRD and The European Commission.

The task is underway

2.5 Maximum use of BIDSF funding for NPP V1 decommissioning projects

To date December 31, 2017 EBRD approved in total 18 Grant Agreements for total sum of € 467 million within which cumulative amount of € 258,5 million was withdrawn to date December 31, 2017 for implementation of NPP V1 decommissioning projects. Amount of guaranteed allocated funds from the EU provided through SIEA amounts to € 26 million, whereby € 0,34 million of this amount was withdrawn to December 31, 2017.

Out of total number of 81 NPP V1 decommissioning projects was mostly 67 projects allocated from the EU to date December 31, 2017.

Estimated total costs for NPP V1 decommissioning (stated in the price level of 2017) amounts to € 1 237 million, whereby the amount of € 671 million is to be reimbursed from the EU.

The task is underway

2.6 Preparation for decommissioning of other NI

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 in line with the requirements under the Act No. 541/2004 Coll. on Peaceful Uses of Nuclear Energy and on amending and supplementing certain acts and the Regulation of NRA SR No. 58/2006 Coll.

Conceptual plans for decommissioning of NPP EBO V2 and NPP EMO 1, 2 [5], [6] were updated in 2017 on account of updated database of NPP facilities, what represents one of primary inputs for establishing costs for decommissioning under ISDC structure, whereby these conceptual plans for decommissioning were elaborated in variant for 60 years of operating life for NPP V2 and NPP EMO 1, 2, what corresponds to the year 2045 for shutdown of NPP V2 and the year 2061 for NPP EMO 1, 2. These updated conceptual plans for decommissioning will be based in 2018 on requirement of NRA SR supplemented by cost comparison in variant for NPP operating life for 40 years.

In order to determine costs for non-reactor installations decommissioning, conceptual plans for decommissioning of other nuclear installations than installations for generating electricity [7], concerning methodology for amount of compulsory payments calculation to NNF were also elaborated.

The task is underway.

Area for handling of radioactive wastes and the spent nuclear fuel in general

2.7 To build and commission Integral Storage Facility for RAW in Jaslovské Bohunice until the end of 2018

Construction of Integral Storage Facility for RAW was completed in 2017, commissioning was executed based on Decision of NRA SR of October 10, 2017. Building permit and permit for bringing the object into use were issued.

The task is completed

2.8 To build new storage capacities for SNF until the end of 2020

Construction of new storage capacities of SNF as a prerequisite for safe operation of nuclear units in SR was reviewed in the process under the Act No. 24/2006 Coll. on environmental impact assessment as amended, on the basis of which Concluding Opinion of Ministry of Environment of SR to proposed

activity No. 1064/2016 -3.4/hp, was issued in 02/2016 recommending implementation of proposed activity "Completion of storage capacity of SNF in locality of Jaslovské Bohunice".

Processing of documentation for submission of application for construction permit in 2017 was administered with estimated date of issuance of construction permit June 10, 2019 and estimated date of finalisation of storage capacities completion with subsequent test operation in 2020 – 2021.

The task is underway

2.9 To establish database of all radioactive wastes from unclear installations in SR and ensure its continuous update until the end of 2016

Assessment of this task was described in detail in the Report for the period to December 31, 2016 [2].

The task is completed

2.10 To construct Facility for remelting of metallic radioactive wastes until the end of 2018

Facility for remelting of metallic RAW, preparation of which started in 2016, was in 2017 in process of designing and obtaining of authorization for construction. The authorization for construction was issued in December 2017. Subsequently the delivery took place and design implementing documentation and implementation works programmes have been developed.

The activity is implemented within the projects for NPP V1 decommissioning (C7-A4) with coverage of 19% funding from BIDSF and 81% from the NNF and JAVYS, a. s. Finalisation including tests is expected until the end of 2018.

The contract with selected supplier was concluded in 2017 and preparation of investment activity and processing of project supporting documents for authorization for construction including implementation project supporting documents took place. NRA SR issued by Decision of December 6, 2017 authorisation for construction. During preparation stage challenges occurred in processing of implementation project caused by uncertainties concerning supply of melting furnace itself, which may present risk for respecting original intention of facility construction and its successful commissioning until the end of 2018.

The task is underway

2.11 To construct and commission Facilities for handling of IRAW and Captured Radioactive materials until the end of 2016

Facility for handling of IRAW and captured radioactive materials was commissioned in 02/2016. Detailed assessment was described in the Report for the period to December 31, 2016[2].

The task is completed

The area of handling of radioactive wastes and the spent nuclear fuel

2.12 To construct the Repository for Very Low-Level Waste until the end of 2018

The first module for Very Low-Level waste from NPP A1 included in National Repository for RAW was commissioned in 06/2016. Construction of the second module of disposal places for Very Low-Level waste from NPP V1 took place in 2017 within BIDSF project C9.4. The second module (disposal space with system of barriers ready for coverage by sliding shelter) was completed in September 2017 and in October after test procedures was transferred to operator of National Repository for RAW. Inspection took place and the permit for bringing into use was issued in December 2017.

The task is completed

2.13 To construct other disposal structure after filling of the second double row of NR RAW until the end of 2018

Within the project of C9.4 preparatory works for building site under the Double row 3 took place and based on authorization for construction of March 2, 2017 construction of the Double row 3 itself of Low-level waste repository started. Terrain works and strengthening of ground under space of disposal boxes and implementation of concrete part of construction took place until the end of 2017. Completion of the Double row 3 implementation including test procedures is planned at the beginning of 2019.

The task is underway

2.14 To adopt decision on continuation or withdrawal from twin approach in development of deep disposal – comprehensive assessment of the idea of joint international deep repository until the end of 2020

As indicated in point 2.4.5 siting of Deep repository in SR will be possible to be decided finally until the end of 2030 and the idea of international deep repository is still one of existing possibilities for several EU states. Therefore, it is appropriate to continue in twin approach of development of deep disposal and to postpone the decision on continuation respectively stopping of twin approach until the end of 2030.

No activity was performed aimed at using of twin approach that is to say development of deep repository in 2017. Slovakia did not participate in activities of this kind and was not involved in this development in 2017. All activities implemented in 2017 were aimed at development of "own" Deep Repository in SR.

The task is underway

2.15 To elaborate plan for further stages of renewed development of deep disposal until the end of 2016

Implementation of the project "Deep Repository – locality selection of the Stage 1", which included also "Proposal for further progress for development of Deep Repository in SR" was completed in 2016. In this context the task of December 31, 2016 was considered to be **completed**. Contract with group of suppliers (State Geological Institute of Dionýz Štúr, Bratislava, ÚJV Řež, a. s., Husinec, ČR; DECOM, a. s. Trnava) was concluded. One of subtasks is to submit inter alia also detailed plan of progress in development of Deep Repository in SR for the period of 2019 – 2024. Other subtasks the group was worked on in 2017 and results of which should be submitted in 2018 are as follows:

- Preparation of geological task project,
- To develop and prepare to implement system for economic stimulations of localities affected by development and operation of repositories and
- Framework programme for development and research in the area of Deep Repository for all stages and for all areas of Deep Repository development.

In the context of document development in 2018 also technical specification for selection of general contractor for implementation of further progress in development of Deep Repository should be developed.

2.16 To decide on siting of Deep Repository of SR (in case of withdrawal from twin approach) until the end of 2030

As a part of the project "Deep Repository – locality selection the Stage II – the Part 1" it is expected in 2017 – 2018 inter alia elaboration of "Project of geological task" pursuant to the Act No. 569/2007 Coll. on geological works (Geological Act) as amended and the Regulation No. 51/2008 Coll. implementing Geological Act as amended built upon the existing works and supporting documents concerning locality selection based on selection criteria. Procedure of geological activities, terrain and exploratory works in selected localities and public participation are considered in such a manner as it would be possible (in case of withdrawal from twin approach) to adopt final decision on siting of Deep Repository of SR up to 2030. At the same time, it should be of a vital priority for competent state institutions in SR to issue document with unequivocal statement, who under which conditions adopt this decision, respectively will be able to adopt it.

The task is underway

2.17 To commission of Deep Repository until the end of 2065

Implementation of the project "Deep Repository – locality selection the Stage I", completed in 2016 and implementation of the project "Deep Repository – locality selection the Stage II– part 1", which took place in 2017 and will be completed in the first half of 2018 should ensure basic conditions for steps leading to locality selection for construction of Deep Repository in SR in such a manner as it would be possible in case of withdrawal from twin approach to ensure construction and commissioning of Deep Repository in SR up to 2065.

The task is underway

Development and research

2.18 To develop framework programme for development and research in the area of deep disposal and set internal conditions for its implementation until the end of 2018

Within implementation of project "Deep repository – selection of locality the Stage II– the Part 1", ongoing in 2017 – 2018 the document in compliance with detailed work plan for further period and proposal of further progress of development of Deep repository in SR will be generated. The document is entitled "Framework programme for development and research in the area of deep disposal including requirements for its implementation". Based on this document conditions for its subsequent implementation in expected date will be set in JAVYS, a. s.

The task is underway

Transparency

2.19 To develop and prepare to implement system for economic stimulation of localities affected by development and operation of repositories. To establish unified system for information and public relations for long-term period until the end of 2018

No meetings, presentations, communications with the public took place in 2017 and no supporting documents or information on Deep Repository, planned process of its development and locality selection were provided. Proposal for unified system for information and public relations for long-term period including proposal for economic stimulation of localities affected by development and operation of repositories will be provided by group of contractors in the first half of 2018. After signing

the contract in July 2017 these proposals were processed based also on documents of 2016 and on recent experiences and were discussed continuously at the project meetings with JAVYS, a. s.

In addition to the task No. 2.19 concerning public information in the area of Deep Repository, the Chapter 8 of the National Programme [1] includes policies described in the following three points.

1. *To continue to inform the public in the manner and to the minimum extent in the same way as implementer of activities for handling of RAW and SNF applies at present.*

   This policy is underway. The public was informed of the activities, procedures and status in the area of the Final Stage of Nuclear Power Engineering primarily in a form of written information issued as annual reports, bulletins, leaflets, magazine JAVYS, a. s. „U nás“, information available on websites of JAVYS, a. s. SE, a. s. and the NNF, regular meetings with representatives of ZMOS, and also within information centres in Jaslovské Bohunice and Mochovce.

2. *To ensure respective processes of EIA were launched as far in advance as possible of intended activity in order to become real instruments for decision making process – this is responsibility of Ministry of Environment of SR in cooperation with Ministry of Economy of SR, National Regulatory Authority and the implementer.*

   No environmental impact assessment was conducted in 2017. This policy is underway.

3. *To proceed to reasonable selection of techniques for public participation and to start their systematic use – this ensures in case of need Ministry of Economy in cooperation with the National Nuclear Fund and the implementer.*

   Selection of techniques for public participation is included in proposal for public participation in the area of preparation for Deep Repository, which is to be submitted in the first half of 2018.

3 Handling of RAW

Overview data of RAW for the period since previous review of the National Programme implementation is included in the report [2] up to December 31, 2017 and listed under individual areas for handling of RAW.

3.1 Overview of generating and recording of RAW

For the period since previous review of the National Programme implementation for execution of the National Policy for handling of the spent fuel and radioactive wastes [1], therefore, for the year 2017 there were following quantities and types of RAW from implemented activities of decommissioning and operation of nuclear installations transferred to company JAVYS, a. s.

3.1.1 NPP A1 decommissioning:

- Liquid radioactive wastes: 524,4 m^3
- Combustible solid radioactive wastes: 22,639 t,
- Compressible solid radioactive wastes: 206,277 t,
- Metallic RAW intended for remelting: 172,661 t,
- Other solid radioactive wastes (fixed ra-sludges in matrix and so on): 111,743 t,
- Contaminated soils: 2 205,2 t,
- Contaminated concrete: 347,4 t,

- Contaminated used filter cartridges of ventilation systems: 2,923 t.

3.1.2 NPP V1 decommissioning:

- Liquid radioactive wastes: 367,37 m^3,
- Combustible solid radioactive wastes: 4,242 t,
- Compressible solid radioactive wastes: 7,264 t,
- Metallic RAW: 4,109 t,
- Contaminated used filter cartridges of ventilation systems: 1,972 t.

3.1.3 Generated from NPP operation of NPP V2 and NPP EMO 1,2 transferred by company SE, a. s. following types and quantities of RAW are located in JAVYS, a. s. for their further handling:

- Liquid radioactive wastes – concentrates: 10,8 m^3,
- Liquid radioactive wastes – ion exchange resins: 47,558 m^3,
- Solid radioactive wastes – combustible: 27,458 t,
- Solid radioactive wastes – compressible: 18,596 t.

3.2 Processing and conditioning of RAW

3.2.1 In NI Technology of Treatment and Conditioning of RAW following activities for handling of RAW were implemented:

- Incineration of RAW – by incineration were processed:
  - 29,758 t of solid RAW from nuclear facility decommissioning,
  - 31,979 t of solid RAW from nuclear facility operation,
  - 0,24 m^3 of combustible liquid RAW and spent sorbents from nuclear facility decommissioning,
  - 13,329 m^3 of combustible liquid RAW and spent sorbents from nuclear facility operation.
- High pressure compression of solid RAW – by high pressure compression were processed:
  - 416,972 t of compressible solid RAW from nuclear facility decommissioning,
  - 34,676 t of compressible solid RAW from nuclear facility operation.
- Cementation of RAW – by cementation into FCC were conditioned:
  - 319,85 t of solid RAW from nuclear facility decommissioning,
  - 22,191 t of solid RAW from nuclear facility operation,
  - 231,967 m^3 of LRAW from decommissioning,
  - 11,833 m^3 of LRAW from nuclear facility operation.
- By fragmentation were processed:
  - 255,742 t of metallic RAW from nuclear facility decommissioning.
- By decontamination were processed:

- 243,839 t of metallic RAW from nuclear facility decommissioning.

3.2.2 Following activities for handling of RAW were implemented in other specialized technology facilities of JAVYS, a. s.

- Vitrification line for chrompik (aqueous solution of chromium and potassium dichromate $K_2Cr_2O_7$)
  - there were processed 2 m^3 of chrompik III.
- Work place for handling of contaminated concrete:
  - there were processed 347,4 t of contaminated concrete.
- Work place for fragmentation of casings of long-term store:
  - there were processed 33 pieces of upper parts of casings of long-term store.
- Facility for fixation of sludges:
  - there were 24,85 m^3 of ra-sludges fixed into cement matrix.

3.2.3 Nuclear Facility for Final Treatment and Conditioning of LRAW JAVYS, a. s. in Mochovce

- There were processed and conditioned predominantly by bitumenation of spent sorbents and by cementation:
  - 91,493 m^3 of RAW from nuclear facility decommissioning,
  - 91,217 m^3 of LRAW from nuclear facility NPP EMO 1, 2 operation.

3.3 Storage of RAW

3.3.1 Storage in nuclear facility Technology of Treatment and Conditioning of RAW JAVYS, a. s.
To date December 31,2017 in locality Jaslovské Bohunice there were stored following quantities in certified stores of RAW forming part of nuclear facility Technology of Treatment and Conditioning of RAW:

- Room No. 30/54 in the object 32 – 3 174 pieces of drums of RAW to volume of 0,2 m^3,
- Room No. 97 in the object 32 – 1 489 pieces of drums of RAW to volume of 0,2 m^3,
- Room No. 106 in the object 32 – 1 361 pieces of drums of RAW to volume of 0,2 m^3,
- Room No. 1 in the object 34 – 2 824 pieces of RAW to volume of 0,2 m^3,
- Object No. 723 – 708 pieces of drums of RAW to volume of 0,2 m^3,
- Object No. 641 – 1 088 pieces of drums to 0,2 m^3 and 59 containers of 2EM01 of RAW.

3.3.2 Storage in SE a. s.
To date December 31, 2017 in stores of NPP V2 following quantities were stored:

- 122,824 t of solid RAW,
- 1 504,9 m^3 of concentrates,
- 136,8 m^3 of ion exchangers.

To date December 31, 2017 in stores of EMO 1, 2 following quantities were stored:

- 7,961 t of solid RAW,

- 1 077,1 m^3 of concentrates,
- 59,1 m^3 of ion exchangers.

3.4 Disposal of RAW

3.4.1 Disposal of FCC in nuclear facility National Repository for RAW Mochovce

- To date December 31, 2017 were in the National Repository for RAW deposited together 5 158 pieces of fibre concrete containers from decommissioning and from operation of nuclear facility while for the period of 2017, 354 pieces of FCC were transported and subsequently deposited into this facility.

3.4.2 Disposal to repository for VLLW

For the period of 2017 were deposited 2 408,47 m^3 of VLLW from NPP A1 decommissioning and 168,48 $m^3$from NPP V1 decommissioning into this facility (the first disposal module having capacity of 20 000 m^3).

4 Handling of SNF

Activities relate to handling of SNF are assessed for the period since previous review of implementation of the National Programme, what is included in the report [2] up to December 31, 2017.

4.1 Acceptance of SNF for storage

For the period since previous review of the National Programme implementation for execution of the National Policy for handling of the spent nuclear fuel and radioactive wastes, therefore for the period of 2017, following quantities of SNF were transferred from NPP V2 and NPP EMO 1, 2 operation to nuclear facility Interim Spent Fuel Storage Facility for long-term storage by company SE, a. s.

- The Spent nuclear fuel from NPP V2 operation: 132 pieces,
- The Spent nuclear fuel from NPP EMO 1, 2 operation: 144 pieces.

4.2 Storage of SNF

To date December 31, 2017 were disposed of 12 042 pieces of SNF assemblies in Interim Spent Fuel Storage Facility, out of this:

- 5 143 pieces from NPP V1,
- 4 979 pieces from NPP V2,
- 1 920 pieces from NPP EMO 1, 2.

5 Proposed Programme of works on development of Deep Repository in subsequent years

In the context of the National Programme Implementation Report developed for the period up to December 31, 2016 [2], it was expected, the documents presenting the development of Deep Repository the Stage II – part 1 will be elaborated in 2017 –2018 under following structure:

- To elaborate framework programme for development and research in the area of deep disposal including requirements for its implementation,
- To develop and prepare to implement system for economic stimulation of localities affected by development and operation of Deep Repository,

- *Preparation and ensuring of task implementation resulting from the plan of works for further period within the project „Deep Repository – locality selection, the Stage II – part 2" from 2018,*

- To launch an information campaign of public relations, establishing of working groups included representatives of municipalities and the general public.

Since outputs of group of contractors based on the Contract from 07/2017 will be submitted in the first half of 2018 and it is expected for further progress to carry out selection of general contractor, delay by around 1 year occurs. Therefore, information on selected techniques and strategy may be provided for in the report for 2018. This delay will be examined at the next following update of the National Programme. It is possible to expect however that up to date timetable for development Deep Repository given in the National Programme will be met.

Research focused on safety review support and research focused on safety demonstration of Deep Repository forms part of framework programme for development and research. As fundamental criterion for achievement of safe disposal of the spent nuclear fuel and RAW is the protection of health of future generations, it is necessary to review the criteria of maximal exposure limit of ionising radiation for population from disposed RAW resulting from possible release of radioactive substances into the environment in future. Equally, it is necessary to determine the duration of the period during which Deep Repository ought to safely isolate RAW from surrounding environment and to define possible geological processes, which may impact the repository in future. Early indication of framework criteria will have positive effect on technical solution for repository and also on package forms of the spent nuclear fuel, respectively other RAW not disposable in the National Repository for RAW.

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

In addition to described area of Deep Repository in terms of research, development and demonstration activities, following research and development activities implemented in 2017 are listed in the table:

Table No. 2: Projects/activities focused on research and development activities in 2017

Project/activity title and content	**Responsible organization in SR**	**User of output**	**Financing method**
Assessment of operating life of WWER units, ageing of materials	Center for science and research, s.r.o., subsidiary of SE, a. s.	SE, a. s.	By resources of SE, a. s.
THERAMIN thermal treatment of waste intended to minimisation of RAW and risk reduction	VUJE, a. s.	The European Commission, user of partial outputs JAVYS, a. s.	The European Commission, H2020 Euratom programme
Development of fixation matrix for sludges of chrompik	VUJE under NPP A1 decommissioning activities	JAVYS, a. s.	By resources of NNF under NPP A1 decommissioning costs
Development of containers for ILW RAW from NPP V1 decommissioning	AIMEC Nuclear Slovakia	Consortium of company Westinghouse	Under the project D4.2 BIDSF costs

Project/activity title and content	Responsible organization in SR	User of output	Financing method
JOPRAD preparation of the conditions for joint programme in RAW disposal	JAVYS, a. s., STU in Bratislava	The European Commission, all organizations engaged	The European Commission, H2020 Euratom programme
ECED 2017	SNUS, STU in Bratislava	Professional public	By reimbursement of conference fees and sponsorship

7 Evaluation concerning Chapter 7 Plan for costs

In evaluation of funds necessary to cover the costs of the Final Stage of Nuclear Power Engineering in relation to Chapter 7 of the National Programme containing data on assumed total costs in price level in 2014 (€ 8 000 million), figures at December 31, 2017 are given below:

- Total amount of funds collected in the NNF accounts: € 1 522,8 million,
- Amount of funds spent to cover costs of sub-account: NPP A1: € 637,4 million,
- Amount of funds spent to cover costs of sub-account NPP V1: € 182,7 million (included SNF storage),
- Amount of costs spent for RAW disposal from NPP A1 and NPP V1 in National Repository for RAW: € 35,0 million,
- Amount of funds spent for development of Deep Repository: € 2,8 million.

To date December 31, 2017 total amount of funds spent for NPP A1 and NPP V1 decommissioning (including SNF storage and RAW disposal in National Repository for RAW in Mochovce) corresponds to the amount of € 855,0 million of the NNF resources and to the amount of € 258,8 million of the EU resources.

Methodology for determining the amount of compulsory contributions and compulsory payments to the NNF for ensuring financial resources for coverage of costs for the final stage of operated facilities was elaborated in 2017 within preparation of new law on the NNF, based on level of expected costs including proportion of nuclear installations impact on Deep Repository costs corresponding to updated figure € 3 573,4 million. The level of compulsory contributions for operating nuclear power plants and reimbursement thereof, defined in the forthcoming Government Decree with the forecasted entry into force from 2019, will not jeopardize the stability of electricity supply in SR.

Transfer from MH SR acquired in form of delivery collected by operators of distribution and transmission systems included in payments of end users for delivery electricity serves for ensuring resources for NPP A1 and NPP V1 decommissioning.

8 Proposals for modifications of the National Programme, its structure and content in forthcoming revision

The European Commission issued the report „Progress of Implementation of Council Directive 2011/70/EURATOM“[7] in May 2017 representing the first report evaluating national programmes for handling of RAW and SNF developed in the sense of Directive 2011/70/EURATOM. Basic data concerning ensuring a solution for the Final Stage of Nuclear Power Engineering in SR is included in this report. Although abovementioned report contains no particular assessment of national

programmes of individual states, it is possible to identify areas for potential improvements within programme update. This update for the National Programme of SR was defined after 6 years from approval of the National Programme [1] by the Government of SR, therefore in 2021. The EC organized 1-day workshop on abovementioned report in November 2017, at which representatives of MH SR, NRA SR and NNF participated and at which some aspects of national programmes were presented and discussed. In addition to key issue of development of deep repositories, aspect of monitoring of national programmes and their progress is highlighted in EC report, pursuant to the Article 12 of Directive 2011/70/EURATOM, according to which is necessary to specify responsibilities, milestones and indicators of monitoring and implementation of programmes. Establishment of key performance indicators and evaluation of programmes implementation is considered to be a priority by EC, while bearing in mind own evaluation of programme implementation, preparation and execution of national programmes peer review.

NNF proposes to conduct peer review in SR in 2020 using monitoring programme ARTEMIS implemented by IAEA. Until such time the NNF will pay attention to reports on outcomes of similar peer reviews in other member states of EU. It is assumed that conclusions and recommendations from peer review of the National Programme will also contribute to improvements in update thereof. Furthermore, information obtained from analysing of programmes of other member states will become source of incentives for update of the National Programme of SR in addition to intended update of economical part and taking into account technical and scientific progress in the field of decommissioning of nuclear installations and handling of SNF and RAW.

9 Conclusion

For first three years of implementation of the National policy for Handling of the Spent Nuclear Fuel and Radioactive Waste and proposal of the National Programme for implementation of the National Policy, progress has been made not only in achieving partial objectives of the National Programme but also in the area of nuclear power plants decommissioning (NPP A1 and NPP V1) and handling of RAW and SNF representing principal activities of the Final Stage of Peaceful Uses of Nuclear Energy in SR. Also progress in the area of the methodology for determining the amount of compulsory contributions and compulsory payments intended for coverage of costs for final stage of operated nuclear installations within preparation of new law on the NNF based on jointly elaborated and approved methodology, which will be integrated in the sense of new law on the NNF in updated National Programme may be included in results achieved in 2017.

Decommissioning of nuclear power plants NPP A1 and NPP V1 and also handling of RAW and SNF were in progress in 2017 in compliance with project timetables, the National Programme and financing plans in the area of costs reimbursement for the Final Stage of Peaceful Uses of Nuclear Energy in SR. Although progress in the area of development of Deep Repository in SR for 2017 is not significant, this issue is viewed as one of the key priorities and increasingly gaining in importance and in need to define legitimate procedure accepted also by public.

Based on the first overall assessment of national programmes by EC issued in 2017, it may be noted that the National Policy in SR is implemented in accordance with the Directive 2011/70/EURATOM and handling of RAW and SNF is implemented in line with the international best practice.

10 References

[1] The National Nuclear Fund for Decommissioning of Nuclear Installations and for Handling of the Spent Nuclear Fuel and Radioactive Wastes: The National Programme for Handling of the Spent Nuclear Fuel and Radioactive Wastes in SR, Slovak Republic: NNF, July 8, 2015.

[2] The National Nuclear Fund for Decommissioning of Nuclear Installations and for Handling of the Spent Nuclear Fuel and Radioactive Wastes: The National Programme Implementation Report for execution of the National Policy for Handling of the Spent Nuclear Fuel and Radioactive Wastes at the date of December 31, 2016, Slovak Republic: NNF.

[3] Jadrová a vyraďovacia spoločnosť, a. s.: The Plan for the Stage III and IV of NPP A1 decommissioning. Issue No. 1, Revision No. 1. Slovak Republic: JAVYS, a. s., August 2015. Registration number JAVYS/2410/VJEA1/SPR.

[4] The Plan for handling and transport of RAW and the Plan for handling with conventional waste from the Stage III and IV of NPP A1 decommissioning.

[5] Slovenské elektrárne, a. s.: Update of Conceptual Plan for NPP EBO V2 decommissioning and generation of input inventory database of decommissioning. Slovak Republic: SE, a. s., October 2017.

[6] Slovenské elektrárne, a. s.: Update of Conceptual Plan for NPP EMO 1, 2 decommissioning and generation of input inventory database of decommissioning. Slovak Republic: SE, a. s., November 2017.

[7] Daniška V. at al.: Costs for non-reactor nuclear installations decommissioning, DECOM, a. s. No. TED/STD/VUJE/SK/006/12. Slovak Republic: DECOM, a. s., February 2012.

[8] European Commission: Progress of Implementation of Council Directive 2011/70/EURATOM. Brussels: European Commission, May 15, 2017.

11 Legislative documents

- The Act No. 238/2006 Coll. on the National Nuclear Fund for Decommissioning of Nuclear Installations and for Handling of the Spent Nuclear Fuel and Radioactive Wastes (The Act on the Nuclear Fund) and amending and supplementing certain acts.
- The Act No. 541/2004 Coll. on Peaceful Uses of Nuclear Energy (The Atomic Act) and amending and supplementing certain acts.
- The Act No. 24/2006 Coll. on Environmental Impact Assessment and amending and supplementing certain acts.
- The Act No. 569/2007 Coll. on Geological Works (The Geological Act).
- Regulation of Ministry of Environment of the Slovak Republic No. 51/2008 Coll. implementing Geological Act.
- Council Directive 2011/70/EURATOM of July 19, 2011 establishing framework of Community for Responsible and Safe Handling of the Spent Nuclear Fuel and Radioactive Waste.