

# **PREPARATION FOR V1 NPP DECOMMISSIONING**



**NUSIM 2010**  
**18th Annual Nuclear Seminar and Information Meeting**  
April 28-29, 2010  
Častá -Papiernička

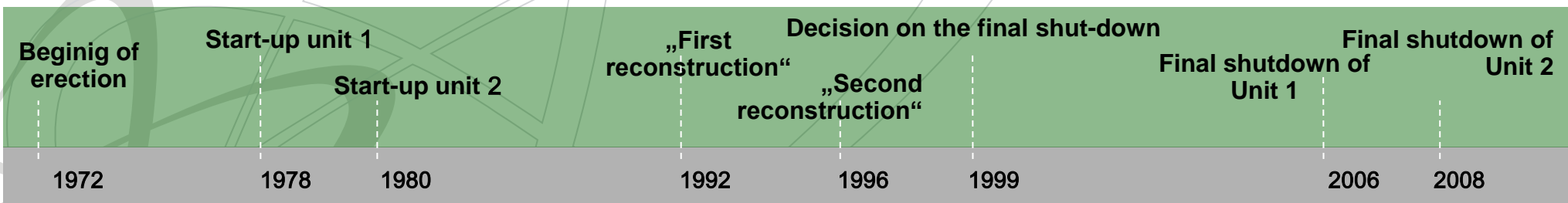
**MIROSLAV OBERT**  
Director of V1 Division

- ❑ **Introduction V1 NPP – Jaslovské Bohunice**
- ❑ **Governmental decision – V1 NPP shutdown**
- ❑ **Legislative aspects**
- ❑ **Funding – BIDSF / National Nuclear Fund**
- ❑ **Termination of operation**
- ❑ **Identification of the BIDSF projects**

# INTRODUCTION OF V1 NPP



<b>2 x WWER 440-V230</b>
<b>Fuel: UO<sub>2</sub> 2,5% U-235</b>
<b>Moderator: H<sub>2</sub>O</b>
<b>Coolant: H<sub>2</sub>O</b>
<b>Units/NPP: 2</b>
<b>Steamgenerators: 6 x 2</b>
<b>Turbines: 2 x 2</b>



## GOVERNMENTAL DECISION – V1 NPP SHUTDOWN

Based on the **accession negotiations** between the SR and the European Union on the **SR joining the EU** the Regulation of the Government of the SR No. 801/1999 was adopted on 14 Sept. 1999. Realistic deadlines for **premature shutdown of V1 NPP** were approved:

- **Shut-down of Unit 1: 31 Dec. 2006**
- **Shut-down of Unit 2: 31 Dec. 2008**

**Units 1 & 2 were shut-down in compliance with the above Regulation on 31 Dec. 2006 and 31 Dec. 2008, respectively.**

- **Act No. 541/2004 Coll.** on peaceful use of nuclear energy, as amended („Atomic Act“), of 9 Sept. 2004 sets forth in § 20 that **after the operation** of a nuclear facility **is terminated**, the **operation license shall be replaced by decommissioning license**.
- The **scope of documentation** necessary for granting decommissioning license is **defined by NRA SR Regulation No. 58/2006 Coll.** of 12 Jan. 2006.
- Based on the Regulation, a **Conceptual Decommissioning Plan (CDP)** for decommissioning of V1 NPP was developed.

## V1 NPP Conceptual Decommissioning Plan

### BIDSF project B6.1

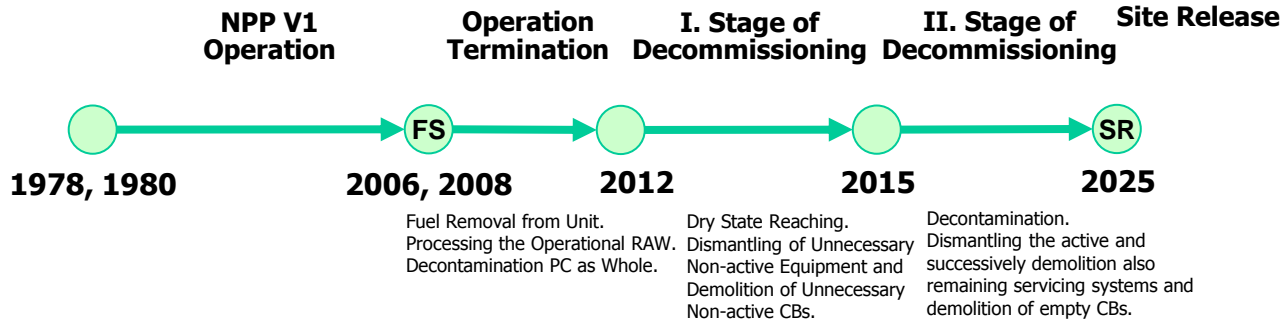
The Plan provides general technical and financial information on selected possible and reasonable decommissioning alternatives, compliant with the Slovak legislation, in order to demonstrate that the decommissioning **process will be technically executable** and mainly **suitable** from the viewpoint of **health protection, nuclear and radiation safety, physical and environmental protection**.

The Conceptual Decommissioning Plan for V1 NPP was developed for following basic alternatives:

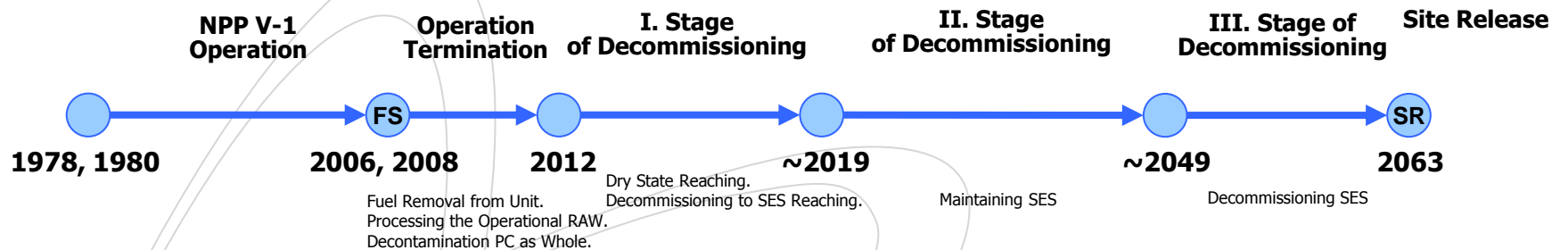
- |                      |   |
|----------------------|---|
| <b>Alternative 1</b> | <b>IMMEDIATE DECOMMISSIONING OPTION - IDO</b>               |
| Alternative 2        | Safe enclosure option under surveillance for 30 years - SES |
| Alternative 3        | Reactor safe enclosure for 30 years - RSE                   |
| Alternative 4        | Zero = no action alternative                                |

# LEGISLATIVE ASPECTS

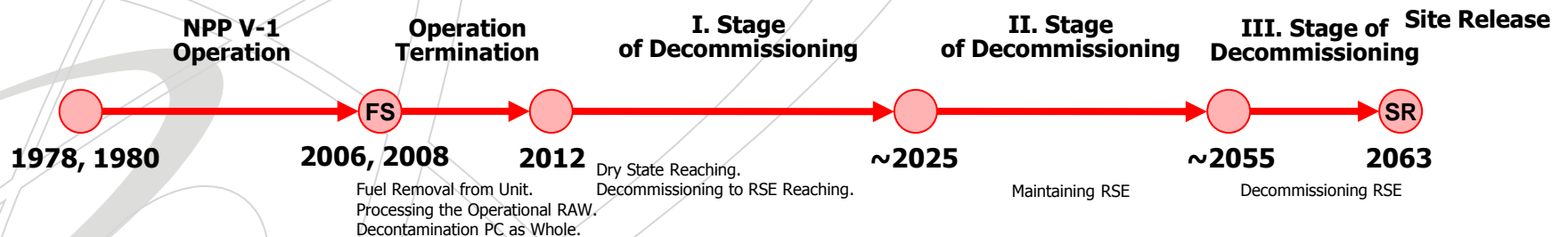
## Option 1 - Immediate Dismantling Option (IDO)



## Option 2 - Safe Enclosure under Surveillance (SES)



## OPTION 3 - Reactor Safe Enclosure (RSE)



## OPTION 4 - Zero (no action) Option (ZO)

## V1 NPP Decommissioning EIA Report

### BIDSF project B6.2

- Based on Act No. 127/1994 Coll. an **Environmental Impact Assessment report had to be developed** for the decommissioning options set out in the Conceptual Decommissioning Plan and approved by the Ministry of Environment (MoE)
- **Conceptual Decommissioning Plan (B6.1)** elaborated under Slovak Government Resolution No. 801/99, on the assessment of impacts and realistic date of the final shutdown of the Jaslovske Bohunice V1 NPP Units 1 and 2 in accordance with the proposed Energy Policy of the Slovak Republic (14 September 1999) was **submitted to MoE on June 2002**
- MoE accepted this study as an **Intention**, the first step of standard EIA-process, and consequently opened the **Scoping process**
- **Expert review of EIA-Report** taking into account also comments, public hearing and standpoints of competent and permission authorities, and affected municipalities, January 2007
- **Final Statement** – elaborated by MoE in cooperation with competent authority – Ministry of Economy and taking into consideration EIA report, expert review, public hearing, comments and standpoints of all involved authorities including public, **7.3.2007**
- On 7th of March 2007 Ministry of Environment recommended in compliance with the valid legislation in the Conceptual decommissioning plan **option of immediate V1 NPP decommissioning from the operation (IDO)**



### **V1 NPP Decommissioning 1st Stage Plan & Other Documentation**

#### **BIDSF project B6.3**

The main objective of the project is to develop design and licensing documentation in compliance with the requirements to obtain V1 NPP decommissioning licence for the first stage of decommissioning (in compliance with the national legal requirements and with the relevant international standards ) according to the selected option– immediate decommissioning of V1 NPP.

#### **The project milestones:**

Contract signing – on 28 August 2008

Beginning of contract fulfilment– on 17 October 2008

Project duration – 2 years

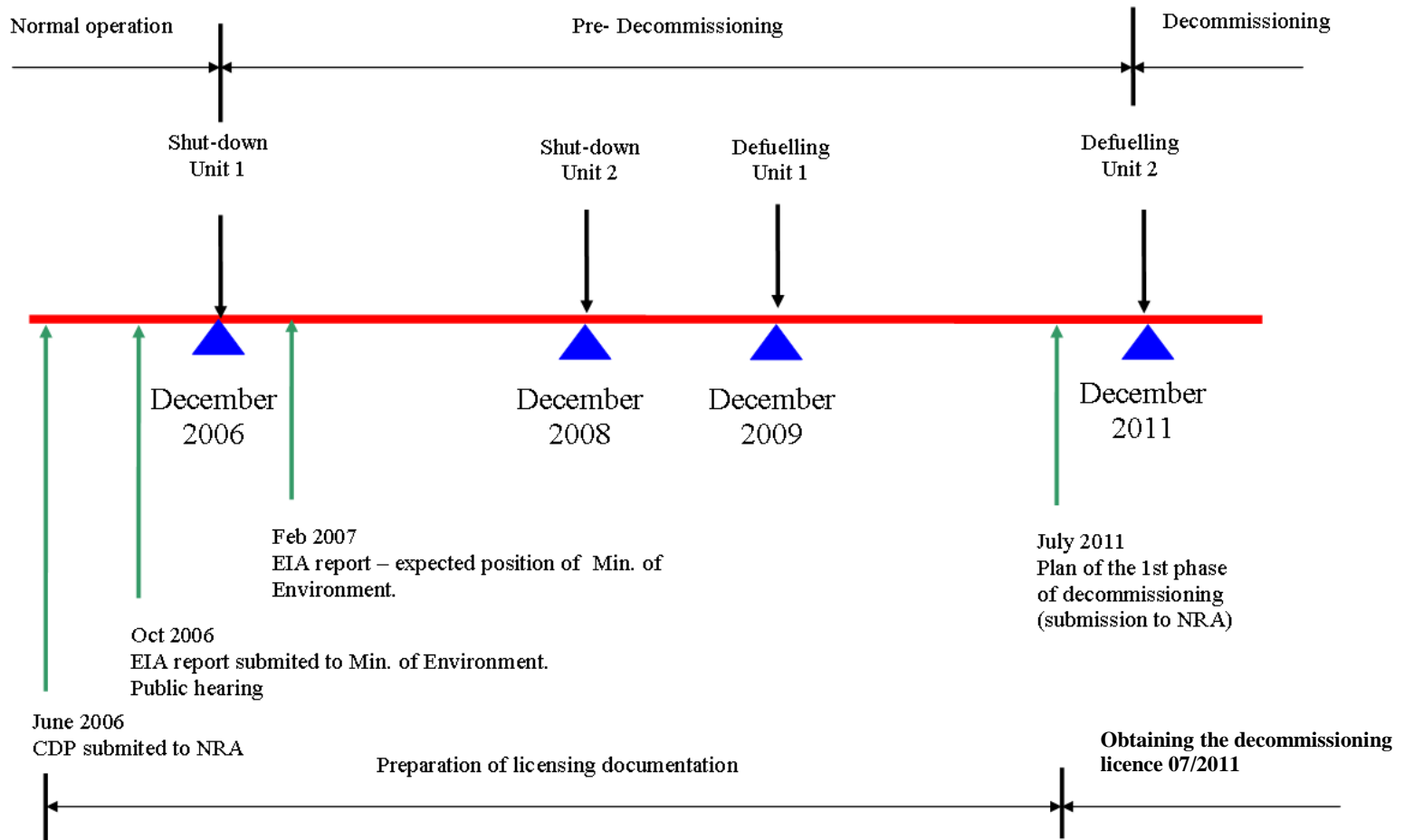
Contractor: VÚJE, a.s., VT Nuclear Services, Ltd, DECOM, a.s.

# LEGISLATIVE ASPECTS

OPERATION LICENCE ▼ DECOMMISSIONING LICENCE

Operating aspects

Legislation aspects

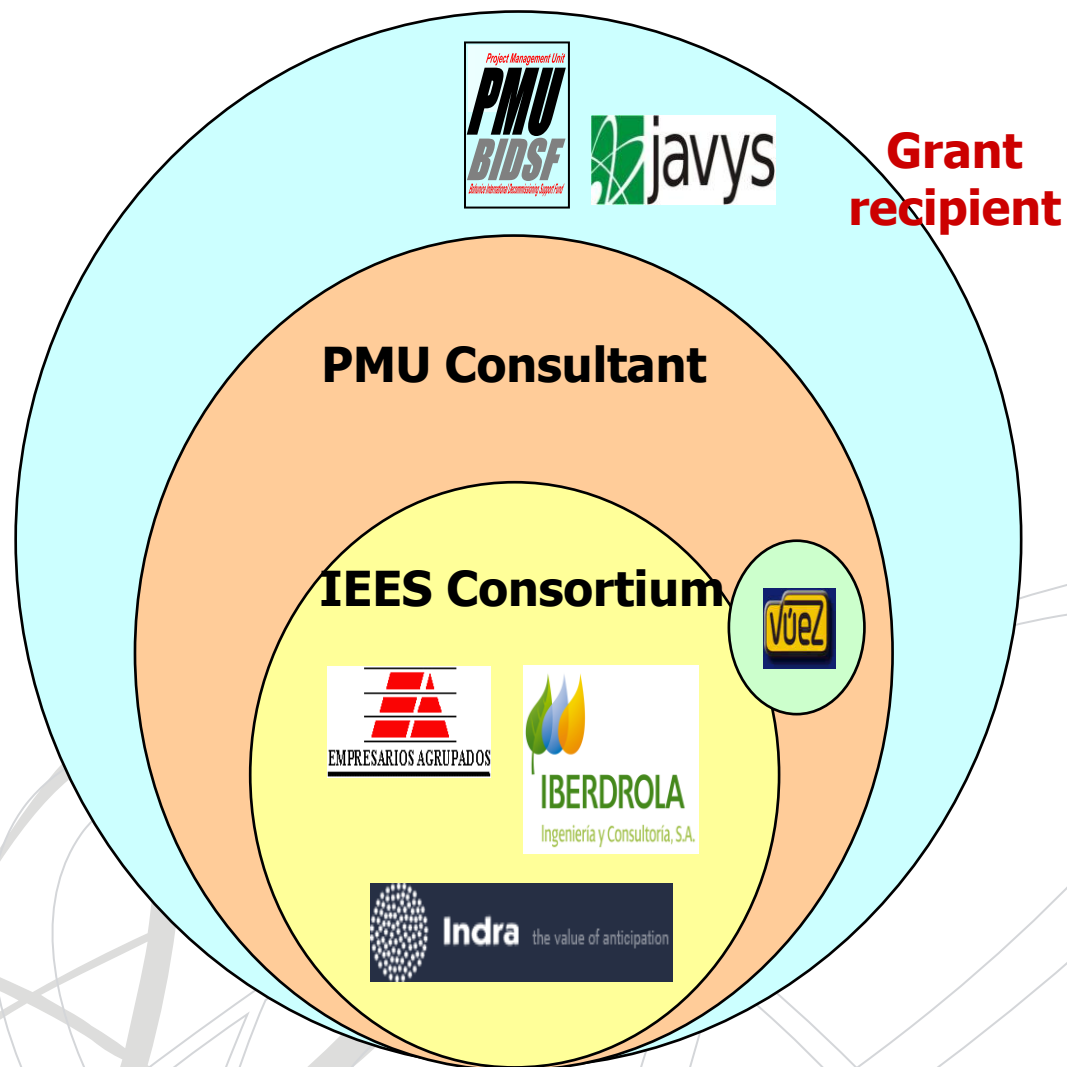


To obtain the decommissioning licence it is necessary to meet the following conditions:

- Development and submission of documentation defined in the regulation of NRA SR No. 58/2006
- Transport of nuclear fuel from V1 NPP to ISFS
- Processing, or transport of radioactive waste
- Transport of hazardous non-active waste

# FUNDING

## BIDSF / NATIONAL NUCLEAR FUND



- The Framework Agreement between the Slovak Republic and the EBRD, relating to the Activities of the Bohunice International Decommissioning Fund in Slovakia (BIDSF) dated 16 November 2001
- The Slovak Republic Government Decision No. 905/2001 for establishment of Project Management Unit (PMU) for coordination of activities in accordance with the Framework Agreement

### Slovak National Nuclear Fund

- allocates the proceeds in accordance with §9 and §10 of the Act Coll. 238/2006 (The Act on the National Nuclear Fund), as amended
- cumulates and administers financial sources on the „V1 NPP Sub-account”

## TERMINATION OF OPERATION

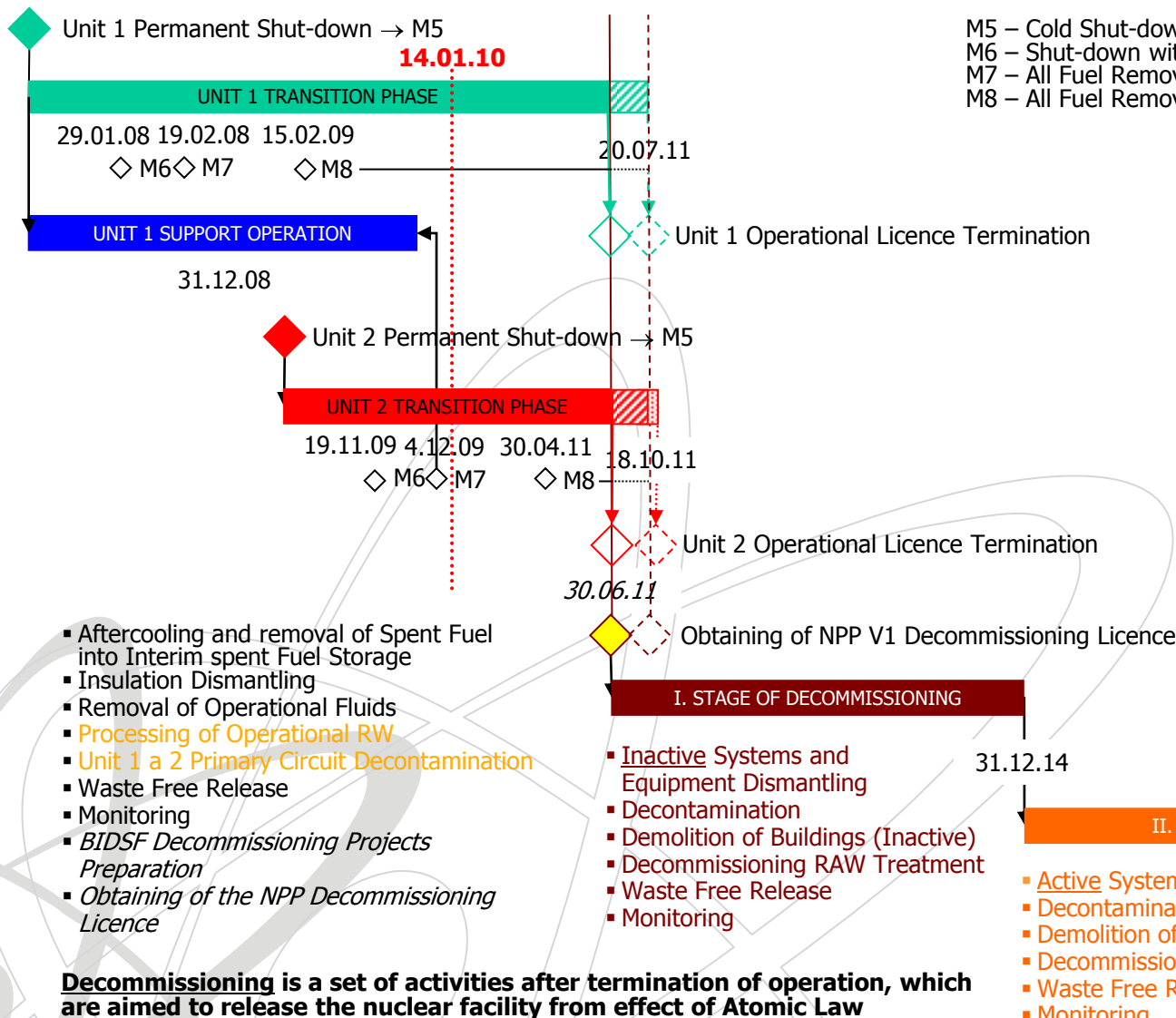
The stage of operation termination is a period of time beginning with shutdown of Unit 1, continuing with final shutdown of Unit 2 and ending with the change of the operation license into the decommissioning license, including transport of the SNF into the ISFS, removal of all the operational RAW and its treatment for V1 NPP. The main activities in this period are the following:

- **safe termination of operation in both V1 NPP units,**
- **suitable mode of SNF storage and cooling aiming at its complete removal from V-1 NPP to the ISFS,**
- **safe and smooth operation of the systems (equipment) remaining in operation,**
- **safe gradual reduction of the number of operated V1 NPP systems (equipment) in order to get the plant ready for commencement of decommissioning works,**
- **identification of all legislative requirements aiming at obtaining the license for Phase 1 of V-1 NPP decommissioning by 2011.**

By the implementation of the above activities such status of V-1 NPP will be achieved by the end of the operation termination period allowing commencement of V1 NPP decommissioning process respecting all the rules of nuclear and radiation protection after necessary legislative requirements are met.

# TERMINATION OF OPERATION

31.12.06



## OPERATIONAL MODES

- M5 – Cold Shut-down
- M6 – Shut-down with Primary Circuit Opened – Reactor Dismantling
- M7 – All Fuel Removed from Reactor Core to Spent Fuel Pool
- M8 – All Fuel Removed from Spent Fuel pool to Interim Spent Fuel Storage

## UNIT 1 SUPPORT OPERATION

Unit 1 systems in support operation for Unit 2:

- Part of HPIS (1HDV) with possibility to inject  $H_3BO_3$  solution with concentration 12 g/kg and 40 g/kg into Unit 2 primary circuit
- Boron concentration system (1BK) with solution concentration 40 g/kg with possibility to feed HPIS (2HDV) suction heads
- Main Isolation Valve Sealing System (1SA), enabling full reserve of 2SA in the case of need
- RHRS, enabling heat Unit 2 spent fuel heat removal in the case of need
- Complete EFWS
- Part of CWS including both circulation cooling water pumps (6DR) and one cooling tower
- Complete ESW system
- Complete NSW system

Operable will stay also all systems common for both units.

Site Free Release



# TERMINATION OF OPERATION

## Status of the equipment expected in 2011:

### Unit 1 - Mode 8

- all the nuclear fuel removed from the active zone (AZ) of reactor,
- primary circuit sealed, all the loops connected to the reactor,
- Primary circuit and the pressurizer filled with clean condensate, the pressurizer's air exhaustion open,
- all the fuel removed from the storage pool to the ISFS, the pool filled with clean condensate up to the normal level in order to reduce radiation load in the Unit 1 reactor hall,
- All the steam generators filled with passivation solution on the secondary side

### Unit 2 - Mode 7 (expected until April 2011)

- Heat removal from the storage pool safeguarded in the standard way
- all the nuclear fuel removed from the AZ reactor to the storage pool,
- Possibility of indirect cooling of the SNF by means of a SS system,
- Primary circuit sealed, filled with clean condensate along with the pressurizer, all the loops connected to the reactor, the pressurizer's air exhaustion open
- All the steam generators filled with passivation solution

### Unit 2 - Mode 8 (expected from April 2011)

- all the nuclear fuel removed from the AZ reactor,
- primary circuit sealed, all the loops connected to the reactor,
- Primary circuit and the pressurizer filled with clean condensate, the pressurizer's air exhaustion open,
- all the fuel removed from the storage pool to the ISFS, the pool filled with clean condensate up to the normal level in order to reduce radiation load in the Unit 1 reactor hall,
- All the steam generators filled with passivation solution on the secondary side

## **BOHUNICE V1 NPP Decommissioning Strategy :**

### **FIVE MAIN DECOMMISSIONING PACKAGES**

#### Common to the whole process

- Licensing (separately for Stage I. and Stage II.)
- Management of historical and decommissioning wastes

#### Specific for the different stages

- Pre-decommissioning
  - Defuelling of reactors
  - Conditioning of historical wastes
  - Preparation of the Licencing Documentation for Stage I. (BIDSF Project B6.3)
  - Plant physical & radiological characterization (BIDSF Project B6.4)
  - Access control & physical security
  - Primary circuit decontamination
  - Preparation of Technical Studies and Specifications, Tender Documents for contracting Stage I. projects
- Decommissioning Stage I
- Decommissioning Stage II



### Requirements for start-up of predecommissioning and decommissioning activities:

- **An efficient industrial organization**
- **Clear and stable regulations and licensing process**
- **Waste management is defined and made available from production to final disposal**
- **Available and adequate funding**
- **Decommissioning strategy**

## What are the decommissioning needs of today?

- Capitalize on the knowledge of a facility and set up inventory databases which are reliable, shareable and revisable.
- Possess a physical and radiological data acquisition system.
- Simulate intervention scenarios and waste productions flows.
- Prepare decommissioning activities before decommissioning licence.
- Optimize waste production and preparation of repositories for future loads.
- Modification of systems allowing continuous decommissioning.



## IDENTIFICATION OF THE BIDSF PROJECTS

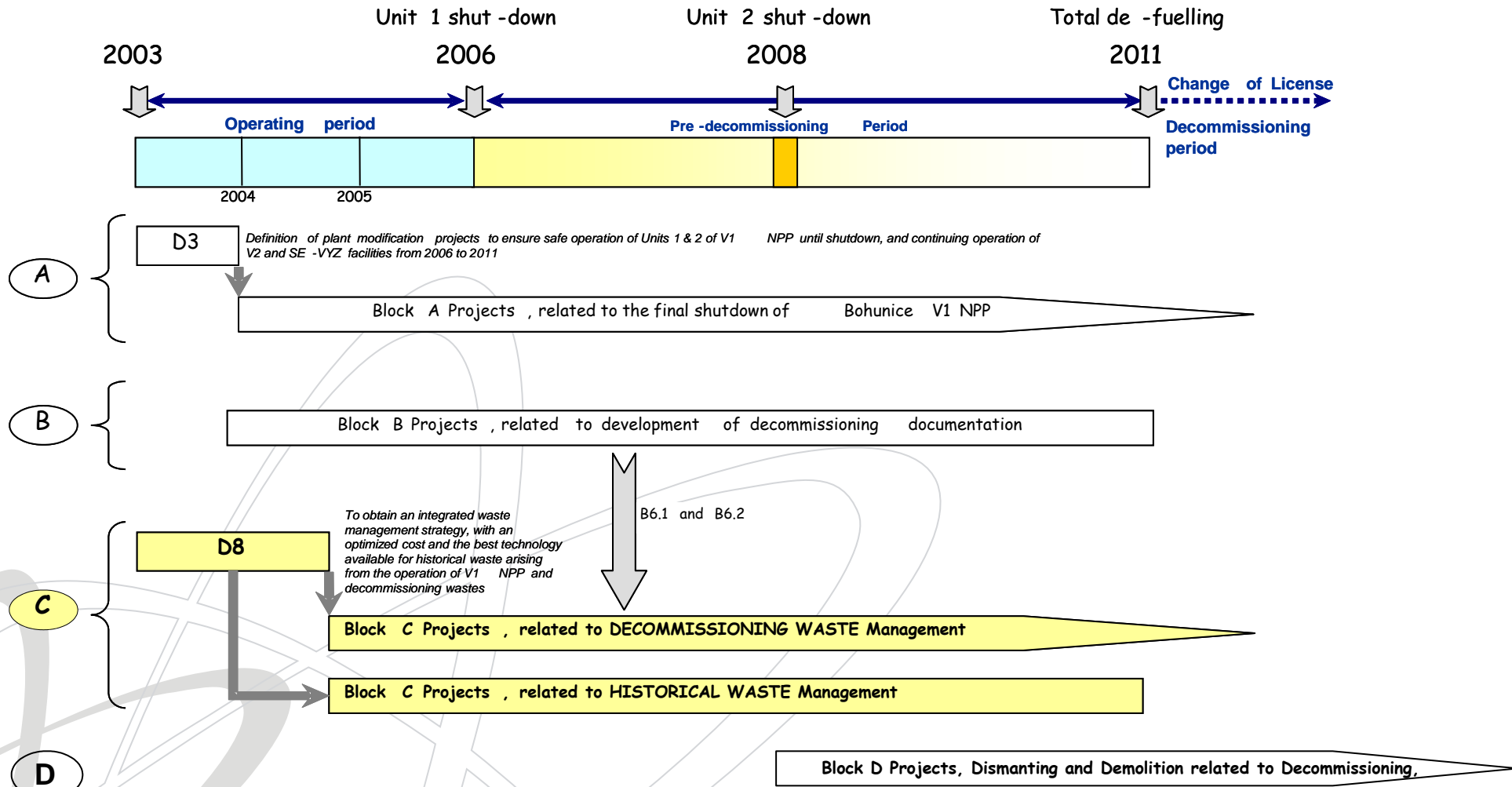
**A Projects** – aimed at V1 NPP systems modification for the purpose of operation termination

**B Projects** – NPP V1 decommissioning documentation in order to obtain the decommissioning authorization.

**C Projects** – aimed at radioactive waste management from V1 NPP decommissioning

**D Projects** – aimed at V1 NPP decommissioning (demolition, dismantling)

# IDENTIFICATION OF THE BIDSF PROJECTS



## IDENTIFICATION OF THE BIDSF PROJECTS (A)

**PMU Consultant services (A1):** Following the Governmental decision 905/2002 (establishing PMU-BIDSF) and Framework agreement this project is the project and financial background of Consultant services for decommissioning. **Status:** The III phase of the project is in progress.

**As-Built documentation of NPP V1 (A2):** Completion and digitization of documentation, implementation of documentation management system for use of all other projects. **Status:** The project is almost finished.

**Reconstruction of the physical protection system – AKOBOJE – for Decommissioning of V1 Units (A3-A):** Existing system (AKOBOJE), currently includes V1 and V2 NPPs and Radwaste treatment facilities located at the same protected Bohunice site. As a direct consequence of the V1 NPP shutdown and privatization of Slovenske elektrarne, the security requirements for V2 NPP structures will be changed, and area protection system will need to reflect those changes adequately by new partitioning. **Status:** Technical specification and tender documents are under preparation.

**Reconstruction of the Public Warning and Notification system – VAR-VYR (A3-B):-** The existing system currently includes V1 and V2 NPPs and Radwaste treatment facilities located at the same protected Bohunice site. As a direct consequence of the V1 NPP shutdown and privatization of Slovenske elektrarne, the requirements for V1 and V2 NPP structures will be changed, and the public warning and notification system will need to reflect those changes adequately by new partitioning. **Status:** Technical specification and tender documents are under preparation.

**Portable Fragmentation and Decontamination Facilities, Treatment of Metallic Waste (A4):** Processing of metallic and construction historical RAW at Bohunice site and RAW from the V1 NPP decommissioning. Metallic components and building structures represent most of the RAW from the V1 NPP decommissioning. Their volume minimisation is provided mainly by fragmentation and decontamination programmes (pre-treatment). Decontaminated wastes below limits could be released to the environment. VLLW (Very Low Level Wastes) could be disposed of in a VLLW repository. Only a part of LILW (Low and Intermediate Level Waste), which is not suitable for decontamination, is treated, conditioned and disposed of in the National Repository of Mochovce. Current projects within this objective are A4 and C7-A projects for Provision of Portable Fragmentation and Decontamination Facilities, Treatment of Metallic Waste. **Status:** The project will start in 2010.



## IDENTIFICATION OF THE BIDSF PROJECTS (A)

**Modification (separation) of the power supply system of JAVYS and SE (A5-A2):** Adjustment of the existing power supply system of V1 NPP and its interconnections with V2 NPP to the successive temporary conditions of the operation termination period of V1 NPP. After removing all of the fuel assemblies of both V1 NPP reactor Units into the ISFS, it is intended to gradually disable all the 6 kV switchboards. Because the ISFS, ABP and other common consumers will remain in operation beyond the year 2011, it is necessary to ensure the continuity of the power supply for the above mentioned consumers. **Status:** A smaller part is under implementation; major changes are under tendering process.

**Reliable heat and steam supply and modification of heating and steam distribution system (A5-B):** Reconstruction of the existing auxiliary steam boiler and changes in steam distribution system to prepare JAVYS – J. Bohunice site for new conditions after the final shutdown of V1 NPP. **Status:** The new boiler for new fuel (natural gas) is finished. There are ongoing tests on modified steam and heating system.

**Modification of Cooling and Service water systems, and Raw water inlet system (A5-C):** After final shutdown of V1 NPP, from economical point of view, it is necessary to connect the non essential and essential service water systems. For supplying the treatment facilities by non essential service water, a new pumping and cooling station will be used. After termination of the main condenser cooling water operation and replacement of service water system by the essential water system as well as the firewater system. **Status:** Project is under procurement process.

**Modification of site supplies of essential fluid systems (A5-D):** Modification of the operating fluid systems so as not to affect the operation of treatment facilities, ISFS and V2 NPP by the V1 NPP shutdown. In addition to the projects A5-B1, A5-B2 and A5-C related to heating, steam supply and water systems it is necessary to replace or to assure the availability of other mediums at V1 NPP. They include demineralised water, chilled water, fire water, waste water, compressed air, nitrogen, and decontamination solution. The requirements for these media during the V1 NPP operation termination period were analysed. **Status:** Project is under procurement process.

**Spent fuel management (A5-E):** Analysing the potential reduction of NPP V1 spent fuel storage inside Unit1&2 to speed up defueling and consequently allow decommissioning activity in NPP. **Status:** The project is finished. NRA allowed 1.8 of month forced storage in V1 spent fuel pool instead of 3 year.

**Storage Casks for Spent Fuel (A5-F):** To ensure adequate capacity of spent nuclear fuel casks (26) for NPP V1 defueling. **Status:** The project is finished.

**Building for Decommissioning Centre (A6-B8):** Connected project - Project Management Unit (PMU) Offices and Decommissioning Information Centre. PMU offices were located in Trnava due to its position in Slovenske Elektrarne a.s. Current decommissioning activities are to be conducted at the Bohunice site. More effective day-to-day management of the implementation of decommissioning projects requires the PMU to be situated at Bohunice site. An extend functionality of the new building is also planned, i.e. to house a public visitor centre. **Status:** Technical specification and tender documents are under preparation.

**The V1 NPP Conceptual decommissioning Plan (B6.1) and The EIA Report of it (B6.2):** The documents are required by Act 541/2004 – „Atomic law“ and Act 24/2006 – „The EIA process“. **Status:** The projects have been finished. The – Immediately decommissioning option (IDO) was approved and there is conditional approval from Ministry of Environment.

**The V1 NPP 1st Stage Plan and Other Licensing Documentation (B6.3):** The documents are required by Act 541/2004 – „Atomic law“ and connected Decrees. There are 26 sub-parts including planning, cost estimation and scheduling of activities in 1st Stage and Conceptual level plan for 2nd Stage. **Status:** The project is in progress.

**The Decommissioning database (B6.4):** The NPP V1 physical and radiological inventarisation and creation of the database for preparation of controlling decommissioning data. **Status:** The project is in progress.



## IDENTIFICATION OF THE BIDSF PROJECTS (C)

**Treatment of metallic RAW (C7-A):** Preparation of sufficient capacity of metallic RAW treatment. The project includes: C7-A1 – Feasibility study, C7-A2 – Increasing of existing F&D facilities capacity (located in A1 NPP); C7-A3 – Erection of new F&D facility (located in V1 NPP) **Status:** C7-A1 is finished. C7-A2, C7-A3 - TS & TD are under preparation.

**Treatment and conditioning historical waste (C7-C):** Reconstruction and modernization of the existing treatment facilities to increase their capacity (Bohunice treatment centre). **Status:** Project is under procurement process.

**Transportation of RAW (C7-D):** The project includes: C7-D1 – procurement of additional transport container for liquid waste; C7-D2 and C7-D3 – sampling and characterisation of „wet“ RAW – sorbents and sediments (sludges). **Status:** The projects have been finished successfully.

**Interim storage of RAW at Bohunice site (C8):** Building of a new Storage hall for dry RAW – as an intermediate storage place for RAW between dismantling and treatment, as temporary storage for treated RAW prepared for final disposal at National RAW disposal facility in Mochovce, as long term storage for RAW not meeting the disposal criterion to be disposed of at the existing places – prepared for treatment and disposal at Deep geological repository in future. **Status:** The design documentation is under preparation, after obtaining building permit -procurement of the implementation of IS RAW building.

**Enlargement of National RAW disposal facility (C9):** The project includes:

- C9.1 Enlargement of the National Repository Mochovce (NR),
- C9.2 Commissioning of the Second Double Raw at the NR,
- C9.3 Erection of a New Double Row at NR,
- C9.4 Design and Licensing of New RAW Disposal Space at the NR
- C11** Very Low Level Waste Disposal Facility

**Status:** C9.1 is finished, C9.4 TS & TD are under preparation, C9.2, C9.3, C11 are in process of basic engineering.

**Free release of decommissioning materials (C10):** Implementation of a new large capacity free release measurement facility close to V1 NPP. **Status:** The project is in progress.

**Refurbishment of the Radiation protection monitoring equipment (C12):** Modernisation and reconstruction of Radiation protection systems and equipment – change from operational to new – decommissioning- conditions, replacement of obsolete ones. **Status:** The Project is under procurement process.

**Decommissioning Logistic (C15):** The project includes: C15-A – Computer system for decommissioning logistic system (an information system with PCs) and C15-B – Decommissioning logistic system including transportation means and casks. **Status:** C15-A is under commenting process. After the final approval basic engineering for C15-B will begin.

**Feasibility Study for the Reactor Large Components Dismantling (C16) -** Project includes technical study for dismantling of the reactor pressure vessels, their internal components, the surrounding concrete biological shield which is highly activated and other large components located in the Reactor building. **Status:** Preparation of the project identification sheet is in progress.

## IDENTIFICATION OF THE BIDSF PROJECTS (D)

**Human sources for decontamination (D0):** Project management for the whole time of V1 NPP decommissioning: (i) development of studies and documentation necessary for grants and project preparation, (ii) planning, project controlling, technical survey, (iii) asset management, operation and maintenance of technological systems necessary for decommissioning, (iv) management and upgrading of databases. **Status:** The I. and II. phase is finished, the IV. phase is under preparation.

**Dismantling of equipment located in turbine hall (D1):** Dismantling of the systems and equipment placed in turbine hall and transformer area and waste management: (i) establishing management work places for thermal insulation, asbestos and metals treatment, (ii) dismantling, (iii) turbine hall and transformers place preparation for temporary waste storages. **Status:** Basic engineering is in progress.

**Pre-dismantling decontamination of primary circuits – Unit 1&2 (D2):** Pre-dismantling decontamination of primary circuit and other technologies: i) decontamination of main primary systems, (ii) RAW management, (iii) removal of thermal insulation. **Status:** TS & TD are under preparation.

**Dismantling and demolition of V1 NPP external buildings (D3.1):** After spent fuel transport to the ISFS non-active facilities and buildings of V1 NPP will not fulfil any safety function and are not needed anymore. The buildings can be decommissioned after the necessary modification has been performed. (Projects A5-C, A3A, A5-D and A5-A2). **Status:** TS & TD are under preparation.

**Partial dismantlings in NPP V1 controlled area (D4):** Partial dismantling of technologies placed in the reactor building, decontamination of rooms: i) dismantling of non-active and radioactive systems, (ii) decontamination of dismantled components, (iii) decontamination of rooms, (iv) RAW management. **Status:** Basic engineering will probably begin in 2010.

**Stated projects will be implemented in the decommissioning phase. It is necessary to prepare it at present in order to start their implementation immediately after obtaining the decommissioning licence.**

# **PREPARATION FOR V1 NPP DECOMMISSIONING**



**Thank you for your attention  
[www.javys.sk](http://www.javys.sk)**