INYPSA, Informes y Proyectos S.A.
General Díaz Porlier, 49
28001 – Madrid
SPAIN

SUBCONTRACTOR: ECO - AS s.r.o. BRATISLAVA

PROJECT B6.7
ENVIRONMENTAL IMPACT ASSESSMENT REPORT OF 2ND STAGE OF V1 NPP DECOMMISSIONING

PRELIMINARY ENVIRONMENTAL STUDY

IPR No: (operation project)

Revision No: 0 Copy No:
Job Number: BIDSF 016 6 001
Employer's Contract Number: ZM-66-12-2-00237-0330
Employer: JAVYS, a. s. Bratislava
Registration Number: B67-PES-INY-001/EN
Date of development: 28-06-2013

Archive Number: B67-PES-INY-000/EN

APPROVAL SHEET

<table>
<tr><th colspan="2"></th><th>NAME</th><th>SIGNATURE</th><th>DATE</th></tr>
<tr><td rowspan="5">CONTRACTOR</td><td rowspan="2">AUTHORS</td><td>Antonio Laguna</td><td></td><td></td></tr>
<tr><td>Soňa Antalová</td><td></td><td></td></tr>
<tr><td>REVIEW</td><td>Óscar Tejado</td><td></td><td></td></tr>
<tr><td>APPROVAL</td><td>José Déniz</td><td></td><td></td></tr>
<tr><td>AUTHORIZED REPRESENTATIVE</td><td>Óscar Tejado</td><td></td><td></td></tr>
<tr><td colspan="2">SUBCONTRACTOR</td><td>Soňa Antalová</td><td></td><td></td></tr>
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REVISION SHEET

Revisions of this document will be made by exchange of the complete document including the title page with signatures. Replacement of the individual pages is not permitted.

The revision number is indicated in the header of all pages.

The reasons for the release of a new revision and/or main modifications in the actual revision and the pages concerned are recorded in the below list revision.

Number of Revision	Reason for revision	Date
00	Initial version	15/05/2013
01	Revised with Client’s comments, dated 20/06/2013	28/06/2013

CONTENS

DRAWINGS

- Drawing 1: General location of the project area (cartographic base).
- Drawing 2: General location of the project area (ortophotographic base).
- Drawing 3: Natura Network Sites (cartographic base).

0 DEFINITIONS AND ACRONYMS

BIDSF	Bohunice International Decommissioning Support Fund
BOZP	Occupational Safety and Health at Work
Client	JAVYS a.s.
Consultant	INYPSA, Informes y Proyectos S.A.
IR	Ionizing Radiation
JAVYS	Jadrová a Vyrad'ovacia Spoločnost' a.s.
MPR	Monthly Progress Report
NPP	Nuclear Power Plant
PES	Preliminary Environmental Study
SoA	Scope of Assessment
SR	Slovak Republic
V1 NPP	Jaslovské Bohunice V1 NPP

1 BASIC DATA ON THE PROPOSER

1.1 Name

Jadrová a Vyraďovacia Spoločnosť, a.s.

1.2 Identification number

Business identification number (IČO): 35 946 024

1.3 Registered office

Tomášikova 22

821 02 Bratislava

1.4 First name, surname, address, telephone number and other contact data on an authorised representative of the contracting authority

Ing. Peter Čižnár
Chairman of the board and head manager
e-mail: ciznar.peter@javys.sk
phone: +421/33 531 5340

Ing. Miroslav Obert
Vicechairman of the board and director of decommission division V1 and PMU
e-mail: obert.miroslav@javys.sk
phone: +421/33 531 5266

Ing. Anton Masár
Member of the board and director of economy and dealing division
e-mail: masar.anton@javys.sk
phone: 033/531 5346

1.5 First name, surname, address, telephone number and other contact data on a person whom the relevant information on the proposed activity and the place of consultations can be obtained from

Ing. Dobroslav Dobák
specialist - spokesman
e-mail: dobak.dobroslav@javys.sk
phone: + 421/33 531 5259
mobile phone: 0910 834 349

2 BASIC DATA ON THE PROPOSED ACTIVITY

2.1 Name

"Environmental Impact Assessment Report of Second Stage of V1 Bohunice Nuclear Power Plant Decommissioning".

2.2 Purpose

In April 2007, by issuance of the Final Statement by MoE, the Immediate Decommissioning (IDO) alternative for V1 Bohunice NPP decommissioning was adopted. The IDO alternative for decommissioning establishes two different phases: the dismantling and demolition of unrequired equipment, systems and buildings (Stage I) and the dismantling of remained elements back to the bottom of the foundation until to fully achieve the planned level site for restricted usage ("brown field", such as for a possible reindustrialization) of the site (Stage II). The present document covers environmental assessment of impacts produced by technical and technological solution adopted for Stage II in accordance with Act 24/2006 Coll. on Environmental Impact Assessment (EIA Act) and recommends the most suitable alternative.

2.3 User

Jadrová a Vyraďovacia Spoločnosť, a.s. JAVYS.
Tomášikova 22
821 02 Bratislava

2.4 Character of the proposed activity (new activity, change of activity and the like)

The proposed activity is the continuation of the decommissioning process of V1 Bohunice Nuclear Power Plant, which has been already planned and for which relevant building authorities have already issued mandatory permits according to the requirements of national Slovak legislation and international applicable legislation.

According to the Appendix 8 of Act No. 24/2006 Coll. on the Environmental Impact Assessment (EIA Act), as amended, the proposed activity belongs to the activities listed in the Chapter 2, "*Energy Industry*", Item 4**,** "*Nuclear power plants and other nuclear facilities or reactors (except research installations for the production and conversion of fissionable and activated materials, whose maximum power does not exceed 1 kilowatt continuous thermal load), including the decommissioning and disposal. Nuclear power plants and other nuclear reactors cease to be such a device, when their territory permanently removed nuclear fuel and other radioactively contaminated elements*".

It will also be applicable, from the previously cited EIA Act, Chapter 9, "*Infrastructure*", Item 9, "*Recovery of building wastes*".

2.5 Location of the proposed activity (region, district, town/village, cadastral district, parcel index)

Region: Trnava
District: Trnava
Municipality: Jaslovské Bohunice
Cadastral territories: Jaslovské Bohunice and Pečeňady

2.6 General situation of the location of the proposed activity (scale 1: 50 000)

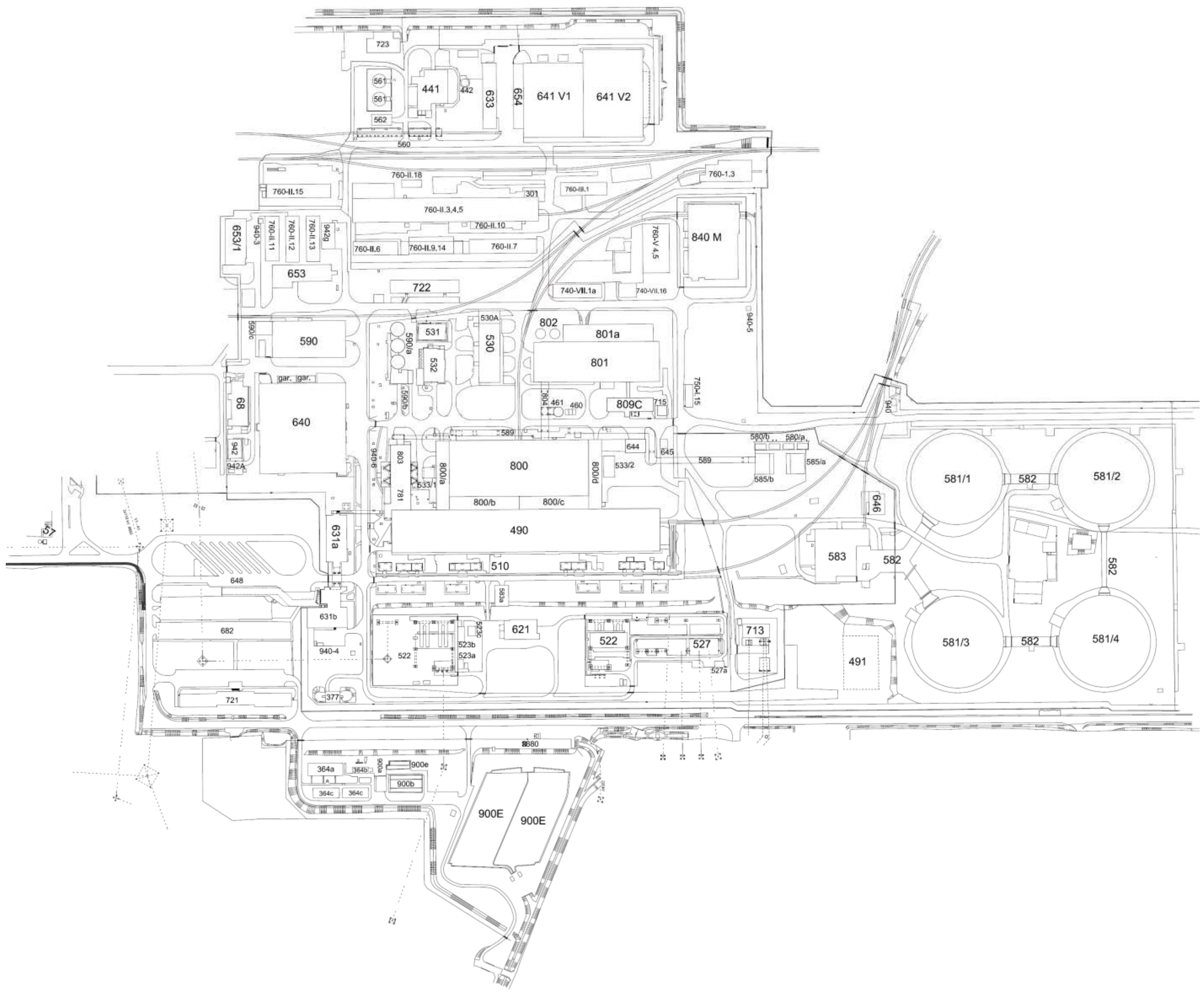
The location of the activity is defined by the area of the nuclear energy complex of Jaslovské Bohunice. Possible impacts arising from the proposed activities on the natural and anthropogenic components of the environment and the population will be evaluated in a broader potentially affected area.

Graph No. 1. Location of the nuclear energy complex of Jaslovské Bohunice at the Slovak Republic

Graph No. 2. Limits of V1 NPP on the nuclear energy complex of Jaslovské Bohunice

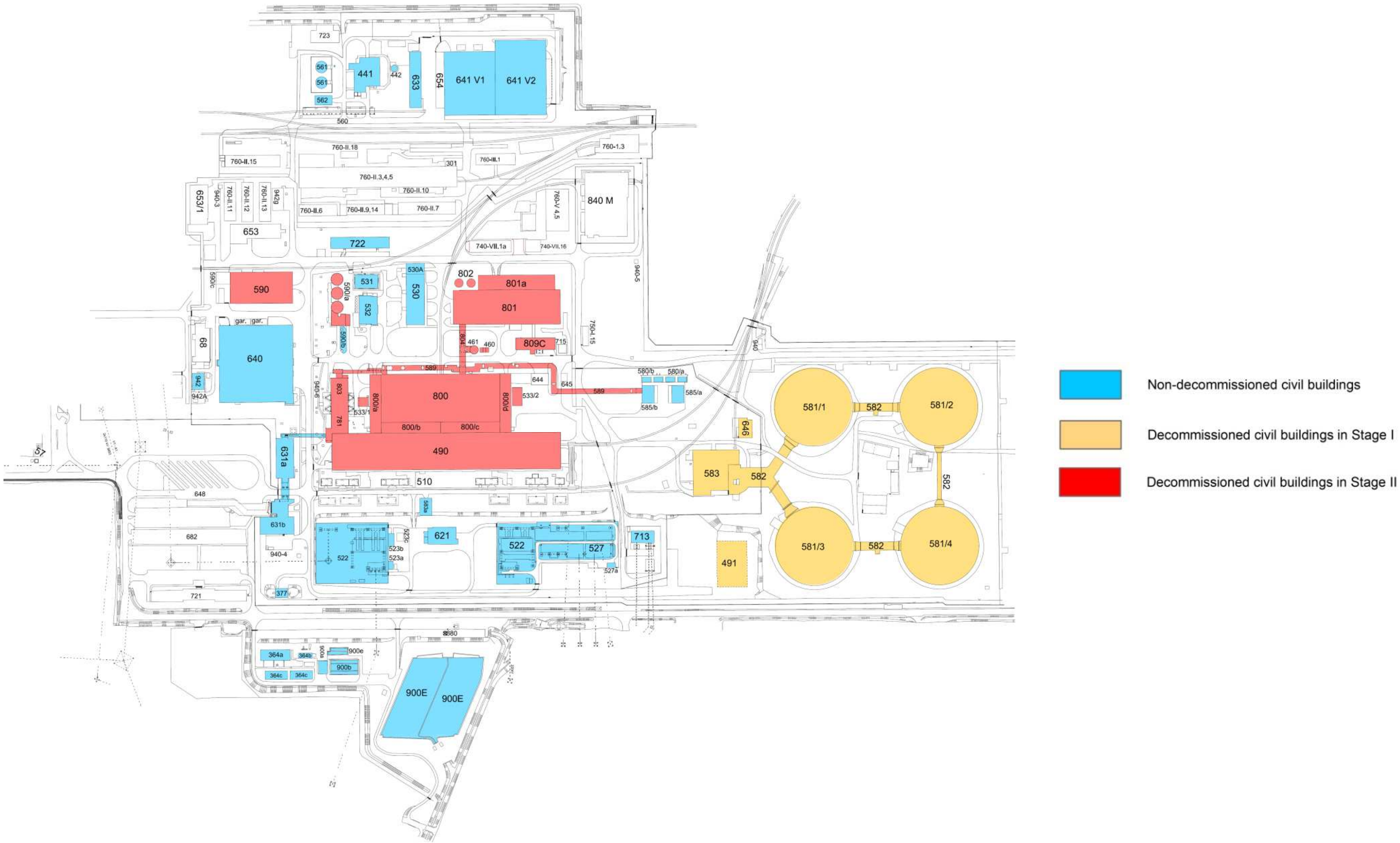
Graph No. 3. Location of a circle of 5 km radius centered on centroid of the proposed activity

Graph No. 4. General layout of V1 NPP



No.CB	NAME
364a	Sump and sewage waters purification plant -BIOCLAR
364b	Sump and sewage waters purification plant
364c	Sump and sewage waters purification plant
377	Drinking water pumping station and water reservoir
441	Reserve boilrer house
442	Boiler house chimney
460	Ventilation stack
490,491	Turbine hall and turbogenerator foundation
522	External switching station
523a	House of relay protection
523b	Compressor plant of switching station- partially
527	External switching station 110kV
527a	House of relay protection 110kV
530	Dieselgenerator station
531	Fuel oil system
532	Compressor station and central cooling station
533/1	Cooling station of emergency ventilation system-unit 1
533/2	Cooling station of emergency ventilation system-unit 2
561	Heating oil tanks
562	Heating oil machine room
581	Coling towers (two)
582	Channels for cooling water piping
583	Cooling water pumping station
583a	Blowdown of circulating circuit
583/1	Pumping station for emptying cooling water piping
589	Aboveground essential service water collector
590	Chemical water treatment
590a	Demineralised water tank
621	Lub-oil system
631a	Administration building
631b	Dining room and gate
633	Civil structures maintenance
640	Workshops and storehouses
641	Storehouses of metallic material,spare parts and valves
644	Hydrogen storages
645	Nitrogen storages
646	Hydrochlorid acid dosing, V1 NPP
653	Fire fighting station
713	Transformer station
723	Store of solidified RAW
781	Defense shelter
800	Reactor building
800a,b,c,d	Reactor building
801,801a	Nuclear auxiliary building
802	Clean condensate tanks
803	Operating building
804,461	Interconnecting bridge between buildings 800 and 801
880	Building of waste waters activity measurement
900a,b,c,e,E	Waste industrial water disposal
940	AKOBOJE

Graph No. 5. Plan for V1 NPP decommissioning



2.7 Date of beginning and termination of the construction and operation of the proposed activity

From January 2015 to December 2025.

2.8 Brief description of the technical and technological solution

The main purpose of the 2nd Stage of V1 NPP decommissioning is to achieve in full the planned condition of the site for further restricted use ("brownfield") through complex dismantling of systems and equipments.

The activities of the 2nd Stage decommissioning comprise removal of the primary circuit (PC) and of any remaining contaminated and non-contaminated systems, decontamination of any contaminated buildings, demolition, site restoration, final survey and site release for further use. The 2nd stage will also include works that have not been finished in the 1st stage V1 NPP decommissioning.

The 2nd stage decommissioning shall hence comprise the following activities:

Groups of main activities in the Stage II of V1 NPP decommissioning

- Preparation and dismantling (of reactors, primary circuit (PC) equipment and other equipment in and out of the controlled zone (CZ))
- RAW management
    - Fragmentation
    - Decontamination
    - Modification and processing
    - Storage
    - Transport
    - Final disposal in the repository
- Decontamination of structures
- Demolition of structures
- Release of decommissioned materials into the environment
- Adjustments, final review and release of the site for further use

Groups of auxiliary activities:

- Management of other and dangerous waste
- Licensing activities
- Modification of systems and equipment for decommissioning purposes
- Operation, control and maintenance of auxiliary systems
- Safety (safety and health protection at work (SHPW), fire protection (FP), nuclear, physical security)

- Radiation protection

The most important activities belonging to the above mentioned groups:

- Disposal of "RH" waste from the "Mogilnik",
- Decontamination of spent fuel pools and other contaminated tanks,
- Modification of technological systems and objects and installation of new equipments,
- Dismantling of large-scale components of the cooling system,
- Dismantling of systems in the controlled zone,
- Dismantling of systems out of the controlled zone,
- Fragmentation of materials and equipments,
- Melting of metallic RAW,
- Decontamination of objects,
- Demolition of objects and filling up of construction pits,
- Restoration of the site into the original condition,
- Final review and release of the site for further use,
- Operation, control and maintenance of auxiliary systems, control of inactive systems to be decommissioned, the building structures and the V1 NPP site,
- Supervision of nuclear safety,
- Safety - SHPW and FP,
- Physical security,
- Processing, modification, storage of RAW,
- Release of materials into the environment,
- Management of inactive waste,
- Storage of RAW in the Interim Waste Storage,
- Operation, control and maintenance of security systems,
- Implementing of project amendments and modifications in the CZ,
- Operation of decontamination lines,
- Provisional arrangement, manipulation and securing of equipments within as part of project amendments and modifications in the CZ,
- Activities connected to securing of radiation protection and provision of personal dosimetry services,
- Usage, control, maintenance, overhaul and storage of manipulators, facilities and technological equipments and parts of technological equipments of the nuclear power plant contaminated with radionuclides originating from the operation of nuclear reactors,
- Collection, processing and analysis of samples of material and media contaminated with radionuclides for purposes of assessment of technological processes, assessment of the condition of barriers, monitoring of radiation levels in the premises of the power plant, monitoring of the nuclear facilities' impact on their environment, monitoring of the environment contamination in case of radiation accidents and monitoring of internal irradiation of workers,
- Decontamination of superficially contaminated workers,
- Cleaning of work clothes and garments and protection devices contaminated by radionuclides,
- Providing of permanently reduced pressure in order to prevent spreading out of contamination in the premises of the CZ in course of any activities,
- Adjustment of air technical systems,
- Updating of radiological classification of equipments and constructions of the reactor buildings,
- Material transport,
- Handling and transport of RAW,

- Registration of material flows,

Activities connected to system dismantling and demolition works comprise in particular the following: provision of the required documentation, necessary technical and technological equipment, classification and separation of waste and metal components as well as handling of materials and waste depending on their character (recycling, reuse or disposal).

Groups of main activities

2.8.1 Preparation and dismantling (of reactors, PC equipment and other equipment in and out of the controlled zone (CZ))

2.8.1.1 Activated equipments

After dismantling, activated equipments constitute usually medium active RAW that due to very high dose rates require remote cutting (either by means of dry or under water cutting equipment) as well as biological protection during transport and storage. Owing to the activation character decontamination is not possible and hence release of such waste into the environment is not possible either, with the only thinkable options being its disposal in the repository or storage.

Activated equipments are:

- Reactor pressure vessel,
- Internal reactor components,
- Annular water tank,
- Shielding cartridges of the active reactor zone,
- Absorbers of control rod assemblies (HRK) and connection rods,
- Racks of the storage pond of spent nuclear fuel,

Reactor pressure vessel will be dismantled after the removal of the internal reactor components, and prior to dismantling any connections will be disabled, including the main circulation circuit. RPV shall be dismantled from its spot as a whole by means of a 250 tonnes heavy reactor hall crane and a suitably installed cross girder (the cross girder for mounting of reactors VVER 440 can be used).

Dismantling of internal reactor components from their mount will be carried out by means of standard heaving machinery, gripping devices and a heavy protective container. Internal reactor constructions will be inserted into the inspection shafts (such as during maintenance).

A universal Storage pond of spent nuclear fuel (assigned technical equipment) shall be used for dismantling of shielding cartridges, absorbers of control rod assemblies and connection rods.

Annular water tank for purposes of radiation protection and immobilisation of the hot isolation layer a protective cylinder with 25 mm thick walls (the total weight of the cylinder is 9.8 t) is mounted to the inner part of the reactor vessel. The space between the protective cylinder and the vessel is filled with immobilisation solution. The total weight of the filling is 2 to 5 t, depending on the filling material (cement, sealing resin etc.).

The annular tank will be dismantled into fragments by means of steel rope cutting. The tanks will be cut into fragments that will then be provided with previously prepared outthrusts.

Welding on of the outthrusts, after the tank has been cut into fragments and the steel rope has been placed, shall be carried out manually with help of a protective platform erected for this purpose and moved by the 32 tonnes heavy reactor hall crane. The total dose rate on the platform (working place) will be around 12 μSv/h.

During the cutting of the annular water tank, the reactor shaft is closed at the level of the concrete bar.

A fragment (with a maximum weight of 6.2 t) cut off the annular water tank shall be displaced to the dry cutting zone where the activated part of the tank shall be separated from the other constructions.

2.8.1.2 Contaminated equipments of PC

In order to dismantle the equipments of the primary circuit it is necessary to disassemble the piping of the auxiliary systems. A supporting construction shall be provided for the disconnection of piping and the main circulation loop (MCL).

First, one steam generator (SG) shall be disconnected (the total number of steam generators - 12). The steam generators are dismantled from their spot in one piece by creating three openings. Coverings are anchored in the floor of the reactor hall by means of metal stripes (gaps between coverings and the frame are welded up by means of metal stripes) and concrete. The covering is dismantled by removing the hinge joints of SG below the mounting openings. For this purpose, the steam collector is dismantled and any piping and connections are cut off, including the circulation loop. Pipes with diameters greater than 150 mm are cut by means of detachable pipe cutters. Any openings created in course of the cutting process shall be closed by seals. The dismantled SG shall be located in the interim storage in the reactor hall. The steam generator shall be placed on the prepared bearers.

The freed space will be used for installation of a band saw and an interim storage for dismantled equipments. The remaining equipment shall be dismantled in the next step.

Dismantling of main circulation pumps (MCP) consists in removing the extractable components in accordance with maintenance schemes and cutting the casing of the MCP into fragments.

The MCP casing shall be cut by means of band saw into appr. 10 fragments.

Dismantling of the main sealing armature (MSA) shall be carried out in the following steps:

- The electric engine will be removed;
- The internal part of the armature will be extracted (in common procedure);
- The body of the armature will be cut into fragments (alike MCP);
- The circulation loop will be cut off; the pump body will be cut into two fragments by means of a band saw;

All mounting components of the MCP and MSA will be sent for disassembling.

Cutting of the pump body will be carried out by flame. Gases and aerosols will be disposed by means of a ventilation tube connected to the steam pipeline (at the SG trunk) and a suction ventilation system. This way majority of generated gases will be lead away to the SG trunk instead of remaining in the working area. The generated fragments will be approx. 18 in total, including two collectors which shall be dismantled in one piece. The fragments will be cut into small parts by means of band saw.

The circulation loop pipes will be cut by means of a detachable pipe cutter. The length of the cut fragments is to be established according to the length of the pipe between components, accessibility and size of the openings and should not exceed 2,300 mm.

The main loop pipes (MLP) are to be additionally secured for cutting. For security purposes parts of the cut pipes can be suspended by steel ropes.

Equipments of the primary circuit shall be completely fragmented in situ and decontaminated by means of existing and planned equipments (C7-A2 and C7-A3). Decontamination aims at minimising RAW and waste release for further use. Fragmentation in situ allows for carrying out works simultaneously. The estimated implementation period is 3 years and all works fit well into the time frame of 2015-2025. These activities will make use of the projects C8-B, C7-A2, C7-A3 and C10. This way optimum utilisation of existing and planned facilities is achieved.

The projects C7-A2 and C7-A3 constitute accessible decontamination approaches and will run on full capacity in the phase of processing fragmented components of the PC. When applying wet decontamination methods a significant amount of liquid RAW will be produced and should be processed in accordance with the existing practice.

Fragmentation and decontamination activities (scope of the project C7-A3) are presently subject to a particular EIA with the title "Construction of a new large-scale fragmentation and decontamination facility V1 NPP, Jaslovské Bohunice", but in general they constitute a part of the 2nd stage of V1 NPP decommissioning. The project C7-A2 has been also assessed under the title "Enhancing the capacity of existing fragmentation and decontamination facilities (BIDSF, project C7-A2), Jaslovské Bohunice".

2.8.1.3 Other facilities in and out of KP

Dismantling and segmentation are aimed at subsequent disassembling of technological units of the nuclear power plant and, to the utmost possible extent, their release for further use, or segmentation to a size that allows for secure transportation to the FaD station for further processing.

The following segmentation methods have been proposed for the dismantling activities:

- Hydraulic segmentation
- High speed segmentation
- Low speed segmentation
- Thermal segmentation

Hydraulic segmentation

Application - materials with no further planned processing (including internal decontamination), e.g. pulse pipes, cables and similar.

Segmentation by means of "high cutting speed"

Application - in settings where other mechanical methods cannot be applied, in particular, when cutting materials with low contamination.

Segmentation by means of "low cutting speed"

Application - including in materials with relatively high contamination.

Thermal segmentation

Application - in settings where other mechanical methods are not applicable.

2.8.2 RAW management

Processing of RAW aims at safety and economic efficiency of handling with them. Basic approaches comprise volume reduction, removal of radionuclides and modification of composition (incineration, pressing, vaporisation, ion exchange, filtration, decontamination, neutralisation, coagulation, flocculation of chemical substances and similar), storage and final disposal. The individual methods are often combined in such a way as to achieve the maximum decontamination effect. This can lead to generation of secondary RAW (contaminated filters, saturated ionex materials, sludge). Processing of RAW at JAVYS a.s. is carried out, depending on the RAW type, at the nuclear facilities RWPTT or at A1 NPP.

General procedures of handling RAW:

In course of operation and decommissioning of a nuclear facility a wide range of radioactive waste is produced that must be isolated from the population and the environment. Radioactive wastes are classified according to various criteria, such as:

- Their state of matter: solid, liquid and gaseous,
- The activity level: Very low, low, medium and highly active,
- Processing possibilities: Pressable, incinerable, non pressable, non incinerable, liquid.

The following targets are pursued by waste processing:

- To lower the amount of wastes by reducing their volume,
- To create a safe form suitable for their storage/disposal by fixation,
- To provide sufficient barriers against radioactivity leaks into the environment during their disposal in the repository.

Wastes originating from the controlled zone are divided already upon their generation into radioactive and non-radioactive (suitable for release into environment) and subsequently separated according to the activity level and the possibilities of further processing (Catalogue of RAW types).

All radioactive wastes are carefully stored, observed and, over the entire time of work with them, monitored, registered and controlled. Liquid and solid wastes are modified by means of suitable technologies to a form appropriate for long-term storage or final disposal in the repository. Gaseous wastes are purified on special filters and released in form of gaseous discharges.

Modification of radioactive wastes represents activities by which their physical-chemical features are altered and a form created that is suitable for secure manipulation when storing and placing them to their final destination. One of these is fixation - solidification of liquid RAW. The liquid component containing radionuclides is incorporated into a solidifying agent providing a solid and stable form in the long run. Among the most used solidifying agents for fixation of radionuclides there belong cement, bitumen and glass. Fixation can be also carried out by means of synthetic or ceramic materials. The decision as to which agent is to be used is guided mainly by chemical and radiological features of RAW to be solidified, their amount, procurement expenses of the individual technologies and further handling with the solidification product.

JAVYS a.s. currently avails itself of the following RAW modification technologies:

- Bitumenation
- Vitrification
- Cementation
- Sialisation

2.8.2.1 Fragmentation of the reactor pressure vessel

For purposes of the reactor pressure vessel fragmentation a zone of dry cutting shall be set up at V1 NPP. The zone consists of the following complex of components:

- Protective dome;
- Anchoring protective structure;
- Band saw with a positionable saw blade (allowing for horizontal and vertical cuts), or alternatively two band saws (a vertical and a horizontal);
- Transferable turning-table with fixing brackets;
- Conveyor;
- Gripping manipulators;
- Detectors of background radiation;
- Heaving mechanisms, wire ropes and traverses;
- Aerosol filters;
- Exhausters;
- Cameras and steering process monitoring detectors;
- Safety walls, gates and revision openings.

The dry cutting zone consists of individual work stations in a row divided from each other by protective barriers:

- Primary cutting area;
- Fragmentation area;
- Loading area.

The reactor pressure vessel, dismantled from its spot will be lowered through the mounting opening to the box ST-MPC (PG-HCČ) and anchored in the construed frame. Above the mounting opening, a protective dome of 4,500 x 4,500 mm and 5 m height will be erected. The dome structure features "connecting" ropes that serve as an interconnection between the transporting traverse of the RPV and the 250 t hook of the reactor hall crane. The reactor pressure vessel will be suspended by the reactor hall crane through the protective dome.

Then the reactor pressure vessel will be cut by means of a band saw into large annular fragments. The cutting process will begin with the lower vessel part sustained by the reactor hall crane.

The cut-off large-scale fragment will be removed to the fragmentation area furnished with other cutting devices and manipulators. Secondary cutting will be carried out in the fragmentation area, providing the storage of all fragments into containers (except from the upper part of the reactor).

Cutting of the reactor pressure vessel in the dry cutting zone is carried out up to the pipe bottom. The remaining upper vessel part is to be fragmented by a standard machine band saw in the main cutting area.

The fragments of the lower and upper reactor parts will be disposed in fibre-concrete containers. Fragments from the central part of the reactor pressure vessel will be disposed in shielded containers, while monitoring whether the dose rate on the surface of the containers does not exceed the value of 10 mSv/h. For this purpose individually manufactured containers with the required dimensions shall be used (this way the optimum thickness of the container walls for specific devices to be placed inside can be chosen, hence reducing the necessary storage space).

2.8.2.2 Fragmentation of internal reactor components

Internal reactor components comprise:

- Control rods unit;
- Active zone basket;
- Reactor shaft;
- Bottom of the reactor shaft.

A wet cutting zone will be set up for purposes of fragmentation of internal reactor components and will consist out of the following main devices:

- Band saw with a positionable saw blade (allowing for horizontal and vertical cuts), or alternatively two band saws (a vertical and a horizontal);
- Plasma cutter;
- CAMC tool (contact-arc-metal-cutting);
- Transferable turning-table with fixing brackets;
- Conveyor;
- Gripping manipulators;
- Detectors of background radiation;
- Heaving mechanisms, wire ropes and traverses;
- Water exchange system;
- Aerosol filters;
- Water treatment filters;
- Exhausters;
- Cameras and steering process monitoring detectors;

- Protective barriers and air seals.
- Wet cutting zone will be set up in the fuel exchange basin and the spent fuel basin which are interconnected by a corridor with an air seal.

2.8.2.3 Fragmentation of the control rods unit

From the fragmentation point of view the control rods unit constitutes the most challenging segment. The complexity of the control rods unit fragmentation consists in the complicated geometry of the control rods unit structure the elements of which have sides of variable thickness (8 to 300 mm).

The control rods unit will be cut into fragments in the following order:

- Cutting of temperature control rods (step 1);
- Cutting and fragmentation of upper casing (step 2);
- Cutting of conductive rods above the upper grid (step 3);
- Fragmentation of upper grid (step 4);
- Cutting of conductive rods below the upper grid (step 5);
- Cutting of rods of the lower casing (in 2 steps) (step 6);
- Curve cutting of the cylindrical part of the lower casing (step 7);
- Cutting of lower grid control rods (step 8);
- Fragmentation of lower grid (step 9).

Cutting of control rods will be carried out by means of the following tools:

- Cutting of rods (steps 1, 3, 5, 6, 8) - plasma cutting device allowing for angle and curve cuts;
- Fragmentation of cylindrical capsules and fragmentation of the upper casing (steps 2, 7) - band saw;
- Cutting of upper and lower grids - CAMC tool together with the plasma cutting device (steps 4, 9).

2.8.2.4 Fragmentation of the active zone (AZ) basket

The AZ basket will be cut into fragments. Cutting of the basket shall progress top to bottom, as the parts become accessible, in particular in this order:

- Fragmentation of upper casing (step 1);
- Fragmentation of casing down to the lower plate (step 2);
- Fragmentation of lower plate (step 3).

Cutting of the basket will be carried out by means of the following tools:

- Band saw (steps 1, 2);
- CAMC tool together with the plasma cutting device (step 3).

2.8.2.5 Fragmentation of the reactor pressure vessel

The reactor vessel will be cut by means of a band saw, top to bottom, into fragments, as the individual parts become accessible.

According to classification, three zones of the cylindrical reactor vessel can be distinguished: fragments of the upper and lower zones constitute low-radiation waste and fragments of the central vessel zone medium-active waste.

2.8.2.6 Fragmentation of shielding cartridges, absorbers of control rod assemblies and connection rods

Fragmentation of shielding assemblies will be carried out in the wet cutting zone. A guillotine knife will be used for this purpose (a similar device as would be used for cutting of fuel assemblies in "hot" chambers). A separated area will be set up in the spent fuel basin of the Unit 1 and will be furnished with an anchored module, a cutting module and a frame construction with conductive rails.

Transport of shielding assemblies from the spent fuel basin of the Unit 2 into the cutting area will be carried out by means of a standard shielded transport channel. The assembly will be lowered and anchored below the water surface.

2.8.2.7 Fragmentation of the annular water tank

Fragmentation of the annular water tank will be performed in order to divide the activated part of the tank with a weight of 10.2 t (maximum weight of the inner casing, considering a protective cylinder and filling of less than 25 t) from the remaining structures and to obtain the possibility to store the activated tank fragments in fibre-concrete containers.

Cutting of annular water tank will be carried out in the dry cutting zone set up for the reactor pressure vessel.

It will be performed by means of a band saw. The bases and middle rings will be cut off at the inner casing of the annular water tank. In the next step, the inner casing fragment shall be cut in approximately 4 parts.

2.8.2.8 Contaminated equipments of the PC

Mogilnik

The historical high level radioactive solid metallic wastes stored in the waste storage facility, called “Mogilnik” (derived from the Polish term for “graveyard” or “burial place”) comprise mostly inner reactor metallic parts (connection rods, absorbers of control rod assemblies and neutron flux measurement channels) that are, besides the surface contamination, activated within their overall volume due to neutron flux.

The major part is constituted by connection rods and absorbers. The *Mogilnik* storage facility is accessible directly form the reactor hall in the main reactor building and it is designed as a dry pit.

The concrete cover of Mogilnik will be destroyed down to a depth of 1 m, starting from the corner of Mogilnik. In doing so, rods become accessible and will be pulled out by the crane. At the same time, a safety floor is constructed at the lower side of the Mogilnik plate (Mogilnik dividing grid) in order to prevent persons, equipments and fragments from falling to the bottom of Mogilnik. Mogilnik rods are designated for further fragmentation. For this purpose, the rods will be lowered by crane to the SG box in the reactor hall where they will be cut by means of band saw.

The scope of this activity includes:

- Removal of waste,

- Classification of waste,
- Fragmentation,
- Packaging into shielded metallic containers or to FCCs.
- Transportation of containers to the Interim RAW Storage Facility or the Bohunice Processing Centre for final conditioning.

The metallic RAW will be processed into a form acceptable for storage or final disposal in the repository.

Other contaminated equipments of PC

Any other components of the PC will be, after dismantling, transported to F&D stations in the framework of projects C7-A2 and C7-A3 and subsequently released to the environment, stored or placed.

2.8.2.9 Other equipments in and out of the CZ

The fragmentation process aims at dividing materials using the suggested devices into smaller pieces, which can be transported to the F&D stations. Fragmentation activities will be carried out at fixed work stations assigned for this purpose. The individual work stations will be adjusted to the given applied methods, with focus put on providing maximum safety at work and minimizing the generation of radioactive wastes and will be connected to exhauster ventilation systems of the power plant V1 NPP, which are equipped with large-volume highly effective aerosol filters and empty into the ventilation stack of V1 NPP.

The individual fragmentation tasks will be carried out by:

- Low speed segmentation,
- Hydraulic segmentation,
- Thermal segmentation.

Low speed segmentation

Application - including in materials with relatively high contamination.

Hydraulic segmentation

Application - materials with no further planned processing (pulse pipes, cables ...).

Thermal segmentation

Application - at places where other mechanical methods are not applicable.

2.8.2.10 Decontamination of equipments

2.8.2.10.1 Activated equipments

There will be no decontamination of activated equipments.

2.8.2.10.2 Contaminated equipments of the PC

Decontamination will be carried out in accordance with the valid legal provisions, using the equipments provided in the framework of the projects C7-A2 and C7-A3.

The decontamination process requires, in addition, to establish a tank for hydro-abrasive cleaning. The hydro-abrasive cleaning tank will be used for decontamination of thick-walled equipment parts (SG, heating apparatus of the volume compensator). Admissible fragment dimensions are up to 3,000 x 1,500 mm.

Fragments will be loaded into the tank by common heaving mechanisms of the reactor hall through the upper opening. The operator performs hydro-abrasive cleaning of the upper fragment part, then the fragment is turned and the lower part is cleaned. Radiometric control takes place upon completion of the decontamination process. On the basis of control results the fragments will be removed into the clean zone for further fragmentation or final disposal.

Electro-chemical decontamination is applied for decontamination of metal structures and fragments. Subjects to be decontaminated are loaded into a basket which is then placed into the decontamination tank with help of an ordinary lifting device. Decontamination is executed in accordance with the procedure applicable to the electro-chemical decontamination tank.

Radiometric control takes place upon completion of the decontamination process. On the basis of control results rod segments will be removed into the clean zone for further fragmentation or solidification and final disposal.

Decontamination can be also carried out in a blast cleaning device (blast cleaning machine).

2.8.2.10.3 Other equipments in and out of the CZ

Decontamination of spent fuel pools and other contaminated tanks

This activity aims at decontamination of basins and tanks in the reactor building and auxiliary premises before the dismantling itself begins in order to reduce the dose rate and surface contamination and hence provide for safe dismantling and subsequent fragmentation.

The tanks are partially emptied and cleaned of sludge, grains and other material remnants, however, in some of them small quantities of sludge and grains are still present. As part of the conditioning of tanks and the spent fuel pool for decontamination purposes, racks for storage of spent fuel and sludge must be removed.

Subsequently, materials will be classified by means of a suitable tool for extraction of samples from liquids and for monitoring of materials. In order to establish the radiation condition of materials the necessary number of radiation and contamination checks will be carried out and their results will serve as basis for establishment of decontamination factors and choice of decontamination methods.

Post-fragmentation decontamination

Post-fragmentation decontamination aims at reducing the surface contamination to such a level that the materials can be released into the environment in accordance with the legislation valid at the time of the release, or to the level applicable to the chosen disposal method. Decontamination calls at the same time for creation of conditions for processing of secondary waste that will comprise the major part of radioactive inventory from the contaminated facilities of V1 NPP.

Only such decontamination media will be used for decontamination purposes that meet the conditions for processing and disposal in the NRR Mochovce. Decontamination work stations will be connected to the exhauster ventilation systems of the V1 NPP plant furnished with highly effective large-volume aerosol filters which empty into the ventilation stack of V1 NPP. At the same time, these work stations will be connected to the system of collection and processing of radioactive contaminated waters.

Proposed methods of post-fragmentation decontamination:

- Electro-chemical decontamination in the decontamination tank
- Ultrasound decontamination in the decontamination tank
- High-pressure blasting in the decontamination tank
- Abrasive blast cleaning in a basket
- Manual abrasive blast cleaning

Electro-chemical decontamination in the decontamination tank

Application - for removal of fixed contamination from the surface of dismantled and fragmented installations, parts of contaminated equipments.

Ultrasound decontamination in the decontamination tank

Application - for final cleaning of materials from lightly fixed contamination using ultrasound, following electro-chemical decontamination.

High-pressure blasting in the washing tank

Application - for washing of materials and removal of remaining non-fixed contamination even at badly accessible surfaces, following electro-chemical and ultrasound decontamination

Abrasive blast cleaning in a basket

Application - for blast cleaning of fragmented metal components with surface contamination that are loosely introduced into the basket (in form of single charges) by the movement of which they rotate and are blast cleaned

Manual abrasive blast cleaning

Application - for manual blast cleaning of large-scale thick-walled objects with surface contamination

Electro-chemical tank decontamination

Electro-chemical tank decontamination method complemented by cleaning in ultrasound tanks and high-pressure water blasting will be applied for decontamination of stainless steel. Mechanical processes can be applied for cleaning of areas with the highest activity (scouring and blast cleaning with abrasives).

The decontamination line must be provided with tools allowing for preparation and filling up of decontamination solutions, filtering and regeneration of used solutions, management of decontaminated materials, operational monitoring of material contamination, operational control, separation and transport of generated RAW to the processing station for secondary RAW.

Dry mechanical abrasive blast cleaning

The principal method applied for decontamination of carbon steel surfaces will be dry blast cleaning of surfaces of fragmented parts by abrasives. This method aims at removing the superficial layer (protective paint, corrosion layer) down to the basic material.

Dry abrasive blast cleaning methods will be applied for primary removal of materials such as oil, lubricants, oxides (corrosion) and paint or other varnishes. Abrasive blast cleaning will be also applied to stainless steel to ensure the effectiveness of electro-chemical decontamination that can be inhibited by the presence of materials sticking to surfaces of components to be decontaminated.

Any equipments to be provided for this purpose must feature an exhauster system with a suitable filtration module. The equipment must be capable of removing any tightly adhering material including corrosion layers.

The work station must also be equipped with manipulation tables, electric chain hoists, fork lifters and trucks for handling of pallets.

2.8.2.11 Other RAW modification and treatment technologies

2.8.2.11.1 Cementation facility (Bohunice RAW Treatment Center, BRWTC)

Radioactive wastes in solid form are introduced into the FCC and sealed with active cement mixture. This mixture is produced in the cementation facility - inclined cement mixer. The cement mixer comprises a dispenser tank into which RAW are introduced either directly (concentrates) from the concentration facility or through the entrance reservoirs (resins - ionexes or sludge).

Following proved formulas, the inclined cement mixer is filled by RAW dispensed from the dispenser tank and admixtures and cement from the reservoirs.

After thorough mixing, the cement product is filled into a fibre-concrete container (volume 3 m^3). Containers with maturated and hardened cement are sealed, checked and transported to the NRR Mochovce.

2.8.2.11.2 Incineration facility (Bohunice RAW Treatment Center, BRWTC)

Here, solid and liquid wastes are incinerated. Combustible waste is packed in the separation facility into plastic sacks with a volume of approximately 15 l and put into 200 l barrels to be transported to the incineration plant where the sacks are filled by means of the dispenser facility into the oven. The facility has a capacity of 30 kg/h solid waste and 10 kg/h liquid waste in the combined incineration mode and 50 kg/h of solid RAW in the solid waste incineration mode. Solid wastes are dispensed through a system of boxes into the feeding box that represents a safety pass-through - loop.

The incineration furnace itself consists of two chambers (the main incineration furnace and a combustion chamber), constructed as shaft oven. There are no internal build-in parts in the furnace. Incineration is carried out in two zones. In the lower zone, incineration with a steam-air mixture takes place, by which it is ensured that the temperature of the burning material is 900 °C and hence excluding that clinker and caking are produced at the furnace walls. In the upper zone, the major amount of air is lead directly above the burning material (operation with oxygen surplus) and the amount of air is set so as to produce a burning temperature of 750 ÷ 950 °C.

Gaseous residues, ash and fly ash from the furnace are further incinerated in the combustion/ post-burning chamber at a temperature between 950 ÷ and 1150 °C. Ashes are regularly discharged and processed into the reinforced agent paraffin, in which they are mixed to form a homogeneous mass.

Prior to the release into the environment the combustion gases are purified in washing devices and filtered, using HEPA filters. Residue washing water is conveyed for cementation and subsequently solidified into a solid agent. The combustion residues are continuously monitored as to the content of chemical pollutants and radiologic characteristics, before they are discharged through the ventilation stack.

2.8.2.11.3 Pressing facility /Compactor unit (BRWTC)

In the pressing facility, the compressed waste is sorted and packed into 200 dm^3 barrels. The barrels are compacted in the high-pressure compactor with a capacity of 20,000 kN. The compacted material is then loaded into fibre-concrete containers and poured over with cement mixture.

2.8.2.11.4 Separation facility (BRWTC)

It consists out of an enclosed suction separator. The non-separated solid RAW is transported into the separator in the following conditions:

- Loosely placed fragments in a foil,
- In 200 dm^3 sacks,
- In 200 dm^3 barrels (2 units).

RAW separated by the device is put into 200 dm^3 barrels and, depending on the type, it is transported for further processing to the following destinations:

- Incombustible, but pressable waste to the pressing facility,
- Incombustible and not pressable waste to the collection point for cementation,
- Combustible waste, packed in 25 l sacks, placed in a 200 dm^3 barrels to the tipping facility of the incineration plant entrance unit.

2.8.2.11.5 Concentration facility/ Evaporator (BRWTC)

The concentration facility serves for reduction of liquid RAW. The concentrate is subsequently reinforced by the cement agent.

The facility uses continuous-flow evaporation and consists out of 3 U-shape units. The capacity of the evaporation facility is 500 dm^3/h, provided the salinity of the dispensed waste is 200 ÷ 300 g/l.

The bride condensate is used to rinse pipes of the concentration facility and as a filling of washers in the cleaning system of gaseous residues from the incineration unit. The superfluous amount of the bride condensate is, after cleaning at the cleaning station, discharged into the environment.

The output product - the concentrate is collected in a collector tank from which it is transported into the cementation facility.

2.8.2.11.6 Bituminization plants PS 44, PS 100 and a plant for bituminization of radioactive sorbents PS 44/II Stage

Bituminization plants PS 44, PS 100 and the plant for bituminization of radioactive sorbents PS 44/II constitute interconnected technological units. The basic element of the bituminization plant is the rotary film evaporator with a capacity of about 120 dm^3/h. The principal function of the evaporator is to evaporate water from concentrated liquid RAW and to coat the dry fine crystals of dried salts with bitumen – fixing agent. The final product is emptied into 200 dm^3 zinc-coated barrels which are sealed, placed into FCC and poured over with cement mixture.

The bride condensate is cleaned by an oil remover, a vapex and carbon filter and pumped to the purification station of waste water for final cleaning.

The operational unit PS 100 consists out of a similar bituminization unit like PS 44 to which a purification line for low-level contaminated water is added.

Water treatment at this purification station is performed by evaporation in an evaporator with natural circulation. The bride vapour is, after condensation, cleaned by sorbent columns. Once the volume activity has been reduced below limit values the condensate is released into the environment in organised manner. The condensed fraction is, after reaching optimum concentration, treated at the bituminization plants PS 100 or PS 44.

The facility for bituminization of radioactive sorbents consists of the basic components: macerator, decanter, centrifuge, dryer and two homogenizers.

Sorbents are conveyed in transport containers to the reservoir tanks from which they are pumped by dosing devices into the macerator. Here pieces bigger than 5 mm are ground. The mixture is conveyed from the macerator to the decanter. In the decanter, any heavy solid particles are separated out of the transported water. These particles fall out of the decanter as solid phase. The solid phase is dosed into the dryer. Water coming out of the decanter is lead through a compensation tank into the centrifuge where particles bigger than 0.005 mm are separated. Sludge from the centrifuge is lead through the sludge tank into the dryer. Dried sludge and ionexes from the dryer are dispensed into the homogenizer, mixed with bitumen and aggregates to form a homogeneous product. The product is filled into a 200 dm^3 barrel. Once hardened the product is transported into the fibre-concrete container.

2.8.2.11.7 Waste water cleaning station - operational part (build. 41)

Serves for collection and cleaning of low-contamination waste water with total gamma volume activity up to $3.7.10^6$ Bq/dm^3.

Water contaminated mechanically, chemically and radio-chemically is cleaned by evaporation in boiler evaporator equipped with an external heater. The designed capacity of the evaporator is 1.5 m^3/h of evaporated water, however the actual capacity depends on the composition of processed water.

Bride condensate is then cleaned by ion exchange filters until the volume activity of radionuclides in the condensate drops below limit values. The condensate is then moved to the bituminization facility PS 44 or PS 100 to fix the salts into a bituminization matrix.

Note: The impacts of the applied technologies of modification and treatment of RAW provided in Chapter 2.8.2.1.3 are subject to a separate Environmental Impact Assessment procedure. They are mentioned by this preliminary environmental study merely as processes associated with management of RAW emerging out of V1 NPP decommissioning.

2.8.2.11.8 Special sewage and waste water system ŠOV-3

The nuclear facilities of V1 NPP are equipped with a functional system of draining (a special sewage system) and cleaning of waste water (waste water processing ŠOV-3) that serves the draining, storage and processing of waste water. The system works in connection to the liquid RAW storage system that drains and stores waste water from the auxiliary premises and the system of drainage water cleaning. The liquid RAW storage facility is designed for transport, admission and storage of RAW. It is further designed for homogenisation, heating, compression, tapping and transport of liquid RAW.

Liquid RAW is stored in stainless steel tanks or ferro-concrete vaults with stainless steel casing.

The purification station ŠOV 3 thus fulfils two basic functions - concentration and cleaning. The concentration function is monitored by the density and total amount of dissolved substances in the concentrated sludge. The cleaning or decontamination function of the evaporator is defined through measurements of the evaporator condensate quality. Cleaning is carried out on ionex filters.

The components of the cleaning unit: evaporator, post-evaporator, condenser - deaerator, dephlegmator, filters with ionex charge, air ejector, pumps, expander with a cooler. The evaporator with automatic circulation of the processed content consists out of a heating chamber and a separator interconnected on the water and steam side. The evaporator distillate is, after ion exchange post-cleaning, collected in control tanks. Upon completion of radio-chemical analysis, the purified water is lead into tanks of cleaned condensate or it can be discharged into the outer sewage system under strictly set conditions. If water does not meet discharge limits it is emptied from the control tanks into the waste water tanks for repeated cleaning.

2.8.2.12 Transport, storage and final disposal of RAW

According to the definition provided by the Atomic Act transportation of radioactive waste comprises: activities associated with loading of radioactive waste from a nuclear facility, institutional radioactive wastes, abandoned radiators, radioactive wastes of unknown origin and unused radioactive radiators at the loading place, their transport and unloading at their destination, carried out within a nuclear facility or between individual nuclear facilities.

Any conveyor and transporting facilities applied for transport of RAW must meet the requirements established by the Act No. 541/2004 Coll. and the European Agreement concerning the International Carriage of Dangerous Goods by Road - ADR Agreement. They are subject to authorisation as conveyor facility and a transport licence and must meet the criteria of technical safety, radiation protection, nuclear safety and fire protection.

Under storage of radioactive waste or spent nuclear fuel it is understood the temporary placement of these materials in spaces, objects or facilities that allow for their isolation, monitoring and at the same time environment protection.

In contrast, disposal of RAW represents their permanent placement in the repository. According to its definition, a RAW depository is a surface or underground space, object or facility that serves the purpose of RAW disposal, allowing for their isolation, monitoring and environment protection.

2.8.2.12.1 RAW from activated facilities

Separation of low-activity from medium-activity waste ensures optimum exploitation of the NRR Mochovce.

2.8.2.12.1.1 Transport to interim storage

Fragments of RPV, the internal reactor components, parts of the control rod assembly and the shielding cartridges from the active zone of the reactor that belong to the category medium-activity RAW will be placed for temporary storage in the interim storage facility (project C8) in shielded containers.

2.8.2.12.1.2 Placement in the interim storage

The described equipments and containers will be placed for temporary storage into the third and fourth module of the interim storage facility.

2.8.2.12.1.3 Transport to final disposal

Fragments of the annular water tank obtained from its dismantling at the site, as well as the reactor pressure vessel fragments (flange zone, pipe bottom zone and base zone) and temperature control channels (upper part of the control rods unit) are assigned for final disposal. Small fragments that belong to the category low-active RAW (that is to say, parts of the reactor vessel and the control rods unit) will be transported in fibre-concrete containers for interim storage in 200 l barrels. Large fragments (parts of the annular water tank and the reactor pressure vessel) that belong to the category low-activity RAW will be transported in fibre-concrete containers covered by concrete mixture. Annular water tank fragments belonging to the category of very low-activity RAW will be transported in ISO containers to the repository of very low-activity RAW in Mochovce. Transport will be carried out according to the current legislation by road.

2.8.2.12.1.4 Final disposal

Small fragments belonging to the category low-activity RAW will be disposed, being placed in fibre-concrete containers. Very low-activity RAW (annular water tank fragments) will be placed in the RAW repository in Mochovce without containers.

2.8.2.12.2 RAW from contaminated PC equipments and other equipments in and out of CZ

Transport to the disposal destination

Transport to the repository will be carried out according to valid transport legislation.

Final disposal

At present, a repository for low-activity waste is available at the Mochovce site and construction of a repository for very low-activity waste is currently in preparation in the nuclear facilities of NRR Mochovce. Activities associated with the repository and the extension of its storage capacity has been subject to a separate EIA process. Placement of RAW is subject to strict keeping of limits and conditions applicable to the repository, approved by the ÚJD SR (Nuclear Regulatory Authority of SR) and the ÚVZ SR (Public Health Authority of SR). Transport package units in which RAW may be transported to the repository are subject to permission as well.

2.8.3 Decontamination of building structures

The amount or RAW will be minimised by decontamination of fragments with help of C7-A2 and C7-A3 equipments. For fragmentation in situ and decontamination, capacities of existing and currently planned facilities will be utilised. Additional new installations are not required. Capacities of NRR Mochovce and existing transportation routes will be used as well.

This activity presupposes that the majority of PC equipments will be released into the environment under the condition that the required decontamination coefficients after dismantling will be reached.

Decontamination of fragmented facilities will be carried out as electro-chemical decontamination, applying standard methods.

After dismantling of the systems deployed in the individual objects the respective dosimetric control and verification of safety at work prescriptions will be carried out since the concrete used in buildings where reactor vessels and other systems are situated is expected to be contaminated to a significant extent.

Decontamination of structure surfaces

Structure's surfaces will be decontaminated only after the equipments have been dismantled. The following decontamination methods have been proposed:

- Surfaces covered by coating out of stainless steel will be decontaminated by semi-dry electrolytic decontamination or, in limited scope, mechanically with subsequent rinsing.
- Surfaces covered by a carbon steel coating with epoxide varnish will be to a limited extent decontaminated by mechanical means.
- Surfaces with epoxide varnish will be decontaminated by means of a detergent-water solution (1:1 ratio) applied on the surface as foam. Mechanical decontamination will be applied in limited scope if it is necessary.
- Surfaces without coating and epoxide varnish will be decontaminated mechanically by abrading to a depth of approximately 5 to 10 mm.

Decontamination will be carried on until the activity measured in the concrete and other masonry walls will reach release levels valid for building structures in Slovakia.

Several decontamination cycles will be applied if necessary.

Examples of typical technologies are:

- Hot high pressure water jet
- Semi-dry electrolytic decontamination
- Decontamination by foam
- Decontamination by gel
- Decontamination by adhesive coatings
- Decontamination by detachable paint (film) and electrolytic decontamination
- Washing cloth
- Decontamination by abrasion/scarification.

Activities in the framework of decontamination will be carried out according to zone classification. The following activities fall within the scope of work:

- Monitoring and control of the area, initial examination in order to identify the contamination levels and places with high activity of structure surfaces and build-in contaminated elements.
- Choice of the most suitable method or methods of decontamination depending on the level and depth of contamination penetration.
- Preparatory activities.
- Dismantling of build-in contaminated elements, removal of contaminated steel constructions.
- Decontamination of structure surfaces until required release activity levels are reached, applying the proposed methods.
- Dosimetric measurements on structure surfaces after decontamination in order to secure that the elements meets release criteria.
- Handling of concrete debris and waste produced in course of decontamination, its loading into the respective packaging (barrels, containers and similar), transport to the waste management stations and provision of other activities of waste management until its disposal.
- Final zone cleaning and maintenance.

Metal residual waste will be processed and modified in accordance with the radioactive and other residual materials management procedures. Secondary waste generated in course of surface decontamination (abrasion/scarification residue) will be processed by the existing technologies of the Bohunice Processing Centre of RAW.

2.8.4 Demolition of structures and filling up of construction pits

The activity objective is dismantling of remaining structures subsequent demolition of structures during the Stage II of decommissioning (after decontamination, if necessary) and waste management, including waste disposal. The activity comprises work in connection with demolition of these structures and buildings (including underground structures), waste management and provision of tools and equipments to be used. The activity scope also includes dismantling the remaining non-contaminated systems and components located in the buildings before demolition works.

Even to demolition, individual building elements will be dismantled, such as metal staircases, platforms, construction steel, e.g. painted steel beams, metal board, embedded pipes etc. The dismantled building parts will be handled as waste and processed and conditioned according to the type of waste. RAW waste management is subject to procedures described in the Chapter 2.8.1.2 above. Conventional waste will be managed pursuant the legal requirements applicable for waste management (Chapter 2.8.2.1.).

Once emptied the structures will be demolished down to the foundations.

Demolition of structures including cooling towers can be carried out only applying mechanical methods, such as:

- Jaw crushing machines - during demolition, small pieces of concrete with diameters of max. 20 cm will fall on the ground, while other structural parts remain unaffected.
- Gradually cutting the upper part down to the height of 50 m. Subsequently, the individual parts will be transported to the ground by crane, where they will be fragmented to smaller parts. After demolition down to 50 m, the demolition method described in the previous alternative will be applied from 50 to 0 m, by means of jaw crushers.

Concrete generated in course of the demolition of cooling towers and the other objects will be subsequently separated from iron reinforcements and after used for backfilling the construction pits remaining after demolition of towers.

When carrying out demolition activities described above, the workers will be protected to the utmost possible extent, minimising vibrations, dust, noise level, emission of gases or smoke, according to the applicable laws of Slovak Republic (in particular the Act No. 355/2007 Coll.). The workers will reduce dustiness by suitable management of work, sprinkling and cleaning of roads.

Demolition activities will be performed gradually in a planed manner. The scope of activities includes:

- Radiological, chemical and radio-chemical controls,
- In case of contaminated objects, decontamination in situ (if necessary) will be applied to the utmost possible extent,
- Removal of contaminated components by cutting and dismantling in a suitable form, allowing for transport to decontamination facilities or waste management facilities,

- Preparatory activities: disconnection of elements from networks, disconnection of feeder from connection lines, assuring the operation of main lines after disconnection, if necessary,
- Elaboration of a demolition plan, a detailed schedule of work plan and necessary procedures, obtaining authorisation for demolition for buildings according to the act 50/1976 coll.,
- Securing disconnected elements and provide protection systems prior to dismantling,
- Prior to any dismantling activities, the respective dosimetric control and verification of work safety will be performed,
- First removing auxiliary elements, such as metal staircases, platforms, construction steel, e.g. Painted steel beams, metal board, embedded pipes etc.,
- Handling the dismantled material and generated waste and transport to recycling/storage destinations,
- Demolition of buildings to the foundations ,
- Removal of underground pipes and structures situated below buildings ground,
- Backfilling of pits with debris generated during demolition works at v1 NPP (if debris cannot be recycled or reused) or with clean debris from the a1 NPP. After these activities, terrain conditioning and landscaping will be performed and finally recycling/disposal of produced waste.

2.8.5 Release of decommissioned materials into the environment

The ideal approach to manage materials from NPP decommissioning is, from the environment point of view, their decontamination and release from administrative control for unrestricted use. The project BIDSF C10 "Release of decommissioned materials" is performed for purposes of continuous monitoring of materials in order to decide on their possible release from administrative control. This project aims is supply equipments assigned for classification and selection of materials generated in course of V1 NPP decommissioning, in a manner allowing for their use in accordance with applicable laws.

The decision on the future use, including final disposal alternatives will depend on the radiological features of the material. Radioactive and non-active materials from the NPP, forming part of the V1 NPP site release process, will pertain to these two streams:

- Waste released from administrative control is generally referred to as "free release" or "clearance", meaning that no further material control from the point of view of radiation protection is required. Such waste can be recycled/disposed of in accordance with waste management laws (Waste Act).
- Material with radioactive contamination exceeding the clearance values will be transported to facilities for further RAW processing.

The release of radioactively contaminated materials aims to achieve effective V1 NPP decommissioning, while securing sufficient protection of public against ionising radiation.

Release of material generated from the nuclear power plant decommissioning is subject to authorisation by the Public Health Authority of SR according to the Act No. 355/2007 Coll. on Protection, Support and Development of Public Health and on Amendments and Supplements to Certain Acts, as amended, § 45 paragraph 5, "Permission to release radioactive substances and radioactively contaminated subjects produced or used in activities resulting to irradiation, which were carried out with a permission by the PHA SR, under administrative control".

Only will be released into the environment non-contaminated or low-contaminated materials with mass activities below the release level values established by the Annex No. 8 to the Regulation No. 345/2006 Coll. and at the same time meeting the criteria for release of radioactive substances into the environment provided by the part II. of the Annex No. 3 to the Regulation No. 345/2006 Coll. According to the point 3, part II. of the Annex No. 3 to the Regulation No. 345/2006 Coll., the release criterion pursuant point 2, part II. of the Annex No. 3 to the Regulation No. 345/2006 Coll is considered as fulfilled if the average effective dose to an individual of the critical group of public does not exceed in any calendar year the value of 10 μSv while, at the same time, the collective effective dose does not exceed 1 manSv.

In order to measure the activity of the contaminated materials classified for release from administrative control, in the framework of the BIDSF project, four work stations have been provided and equipped with respective tools and a central software for registering data from monitored material. At work stations, radiological characterisation of materials will be carried out not only by measuring and evaluation of volume activity and surface contamination activity but also a radiological characterisation control will be performed.

The 4 work stations are:

- Work station with a large-volume measuring chamber
- At this station a large-volume measuring chamber will be placed in the delivery track corridor at the border of the controlled zone and will work in shielded regime.
- Work station for measuring of large-volume materials
- At this station a large-volume measuring facility with a large-volume container will be placed.
- Work station for large-volume material
- At this station, to be situated outside of the controlled zone of V1 NPP, large-scale construction components of V1 NPP equipments will be controlled. Measuring facilities will consist in devices for measurement of surface contamination and local gamma spectrography systems.
- Work station for release of building structure components
- This station will be used for release of surface contaminated structural parts of V1 NPP. Measuring facilities will consist in devices for measuring of surface contamination of large-scale components, working in scanning regime, devices for measuring of surface contamination and local gamma spectrography systems.

The equipment of the work stations will also include manipulation mechanisms and scales. Documentation on metrological certification and calibration will be available for all applied measuring devices.

The locations No. SO 800-2:V1, SO 800/c:V1, SO 490-2:V1 and the newly constructed No. 510/2:V1 serving the temporary storage of released material for purposes of PHA SR I have been adjusted to accommodate the monitoring equipments and logistics.

Various materials will be released into the environment, such as: metal, thermal isolation, construction waste and soil, large-volume and large-scale materials and parts of buildings.

Materials will be released in form of fragmented metal materials in pallets and construction material waste in containers. Large-volume and large-scale materials and parts of buildings will be measured in situ.

The total material amount to be released is ca 722 thousands tonnes. Out of the total amount of 235 thousands tonnes of primary circuit material, 228 thousands tonnes are expected to be released and7 thousands tonnes of radioactive material will have to be further processed as RAW. All the individual activities performed are optimised to produce as little as possible adverse influence on the working environment, workers and surroundings of the nuclear facilities V1 NPP.

2.8.6 Restoration of the site into the final condition

The main objective of this activity is the remediation of the territory before the beginning of the final survey, with the objective to release the territory from the control regime.

Contaminated superficial and substratum (non-saturated) soil and rock on the outside areas will be decontaminated or processed as necessary at the Bohunice Processing Centre of RAW, until the contamination level is lower than the values for the determined locality usage. Finally, the superficies of the site will be conditioned so as to match with the surrounding field.

Contamination of groundwater has been registered at the site; this fact will have to be considered when planning the correction measures. It has been concluded that groundwater in the proximity of one of the boreholes is contaminated with tritium and it is also presumed that there are leakages from the sewage system, tanks and the spent fuel pool. For this reason, it will be necessary after the decommissioning process, to carry out groundwater contamination monitoring by means of a net of boreholes, in compliance with the site restoration plan, to complete and extend the existing net of boreholes according to the needs and the results of the analyses performed during the initial radiological survey by which the groundwater contamination was evaluated.

It is presumed that the volume of contaminated soil that will have to be decontaminated in order to release the site for new industrial use is approximately 170 m^3. The volume of soil contaminated by other non-radioactive polluting substances is estimated at about 320 m^3.

If so required, the activity would also comprise site restoration works in case this will be deemed necessary due to measured contamination above the release levels in the first stage of examinations within the final site survey.

Site restoration works in course of the Stage II of decommissioning will be performed in an integrated manner and in parallel to the demolition and removal of foundations.

Final examination and site release

The main target of this activity is to carry out the final radiological survey at the end of the decommissioning process and prepare the documentation to be submitted to the authorities in charge.

Radiological control of non-contaminated and decontaminated outer spaces will be carried out in order to prove that levels for release of the site for restricted use, set by the competent authorities, have been kept. If it is not possible to show that these values have been kept the failing spaces or soils will be restored again.

GROUPS OF AUXILIARY ACTIVITIES

2.8.7 Management of other and dangerous waste (conventional waste)

The preferred approach in case of conventional (non-active, non-contaminated) wastes will be their valorisation (recycling or reuse). Waste will be disposed at dumping sites only if no other possibility is available and the capacity of the surrounding dumping sites is sufficient. Management of diverse types of conventional waste and their destinations are summoned up by the following table.

Waste flow	Modification	Destination
Conventional waste	Size and volume reduction: - pressing - Crushing (concrete) - fragmentation	Valorisation/disposal
Decontaminated material		Valorisation/disposal
Hazardous waste		Valorisation/disposal

Conventional wastes out of V1 decommissioning will be handled in common manner like in cases of non-nuclear industrial facilities and sites (recycling, filling up of construction pits, transport to dumping sites, if applicable). A basic prerequisite is constituted by separation of waste into categories at the place of its generation (other, hazardous and waste types according to the Regulation of the Ministry of Environment SR No. 284/2001 Coll. on the Establishment of a Waste Catalogue). That is to say, these wastes will be sorted according to the Waste catalogue and will be valorised or disposed of according to the possibilities given for the individual waste types.

Generation of waste of three groups is expected:

- Waste assigned for back-filling of foundations pits created through demolition of buildings - construction debris conditioned by a crushing machine into the necessary size, with separation of reusable metal waste.
- Waste for free reuse - waste will be transported out of the JAVYS, a.s. site and which can be used as secondary raw material directly without further conditioning, once it has been partially conditioned and sorted out or recycled. This concerns mainly metal waste from dismantling and metal waste separated out of construction debris.
- Waste not suitable for free reuse - wastes in the categories of "other" or "hazardous", which will be transported out of the JAVYS, a.s. site for valorisation or disposal. These are, e.g. floor materials, thermal roof isolation, suspended ceilings, external panels, waterproof isolations, floor claddings, wood products, sanitary facilities and similar.

<u>Material valorisation of construction waste</u>

Valorisation of non-radioactive construction wastes will be performed by means of mechanical modification - crushing, separation and fragmentation of the individual materials. Valorisation will aim at obtaining secondary raw materials (metal) and backfilling materials for use on site. Mobile crushing equipments will be applied to this end, provided by the unit responsible for demolition works for each project separately. The crushing device capacity will be adjusted to the scope of buildings to be demolished, or alternatively, a new mobile sorting and crushing facility will be provided to perform material valorisation of suitable construction wastes, with a total recycling life cycle capacity of appr. 500.000 tonnes (± 10%). The total life cycle of the crushing machine will be 11 to 13 years. The crushing machine will be applied over the whole process of V1 decommissioning.

The new crushing machine shall have a min. capacity of 300 t/h and will allow for separation of iron reinforcements from concrete and separation of crushed concrete according to the particle size. The maximum input material size on will be 1,100 x 900 mm. The maximum size of crushed products shall not exceed 5 cm.

Construction iron will be, after separation from concrete, fragmented according to transport requirements.

The priority of conventional waste management is to enhance the recycling level of construction and demolition materials which will not be transported out of the JAVYS, a.s. site considering the necessity of their utilisation for backfilling of construction pits of the demolished buildings themselves. Thanks to such waste utilisation the traffic on road will be released considerably. Only materials assigned for disposal or valorisation by organisations specialised on recycling and disposal of the individual waste types will be transported out of the site.

Hazardous wastes may be collected at the waste collection yard or at the storage of NW at the JAVYS site or directly in suitable, properly labelled containers located close to the buildings to be demolished and protected against leakage, theft and climate conditions. Construction material containing asbestos must be stabilised prior to transportation to a dumping site.

2.8.8 Modification of systems and equipments and mounting of new equipments for decommissioning purposes

The main objective of this activity is to prepare the reactor building, the auxiliary building and, if necessary, other locals and outdoor spaces for dismantling and hence facilitate the performance of subsequent activities and minimise time consumption and collective doses.

The following activities belong herein:

- Construction of a recycling line for non-radioactive construction waste.
- Establishment of a dumping site for recycled material.
- Acquisition of personnel facilities and equipment.
- Construction of a specialised fragmentation work station for activated components.
- Construction of a specialised fragmentation work station for contaminated facilities of the PC.
- Mounting of manipulators for purposes of fragmentation of RPV and fittings.
- Mounting of manipulators for purposes of fragmentation of contaminated PC equipments.

- Acquisition of specific containers for activated and contaminated equipments (RPV, PC equipments, Mogilnik ...).
- Systems modifications or adaptations (electricity, telephone, water, draining of sewage water, waste collection and similar).
- Reconstruction of LAN infrastructure and telecommunications.
- Modification of ventilation air systems in the reactor hall in order to prevent air contamination and radioactivity release into the surroundings.
- Construction of necessary elevators and transport openings, lifting devices for moving large components from/into the reactor building.
- Acquisition or leasing of special equipments required for decommissioning works and transportation of decommissioned waste (as necessary).
- Identification and labeling of equipments and boundaries of contaminated and non-contaminated places according to the individual systems. During dismantling planning will be carried out according to the individual zones to be decommissioned; planning identifies all preparatory measures applicable to a given part of the plant.
- Disconnection of ISFSF and BPP (auxiliary building).
- Mounting of a washing room.

Activities will also comprise conditioning and modification of other locals and outdoor areas to adequate for their utilisation during the Stage II of decommissioning, such as buildings accommodating the turbine, storage areas, the maintenance halls and other outdoor buildings.

2.8.9 Operation, control and maintenance of auxiliary systems

In order to achieve reliable operation during the decommissioning stages it is necessary to carry out supervision and maintenance of remaining systems in order to assure operational applicable prescriptions for full or restricted operation. If a system reduction is performed during the decommissioning process, a readjustment or updating of operational prescriptions and provisions for maintenance and supervision of equipments is required.

General requirements to maintenance of equipments in the NPP are:

- To comply with the valid legal provisions of SR, EU and recommendations by IAEA,
- To secure nuclear safety and radiation protection in any operational phase,
- Keep operational technological equipment in good technical state in respect to reliability,
- To focus on the quality of any activities when carrying out maintenance tasks,
- To ensure technical safety.

In difference to maintenance of traditional industrial facilities, in a nuclear power plant, the factor of radioactive radiation has to be considered since it represents a certain risk for the maintenance personnel. This risk must be taken into consideration in respect to the general requirements as follows:

- The effective doses to which personnel is exposed during maintenance works must be minimised - ALARA principle.
- Maintenance will be carried out taking into consideration the recommendations of supervisory organism and IAEA.

- It is indispensable to allow for inestimable experience gained in its own operation and during completed decommissioning of other NPPs.
- Maintenance tasks are carried out under an effective system of prevention of human errors.
- The maintenance unit is to keep the special appliances, manipulators and other equipment for special maintenance tasks in good technical condition.
- Maintenance works are carried out so as to possibly minimise the direct and indirect maintenance costs.

The following maintenance tasks will be carried out during decommissioning following the 1. stage of decommissioning:

- Preventive maintenance.
- Corrective maintenance.
- Predictive maintenance.

2.8.9.1 Control and maintenance of systems applied during decommissioning

Planning of maintenance and repairs is to continue during the decommissioning process like in course of normal operation. Equipments assigned for decommissioning will be in short time will be gradually excluded from the work. Some equipments will be needed until the very end of the decommissioning process of technological systems and will be removed as last. Control and management system and groups of systems which belong to the most important ones in the decommissioning process, are described in the following chapters.

2.8.9.2 Control and supervision systems

Control and supervision systems can be divided, as to the functions, into these three subsystems:

- Supply systems,
- Supervising systems,
- Information systems.

Control and supervision systems serve the purpose of securing a safe operation of the system. They provide for supervision of operational processes, control of operational parameters and deviations from them, protection of equipment against dangerous operation stages, remote transfer of measured values, command of operational components, automatic keeping of set values, starting of reserve equipment together with signalisation notifying the personnel in case of non-compliance with required parameters and similar.

The required condition of equipment operation is fulfilled when the prescribed operational values depending on the type of the operated equipment are observed (e.g. pressure, flow volume, speed, level height and similar).

System of supervision and control of operational equipment is situated in switch boards and SKR panels.

Maintenance is performed according to maintenance planning through yearly and long-term plans. Updating of plans is provided by means of IT systems of automatised maintenance process management. The system provides complex information on the state of the equipment, allows for notifications on break-downs, creation of tasks and work instructions.

2.8.9.3 Air technical systems

Air technical systems (air-conditioning, heating, cooling and ventilation) provide for suitable working conditions for personnel and technological equipments. Prevention of leakage of radioactive substances through air technical systems into the atmosphere is provided by means of aerosol filters and filters of air conducted away from locals in which activity can occur. Upon filtration, air is released through the ventilation stack into the atmosphere.

The required condition of equipment operation is fulfilled when one of the aggregates of the given system is operational, while keeping the prescribed operational parameters (e.g. air flow volume, humidity, temperature, pressure on entry, pressure on exit, pressure drop on filters, reduced pressure in HP and similar).

The air technical systems considered are as follows. Circulation systems and air supply systems to spaces and rooms with active operation are situated in the reactor building. Most of the supply and exhauster air technical systems are situated in the rooms of the longitudinal and lateral intermediate building. An exhauster system provides a reduced pressure in air proof spaces and other rooms with contaminated equipments.

The system ARSOZ provides complex information on the state of the equipments, allows for notifications on break-downs, creation of tasks and work instructions. Workers of the air systems maintenance unit carry out corrective maintenance on the basis of the issued instructions as well as planned maintenance in prescribed periods.

The periodicity of maintenance is determined by operational procedures applicable for air technical systems of the reactor building, BPP (auxiliary building) and PB (operational building).

2.8.9.4 Radiation control system

Radiation control systems are determined for control of the radiation levels in the operational locals of the NPP with operation in course (HVB - main production building, BPP - auxiliary building and the ventilation stack). A systematic control of activity levels in individual environmental points is provided for in the surroundings of the NPP. From the functional point of view are provided: radiation monitoring (RM) of the working environment, RM of the technological process, discharges and the NPP surroundings and RM of persons - dosimetric control. Monitoring is secured by means of a centralised autonomous supervision-measurement system of radiation monitoring that allows for continuous measuring of the monitored parameters.

The required operational condition is continuous surveyed and secured by a central IT system of RM.

Operational work stations of the central system are the radiation control room, supervision rooms of the two units, TPS in the permanent shelter below the administration building and in the building of the Laboratory of Radiological Environmental Monitoring (LRKO). Detectors of the centralised measurement system are placed in all operative rooms significant from the point of view of RM.

Our objective is to ensure a safe condition of the equipments by means of organised systems maintenance. Maintenance is performed according to maintenance planning through yearly and long-term plans, applying an IT system of automatised maintenance process management. The system ARSOZ provides complex information on the state of the equipments, allows for notifications on break-downs, creation of tasks and work. Workers of the maintenance unit of radiation monitoring equipments carry out corrective maintenance on the basis of the instructions generated by the system as well as planned maintenance in prescribed periods.

The periodicity of maintenance is determined by operational procedures for Radiation Monitoring in HVB (main production building) and BPP (nuclear auxiliary building). The yearly plans are introduced into the ARSOZ system which generates instructions to carry out regular control and maintenance of equipments.

2.8.9.5 Service water supply system

Service water supply systems consist out of a reservoir unit (tank or pit), a pumping unit, a pipe system for distribution of water to the individual components to be cooled, a system of return pipes leading into the draining collector of used heated water and a device to cool de water (cooling towers). The system provides for pumping of service water, its draining and repeated cooling and usually works in a closed circuit (tank-pump-component-cooling tower-tank).

The pumping unit together with the reservoir tank represents an auxiliary system with non-active water located in a separate building. The pipes are placed in pipe channels that enter into the building to feed components. Here, the pipes branch out into the individual components. The return line leads again through the pipe collector to the cooling device (ventilation cooling tower) from where service water flows back to the reservoir tank.

Organised maintenance of service water supply system secures prevention of break-down situations and system operation failures. Maintenance of the facility is carried out according to planning determined in yearly and long-term plans provided for by the ARSOZ system. Pursuant to instructions issued by the ARSOZ system, workers of the maintenance unit (of pumping devices, turning machines, armatures, servo-armatures, regulation valves and their equipment) carry out corrective maintenance as well as planned maintenance in prescribed periods.

The periodicity of maintenance is determined by operational procedures applicable to the given operational equipment or system. The facility supervisor participates in drafting of yearly maintenance plans to be introduced into the ARSOZ system which generates instructions for regular control and equipment maintenance. The maintenance period and extent are determined by the plant leader and are provided for in the respective operation manuals.

2.8.9.6 Energy supply systems

Electric energy supply systems play an important role and hence must be paid due attention. Considering that they belong to specific equipments they must fulfil specified parameters and a required technical condition. These systems are subject to particular provisions and checks. These systems are to supply the individual consumers with electric energy according to the required parameters and safety conditions, (e.g. suitable isolation, current and voltage protection, separation of circuits, isolation of active parts, setting up barriers and similar).

In decommissioning conditions, focus is put on supply with energy of important electrical consumers necessary for securing of a failure-free decommissioning process. In this period, distribution lines for illumination of building structures play a crucial role.

The electric equipment is placed in the respective main switch board rooms to which secondary switch boards are connected which are placed close to consumers electrical bars. From the secondary switchboards electricity is distributed by cable lines to the individual consumers. Room illumination circuits in buildings are projected as separate circuits.

Maintenance of the electrical installations is carried out according to planning determined in yearly and long-term plans by means of the ARSOZ system. Apart, a special system of revision management applies to specific equipments. As a rule, revisions are carried out on the basis of updated project documentation in respect to electricity supply and the initial revision report on the facility condition. Regular revisions of the electric facilities are carried out periodically as established by the applicable legal provisions for specific equipments.

The periodicity of maintenance is determined by operational procedures. The equipments are subject to general maintenance according to the yearly maintenance plans and, apart, repeated equipment revisions are carried out according to maintenance procedures. The facility supervisor participates in drafting of yearly maintenance plans to be introduced into the ARSOZ system which generates instructions for regular control and equipment maintenance.

2.8.9.7 Lifting devices

The purpose of lifting devices is to provide the movements of loads of different size and weight during dismantling operations, fixing of the individual components prior to division of fragments (e.g. pipes) and similar.

In the context of nuclear facility decommissioning, lifting devices constitute a significant element of dismantling activities, with extraordinary requirements as to their functionality, reliability and safety.

Maintenance of the facility is carried out according to planning determined in yearly plans, lubrication plans and long-term plans provided for by the ARSOZ system. Lifting devices belong to the specific equipments and are subject to a special system of revision checks management.

2.8.9.8 Control and maintenance of building structures

From the functional point of view, building structures represent a significant barrier preventing the diffusion of radioactive substances into the environment. In course of decommissioning activities, increased occurrence of aerosols, particles due to material fragmentation, generation of liquid and solid RAW can be expected and there is a certain, even if remote, risk of their diffusion into the environment, spreading out of contamination and affecting exposure of public. Therefore, it is essential to maintain building structures in good technical state, focusing on leak proofness of isolations of roof structures, wall penetrations structures etc.

Maintenance of building structures is based on the executive project documentation, including amendments and supplements on the performed changes of structural character.

2.8.9.9 Security (security and health protection at work (SHPW), fire protection (FP), nuclear, physical security)

2.8.9.9.1 Radiation protection

Within the process approach of the integrated management system applied by JAVYS, a.s. "Radiation protection" forms part of the process "Security". The radiation protection concept is based on requirements and international recommendations issued by IAEA; ICRP, further on IEC and ISO standards and criteria and national provisions on radiation protection of personnel working with radiation sources in conditions defined by technological processes. JAVYS, a.s. has provided a summary of legal provisions valid in SR in the sphere of radiation protection, a description of the working environment radiation control system, protection of persons against exposure to ionising radiation, definition of zones subject to radiation control and work management in these zones in the sub-process guidelines "Radiation protection" and in operational documentation.

Radiation control of working environment focuses on health protection and monitoring of observance of radiation protection rules in the locals of the controlled zone.

2.8.9.9.2 Basic principles of radiation protection

The radiation protection system of the Jadrová a vyraďovacia spoločnosť, a.s. is based on the following basic principles:

- Activities that can result in irradiation may be only carried out if it is justified. An activity resulting in irradiation is justified if the health damage potentially caused by the activity is outweighed by the expected advantages it brings for the individual or society (principle of justifiability).
- Anybody performing activities resulting in irradiation is obliged to ensure that the number of exposed persons, level and probability of them being irradiated be permanently kept as low as can reasonably be achieved considering economic and social perspectives (the so called ALARA principle of protection optimisation).
- Anybody performing activities resulting in irradiation is obliged to reduce radiation total personal doses in individuals from all performed activities to values below the irradiation limits set by the regulation no. 345/2006 Coll. (so called principle of limiting personal doses).
- Observance of basic principles and standards of safety culture at all management levels of the company pursuant to BZ/JB/SM-02 (safety culture).
- Projects, operational provisions, procedures and other documentation of work with sources of IR must comprise in-depth protection in order to compensate for potential operational events in respect to radiation protection (principle of in-depth protection).

Any activities carried out in presence of ionising radiation sources are, prior to permission, during and after their performance, subject to optimisation of radiation load according to the valid national laws and the internal system of quality assurance.

Radiation protection of workers carrying out activities resulting in irradiation is assured in particular by:

- Justification of activity and optimisation of radiation protection of working conditions including prior evaluation of the character and extent of a possible threat to workers' health, risks connected to the planned activity and regular re-evaluation considering the operational experience,
- Demarcation of supervised zones and controlled zones at the work place, focusing on estimation of expected irradiation during standard operation and probability and extent of potential irradiation,
- Categorisation of workers,
- Ensuring permanent monitoring of radiation protection, regulatory and control measures, providing the work station with appliances, equipments and tools in sufficient number and quality in order to enable the measurements determined in the monitoring plan, emergency plan or the quality assurance program, providing workers with personal worker protection equipment with adequate shielding effect and protective tools,
- Monitoring of working conditions in determined protected zones and, where necessary, also by means of personal monitoring,
- Health attendance.

All persons working in the controlled area are subject to control and regulation of irradiation. Monitoring of radiation load in the individual employees and suppliers and measurement of received doses during work in environment with ionising radiation is basically carried out by means of a film badge dosimeter. Any person working with sources of ionising radiation is at the same time obliged to wear operative electronic signal dosimeter and, if prescribed, also a supplementary thermoluminescent dosimeter. Apart, measurement of internal contamination by radionuclides is provided for in form of regular examinations and following activities bearing higher risks (such as activities with increased risk of inhalation of radioactive aerosols).

Any new activities to be carried out in the controlled zone of V1 NPP must be described in detail in the respective project or work plan. Any such activity/work process must include a chapter on radiation protection that shall indicate all safety measures and calculated expected doses in accordance with the directive BZ/RO/SM-02 "Enforcement of the ALARA principle". These work processes are subject to permission by the radiation protection department. If these activities are significant from the point of view of radiation protection they will be examined by the supervisory authority (PHA SR) or by the ALARA Commitee. Activities in the controlled zone are performed upon the Radiation instruction.

The character of the activities determines the extent of radiation monitoring:

- Monitoring of dose rate level in the working environment.
- Monitoring of volume activity of radioactive aerosols in the working environment, ahead of and behind the aerosol filters.
- Monitoring of surface contamination of working surfaces, equipments (tools), transport routes and means (mobile dosimetric systems).
- Monitoring of contamination levels and radiation loads of personnel.
- Monitoring of gaseous discharges from ventilation systems.
- Monitoring of activity and radionuclide composition of RAW.
- Monitoring of dose rates of the processed product.

- Monitoring of discharged liquid effluents.

2.8.9.9.3 Monitoring of gaseous and liquid discharges

Monitoring of discharges in course of decommissioning is carried out by the control measurement system of gaseous and liquid discharges. Monitoring of liquid discharges from nuclear facilities in Jaslovské Bohunice is organised in stages, that is to say, discharges of the individual appliances (according to the principle of monitoring at the source) and of the whole locality are monitored. Continuous monitoring is carried out at the obj. 880 (discharge water control station) - water conducted to the Dudváh recipient and obj. 368 (monitoring station of discharge water activity) - water directed to the Váh recipient.

The air exhausting system in the controlled zone provides for transfer of air, filtered on absolute filters with 99.95% effectiveness for 0.3 micron particles according to respective operational specifications, to the ventilation stack of V1 NPP by means of an exhausting system operating in reduced pressure regime. The ventilation system provides for a fast air renewal in the individual types of rooms (non-attended, semi-attended and attended) and also guarantees suitable climatic conditions (temperature, relative humidity).

2.8.9.9.4 Safety

The basic function of the sub-process "Standard safety" is based on the requirements of the Act of NC SR No. 124/2006 Coll. on Safety and Health Protection at Work, the Act of NC SR No. 311/2001 Coll. Labour Code and the Act of NC SR No. 314/2001 on Fire Protection, in respect to:

- Provision of fire prevention at JAVYS, a.s. and supervision in the frame of safety and health protection at work, SHPW (supervision of BTS - safety-technical services and PO - fire protection technicians),
- Maintenance and processing of documentation related to SHWP and OPP - protection against fire,
- Provision of checks, revisions and repairs of fire extinguishers.

Safety and health protection at work is determined by the respective basic quality directive BZ/KB/ZSM. Its objective is to set basic conditions for safety and health protection at work, exclude or reduce occurrence of work accidents, work diseases and other health damages owing to work and rule on liability, competencies and processes in respect to performance of tasks in the frame of SHPW at JAVYS, a.s.

2.8.9.9.5 Nuclear safety

The main objective of the sub-process "Nuclear safety and licensing" is determined by requirements of the Act of NC SR No. 541/2004 Coll. on Peaceful Usage of Nuclear Energy (Atomic Act) and corresponding regulations issued by the Nuclear Regulatory Authority of SR (ÚJD SR) related to:

- Assessment and independent evaluation of nuclear facilities operation from the point of view of nuclear safety (monitoring of parameters of nuclear safety and operational reliability, activity of the nuclear safety committee).
- Assessment of the extent and content of modifications of NPP and evaluation of their impacts on nuclear safety.

- Registration of nuclear materials as required by international guarantees given by Slovak Republic.
- Notification and analysis of operational events at the JAVYS, a.s. Nuclear facilities (organisation of the activity of a break-down commission, monitoring and evaluation of tendencies in respect to operational events at the JAVYS, a.s. Nuclear facilities, notification of events to supervisory authorities as required by law).
- Maintenance of safety documentation on the JAVYS, a.s. Nuclear facilities and specified operational documentation in respect to nuclear safety (safety news, limits and conditions of safe NPP operation, reliability analyses, emergency operation prescriptions, prescriptions assessed and authorised by the nuclear regulatory authority (ÚJD SR).
- Coordination of intercourse with supervisory authorities of SR (methodical management of intercourse with supervisory authorities, preserving of writs issued by supervisory authorities).
- Obtaining of approval or authorisation of necessary activities by the supervisory authority (ÚJD SR).

2.8.9.9.6 Physical security

Protection against theft and other threats is ensured by physical security provided according to the Act No. 541/2004 Coll. Physical security is subject to liability of the authorisation holder in the extent of the authorised activity. The authorisation holder (JAVYS, a.s.) guarantees by meeting the requirements of the Regulation of ÚJD SR No. 51/2006 Coll. that effective protection of nuclear materials, RAW, building structures and technological equipments is guaranteed on the basis of their categorisation. The main objective of this protection is to reduce to the maximum extent the risk of misuse of nuclear facilities and nuclear materials for purposes of threatening the life and health of persons and environment. The physical security issue is subject to separate documents called "Physical Security Plan" for each nuclear facility. This plan defines the physical security level, technical means to be applied and similar. In course of gradual decommissioning of equipments the requirements on physical security levels will be modified as required.

2.9 Substantiation of the necessity of the proposed activity in the given location (its pros and cons)

According to Government Decree SR no. 801/1999 and in accordance to conditions about accession to European Union, the first unit V1 NPP was shut down on 31st December, 2006 and the second unit V1 was shut down on 31st December, 2008. Additionally, nowadays, also at Bohunice site, there are two additional nuclear units with VVER 440/V-213 pressurized water reactors (named NPP V2), which were commissioned in 1984 and 1985 respectively, and another nuclear power plant (named NPP A1) in decommissioning process.

The only possible location for activities related to dismantling of equipment and demolition of facilities is the place itself. In the other hand, the most effective way for disposal solid RAW is to construct new facilities at adequate place available in controlled area NPP V1 and after small reconstructions will be adequate to work with contaminated materials. The principal advantages of this location are related to proximity to all places where the RAW will be collected and to transport corridors. The main aim of after-removal decontamination in new workplaces will be to reduce the surface materials contamination to the level that allows the location of these materials into the environment according to Slovak environmental law. This aim will be successful in getting minimum creation of secondary RAW that can be produced again minimizing costs and maximizing social benefits with a minimum impact to the environment.

2.10 Total costs (tentative costs)

Total cost estimate for the whole decommissioning process of V1 Bohunice Nuclear Power Plant is 1.141.295.594 €, valued in $€_{2011}$. From this total amount, cost estimate for the decommissioning Stage I is 454.506.726 € (128.101.926 € of them for pre-decommissioning). Cost estimation of decommissioning during Stage II is 686.788.868 €.

2.11 Municipality concerned

Affected municipalities, included in a circle of 5 km centred on the centroid of V1 NPP are as follows: Jaslovské Bohunice, Ratkovce, Žlkovce, Nižná, Pečeňady, Veľké Kostoľany, Dolné Dubové, Malženice and Radošovce.

2.12 Self-governing region concerned

Trnava Self-Governing Region.

2.13 Authorities concerned

District Environmental Office Trnava.

District Environmental Office Piešťany.

District Environmental Office Trnava – Permanent Office in Hlohovec.

Regional Public Health Office in Trnava.

Regional Directorate of the Fire and Rescue Corps in Trnava.

District Office Trnava, Civil Protection and Crisis Management Department.

District Office Piešťany, Civil Protection and Crisis Management Department.

District Office for Road Transport and Land Communications Trnava.

District Office for Road Transport and Land Communications Piešťany.

2.14 Approving authority

Nuclear Regulatory Authority of the SR.

Public Health Authority of the SR.

Regional Environmental Office Trnava.

2.15 Departmental authority

Ministry of Economy of the SR.

2.16 Type of the required permission for the proposed activity in accordance with special regulations

Permit to implement the proposed activities in the area of interest is required according to the following legal regulations:

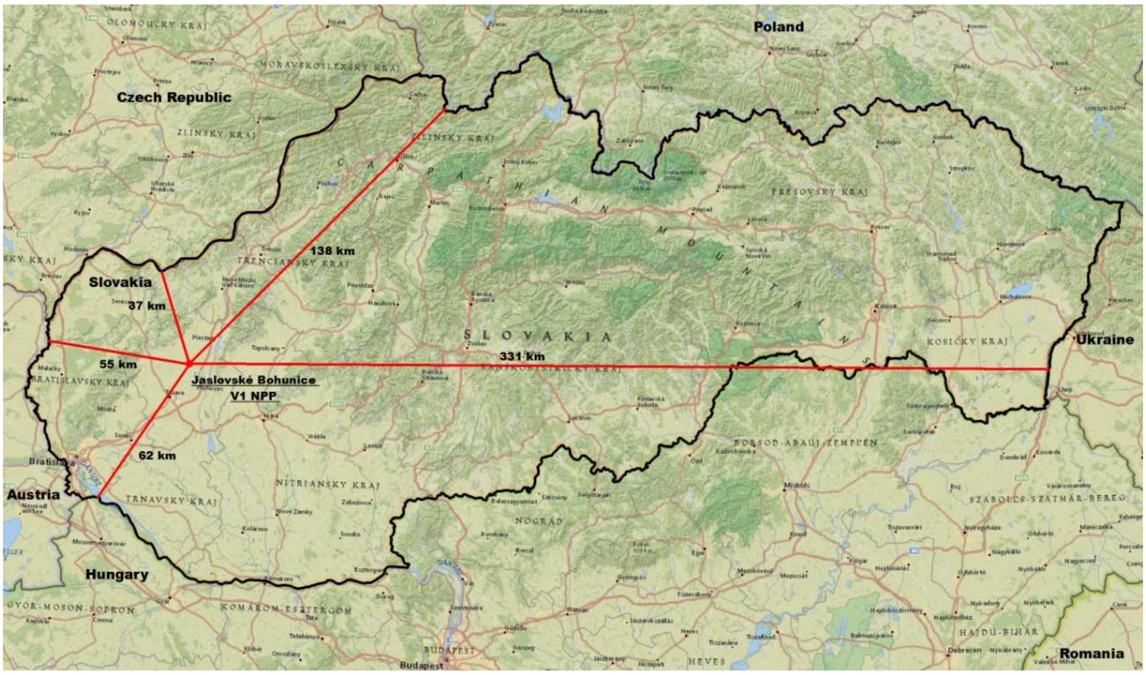
- Act No. 50/1976 Coll. on Territorial Planning and Construction Order (so-called Construction Act, or Building Act) as amended by later regulations. Basic requirements for building removal permission.
- Act No. 541/2004 Coll. on Peaceful Use of Nuclear Energy (so-called Atomic Act), amended by Act No. 94/2007 Coll. Basic requirements for decommissioning permission.
- Act No. 355/2007 Coll. on Protection, Support and Improvement of Public Health (so-called Public Health Act). Basic requirements for activities leading to irradiation.

2.17 Statement on anticipated transboundary impacts of the proposed activity

The environmental impacts from the proposed activity must be considered negligible in comparison with usual impacts of V1 NPP units in operation added to the rest of facilities located at the nuclear energy complex of the Bohunice site. All impacts of radiological character are restricted to the site of the decommissioned power plant, with some non-radiological and socio-economic impacts extended to municipalities from a broader threatened area (districts of Trnava, Piešťany and Hlohovec). According to this, the proposed project does not fall under the provisions of the Espoo Convention[1], because no significant transboundary impacts are expected at any stages of the decommissioning activity. Furthermore, the decommissioning is not in the Annex 13 of the Act as an activity that is obligatory to international assessment.

[1] The Espoo Convention on Environmental Impact Assessment in a Transboundary Context was ratified by the Slovak Republic on 22nd November 1999 and it came into force on 17th February 2000.

Graph No. 6. Distance from V1 NPP to state boundaries



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3 BASIC INFORMATION ON CURRENT ENVIRONMENTAL CONDITIONS IN THE CONCERNED AREA

3.1 Characteristics of the natural environment, including protected areas [e.g. proposed protected bird areas, areas of European importance, a continuous European system of protected areas (Natura 2000), national parks, protected landscape areas, water conservancy areas]

3.2 Landscape, stability, protection, scenery

3.3 Population, its activities, infrastructure, cultural/historical values of the area

3.4 Current environmental quality, including health

4 BASIC DATA ON ANTICIPATED IMPACTS OF THE PROPOSED ACTIVITY ON THE ENVIRONMENT, INCLUDING HEALTH, AND ON POTENTIAL MITIGATION MEASURES

4.1 Requirements for inputs

4.1.1 Land required

4.1.1.1 Total land requirements

The proposed activity does not require new occupation of land.

4.1.2 Water consumption

The same actual water sources (surface and groundwater) will be used at 2nd Stage of V1 NPP decommissioning.

4.1.2.1 Surface water

The Jaslovské Bohunice nuclear complex is currently supplied with potable water from two branches of the distribution pipelines managed by Trnava Water Supply Company (TAVOS, a.s. Piešťany). The performance of proposed activity will not require the new water sources.

4.1.2.2 Groundwater extraction

Presently, there is no potable water supply from ground water sources in V1 NPP and there is no intention to extract groundwater during the proposed activity period.

4.1.2.3 Estimates of water consumption

For the estimation of water consumption, the following planned decommissioning activities should be taken into account:

- Drinking water consumption consists of water consumption for personal hygiene of the staff; in 2012 it was about 150 thousand m^3, during the decommissioning activity the volume will be decreased gradually.
- Technological water for the cooling of technological equipment and in heat exchangers, estimated volume is about 1 mil.m^3 per year at the beginning of decommissioning and gradually the consumption will decrease.
- Demineralised water for the decontamination.
- Water for RAW treatment and conditioning
- Water for steam production.

In order to have a general characterization of water consumption during the 2nd Stage of V1 NPP Decommissioning, the following figures shall be considered per each activity to be performed:

Tab. No. 1. Estimates of water consumption

2nd Stage of V1 NPP decommissioning item	Demineralised water (m^3)	Steam (t)	Total amount (m^3)

Tab. No. 1. Estimates of water consumption

2nd Stage of V1 NPP decommissioning item	Demineralised water (m^3)	Steam (t)	Total amount (m^3)
Dismantling	16.175	1.142	17.317
Treatment, storage and disposal of RAW	2.757	40.385	43.142
TOTAL AMOUNT	**18.932**	**41.527**	**60.459**

4.1.3 Other raw-material and energy resources

4.1.3.1 Raw materials

The following activities will contribute to the consumption of raw materials:

- The decontamination of contaminated equipment and building surfaces.
- The dismantling of technological equipment in contaminated buildings.
- The demolition of buildings.
- The RAW waste treatment, storage and disposal

Requirements for raw materials consumption for 2nd Stage of V1 NPP decommissioning per each activity are as follows:

Tab. No. 2. Consumption of raw materials

2nd Stage of V1 NPP decommissioning item	Oil (t)	Bitumen (t)	Cement (t)	Compressed air (Nm^3)	Oxygen (Nm^3)	Acetylene (Nm^3)
Dismantling	7	0	0	167.578	245.472	15.185
Treatment, storage and disposal of RAW	497	293	1.639	100.234	74.497	4.966
Demolition, restoration and landscaping of the site	1.100	0	0	59.553	679.825	43.509
TOTAL AMOUNT	**1.604**	**293**	**1.639**	**327.365**	**999.794**	**63.660**

In order to assure provision of raw materials, they will be ordered at selected suppliers.

4.1.3.2 Energy sources

The supply of energies (electricity) will be provided from SE EBO sources.

Tab. No. 3. Consumption of energy

2nd Stage of V1 NPP decommissioning item	Electricity (kWh)
Dismantling	1.774.356
Treatment, storage and disposal of RAW	674.297
Demolition, restoration and landscaping of the site	155.332.631
TOTAL AMOUNT	**157.781.284**

Natural gas for relevant existing and proposed activity supporting facilities and fuel for all machines and transport vehicles for so long period could be estimated after the detailed study.

4.1.4 Transport and other infrastructure

There is a network of roads and railway lines in the affected territory. Realization of the proposed activities will not place a greater burden on road communications, railway lines or technical infrastructures. The expected amounts of raw materials and waste for shipment will require the reconstruction of access roads in addition to their usual maintenance, so that they can bear the anticipated loads.

Currently no requirement for a new transport infrastructure is defined.

4.1.5 Requirements for labour force

The 2nd Stage of V1 NPP decommissioning will increase new qualified job opportunities, and the estimated labour requirements are as follows:

Tab. No. 4. Man labour needs

2nd Stage of V1 NPP decommissioning item	Labour (10^3 hours)	Labour (Men · Month)
Pre-dismantling decontamination	78,3	489,4
Demolition	1.233,4	7.708,8
Post-dismantling decontamination	535,2	3.345,0
Decontamination of buildings	328,0	2.050,0
Demolition	4.719,9	29.499,4
RAW management	271,2	1.695,0
Non-RAW management	182,7	1.141,9
Site restoration and landscaping	104,0	650,0
TOTAL AMOUNT	**7.452,7**	46.579,4

The existing staff of JAVYS will be allocated as much as possible and for some specific works the external staff will be contracted.

4.1.6 Other requirements

The propose activity evokes the need for specific technical and technological equipment and installations, in particular:

- Laboratory equipment and equipment for radiation monitoring
- Specific equipment for dismantling and fragmentation in primary circuit

- Specific installations for fragmentation and decontamination (F&D facility) and waste treatment (metallic RAW melting facility)[2]

4.2 Data on outputs

4.2.1 Air pollution sources

The activities of 2nd Stage of V1 NPP decommissioning include dismantling works, demolition of buildings, crushing of rubble, disassembly of plant and machinery, movement of vehicles and machinery and operation of supporting installations and systems. All these activities will lead to the emission of radioactive and non-radioactive gases, particulates and aerosols, and will affect the quality of the air. A precise quantification of amounts in this sense is not possible at the present phase of the decommissioning process.

Regarding the quality of non- radioactive emissions of the basic pollutants (PM, SO_2, NO_2, CO, TOC) the following types of emission sources are presumed:

- Emissions from all machines using fuel (construction and transport machines).
- Emissions from the existing air static, mobile and surface area pollution sources in place, which will be also in operation in 2nd stage of decommissioning.
- Primary dust and secondary dust during demolition, fragmentation and mechanical waste treatment (operation of shredder) and landscaping (PM, PM_{10}).

JAVYS currently operates several air pollution sources of all three categories (small, medium and large sources) which will also be in operation in certain time during the 2nd stage of decommissioning. Emissions from these sources are defined and monitored; results are evaluated and published each year in annual report. No problems with limits compliance was registered in 2012.

Regarding the quality of radioactive emissions, the following types of emissions are expected:

- emission from dismantling and fragmentation of activated and contaminated materials including the secondary contamination of materials
- emission from decontamination
- emission from RAW treatment

The quality of emission is described in chapter 4.2.5.

All air from controlled zones will be collected and discharged in an organised manner. All potential area (or fugitive) sources of contamination thus become spot sources of air contamination, equipped with cleaning and monitoring devices.

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[2] *These facilities are the subject of separate EIA procedure.*

4.2.2 Waste water

Waste water will come from social installations for employees and from technological procedures. For waste water treatment the existing systems and facilities will be used, as follows:

- Rain drainage system enters the river Dudváh via open channel Manivier.
- Sewage drainage system enters the waste water treatment facility – BIOCLAR and via pipelines SOCOMAN is discharged into the river Váh.
- Industrial drainage system collects water polluted by oil, leads the water in central gravitational oil separator and after the pre-cleaning the water goes to cooling water treatment facility at EBO V2.
- Special drainage system leads water to collection tanks for special cleaning of radioactive water and for special treatment; after treatment and inspection is waste water discharged according to accepted procedure.
- Final drainage system collector SOCOMAN drained the other waste water from technological installations for RAW treatment, including low active water, into river Váh.

Waste water discharged from JAVYS is monitored regarding the volume activity of corrosion and fission products and ^{3}H as well as chemical pollutants according to requirements of decisions issued for FAVYS by CA.

The total volume of waste water generated by proposed activity is estimated at the level of about 500 thousand m^3 per year in the first years of 2nd stage of decommissioning period, later the volume will decrease.

The precise quantification of waste water release is not possible at the present phase of the decommissioning process.

4.2.3 Waste

During the 2nd stage of decommissioning both, the conventional and radioactive waste will be generated.

4.2.3.1 <u>Conventional waste</u>

The estimated amounts of conventional waste flows produced during decommissioning are expected to be up to 860.000 tons.

According to the previously mentioned information, most important conventional materials are mainly concrete (close to 85% of total amount of this kind of materials, including porous concrete) and some black steel (around 10% of total amount) is produced as the most important conventional wastes.

The most important source of conventional waste during 2nd Stage of V1 NPP decommissioning is buildings demolition and backfilling (up to 57% of total amount). Other relevant sources are the systems removal in control area and the dismantling and demolition of V1 NPP external buildings, both around 16% of total amount of this kind of materials.

Processing, treatment, conditioning and final disposal activities for each type of conventional waste will have to be well adapted to these waste flows during next steps of decommissioning. Waste generation, including of waste disposal (or temporary storage), will be treated in more detail in corresponding Environmental Impact Assessment report.

4.2.3.2 Hazardous waste

Regarding hazardous waste generation during 2nd Stage of V1 NPP decommissioning, a total amount of up to 6.000 tons of this kind of waste is expected.

Equipment or civil structures that contain (according to its material composition) or are contaminated by a hazardous substance are coded by waste catalogue number in accordance with the Regulation 284/2001 Coll.

Considering the aforementioned catalogue, there are seven kinds of hazardous waste to be managed in decommissioning process:

- Construction materials containing asbestos (Waste catalogue code 17 06 05), including asbestos sheets corrugated and asbestos bonded.
- Insulation materials containing asbestos (Waste catalogue code 17 06 01) including asbestos fibrous and asbestos insulation products.
- Lead batteries (Waste catalogue code 16 06 01), including lead acid drained and undrained batteries.
- Waste containing heavy metals other than arsenic or mercury (Waste catalogue code 06 04 05), could be correspondent to bismuth compounds, waste and scrap, antimony compounds, arsenic compounds, cadmium compounds, cobalt compounds, copper compounds, lead compounds, molybdenum compounds, nickel compounds, selenium compounds, tin compounds or vanadium compounds.
- Metal waste contaminated with dangerous substances (Waste catalogue code 17 04 09), including ferrous metal scrap, ferrous metal turnings, iron scrap, iron corrugated sheets, steel scrap, ferrous swarf, steel cladding, steel pipes, steel wool, metal non-ferrous scrap and mixed ferrous and non-ferrous.
- Discarded equipment containing hazardous components, not containing PCBs, chlorofluorocarbons or free asbestos (Waste catalogue code 16 02 13), including capacitors (without PCBs or PCTs), computers and computer screens, cathode ray tubes, electronic appliances and electronic equipment.
- Waste containing mercury (Waste catalogue code 06 04 04), including mercury waste and residues and mercury compounds.

Among these hazardous compounds, a considerable amount of asbestos (up to 98% of total amount, including 17 06 05 and 17 06 01 categories) is expected. Most important sources are related to the cooling tower internals, produced during dismantling and demolition of V1 NPP external buildings. Other relevant source for asbestos is buildings demolition and backfilling, activity that will also produce this type of material.

Only lead batteries and waste containing heavy metals (other than arsenic or mercury) are relevant in addition to asbestos, in both cases around 0,5% of total amount of this kind of wastes produced during 2nd Stage of V1 NPP decommissioning.

4.2.3.3 Radioactive waste

The primary and secondary RAW in all three states of matter will be generated during the 2nd stage of NPP V1 decommissioning.

The generation of solid and liquid RAW could be estimated in a total amount of around 7.000 tons. It consists basically of steel (stainless and black, up to 85% of total RAW) activated or contaminated, and its generation is concentrated at the middle of 2nd Stage of V1 NPP decommissioning period.

Activated installation and equipment (from primary circuit) will be dismantled and fragmented and waste will be selected into groups of VLLW, LLW, MLW in period of 3,2 years.

From decontamination of installation and equipment the following amount of RAW will arise.

Tab. No. 5. Estimated quantities of RAW

For storage	For release	Secondary RAW
VLLW 204 t; 40,8 m^3 LLW 204 t; 40,8 m^3 Bitument (Mogilnik) VLLW – 34,7t; 26,7m^3	Concrete – 125,4 t Black steel - 2059,8 t Stainless steel 1414,5 t	Metal chips and debris 6,661 t; 1,356 m^3 Concrete debris 27,95 t; 21,5 m^3 Volume of liquid RAW 480 m^3

4.2.4 Noise and vibrations

Sources of noise and vibrations are machines, transport vehicles and equipment - pumps, turbines, compressors and waste shredder. Submitted activities are mostly carried out in enclosed areas. Common working activities and shipment (motor vehicles) will be carried out in outside areas.

The recycling of demolition materials in some cases may require corrective measures to mitigate the noise impact . Nevertheless, demolition work will have a temporary nature.

No excessive noise was recorded at the site during 1st stage of decommissioning. There are no workplaces at the site with vibration levels higher than the limit set by the relevant governmental decree.

4.2.5 Radiation and other physical fields

During the operation of the reactor, gamma and neutron radiation were generated.

The quality characteristics of radiation are defined by currently set up limit values defined for JAVYS by CA separately for atmospheric and hydro spherical outputs. These characteristics will be relevant also for decommissioning procedures. These are as follows:

Discharges into atmosphere:

a) For chimney of MSVP (object 840):
Aerosols – mixture of radio nuclides with long-term decay (^{51}Cr, ^{54}Mn, ^{59}Fe, ^{57}Co,^{58}Co, ^{60}Co, ^{65}Zn, ^{90}Sr, ^{95}Nb, ^{95}Zr, ^{103}Ru, ^{106}Rh, ^{110}mAg, ^{124}Sb, ^{134}Cs, ^{137}Cs, ^{141}Ce,^{144}Ce, ^{238}Pu, $^{239+240}$Pu, ^{241}Am).
Tritium, ^{90}Sr and radionuclides ^{238}Pu, $^{239+240}$Pu a ^{241}Am[3].

b) For ventilation chimney NPP V1:
Aerosols – mixture of radio nuclides with long-term decay (^{54}Mn, ^{59}Fe, ^{57}Co, ^{60}Co, ^{65}Zn, ^{95}Nb, ^{110m}Ag, ^{124}Sb, ^{134}Cs, ^{137}Cs, ^{144Ce}).
Strontium ^{90}Sr in aerosols;
Radionuclides emitting alpha radiation – ^{238}Pu, $^{239+240}$Pu, ^{241}Am.
Tritium a ^{14}C (organic and inorganic).

Discharges into hydrosphere:

Tritium
Corrosion and fission products

During the decommissioning activity the dose rate will be gradually and dramatically decreased in comparison of radiation during the operation.

Level of radiation in rooms and spaces is determined by the activity of the given technological systems and the tightness of the equipment, which influences the surface contamination of the rooms.

During decommissioning, average and maximum dose rates are diminishing in rooms, classified in three categories:

Tab. No. 6. Decreasing of dose rate by spaces (classified) during dismantling.

Category	Cause of decreasing the dose rate	Decrease
1	Proportionally with the decrease of radiation in the neighbouring spaces	Proportionally

[3] For the purpose of balancing the impact assessment and the dose burden in terms of the decision by JAVYS required to monitor the ventilation stack that also activity these elements

2	Discharges of operational radioactive substances (media)	1 order of magnitude
3	Partly discharge of the media, partly decontamination of the whole primary circuit	1 or 2 orders of magnitude

The magnitude of personnel radiation load is a collective effective dose, which represents the sum of individual doses of all workers participating.

The following table shows that the most significant part of collective effective dose is caused by radioactivity of liquid discharges.

Tab. No. 7. Share of collective effective dose and radioactivity of gaseous and liquid discharges.

	Collective effective dose (manSv)	Radioactivity of gaseous discharges (Bq)	Radioactivity of liquid discharges (Bq)
Total	13,87776	3.216.573	79.403.407

4.2.6 Heat and malodour

Submitted activities would not present a significant thermal burden of the Jaslovské Bohunice nuclear complex surroundings and no odours are estimated in the successive phases of stage II of decommissioning. During NPP operation, the most important source of heat to the atmosphere was from cooling towers. Currently, after shut down and decommissioning of the cooling towers, only release of heat to the water recipient by discharges are produced.

4.3 Data on anticipated direct and indirect environmental impacts

4.3.1 Impacts on the population

In accordance with the decree No 533/2006 Coll. on details and protection of inhabitants against effects of hazardous substances, a 5 km radius has been considered as affected area for the assessment of potential impacts on the natural and anthropogenic components of the environment and population. The municipalities situated within a circular area of 5 km diameter from the centre of the V1 NPP, to be considered as affected population, are as follows:

- Jaslovské Bohunice, Malženice, Radošovce and Dolné Dubové within Trnava District;
- Žlkovce and Ratkovce within Hlohovec District;
- Veľké Kostoľany, Nižná and Pečeňady within Piešťany District.

According to previously presented data, the total population of the affected area is 9.161 inhabitants. The urban areas closest to the Proponent´s site are the urban areas of Jaslovské Bohunice (2.011 inhabitants) and Radošovce (429 inhabitants) municipalities, at a distance in both cases of approximately 2 km.

The activities of 2nd Stage of V1 NPP decommissioning induce both positive and negative impacts, as well as direct and indirect impacts on the population. In general, consideration may be given to the following factors under this heading: the quality of life, investment and expenses, population centers, nuisance, population density, migratory movements, well-being and lifestyle, and the local, provincial and national economies and energy consumption. Here impacts on health and safety are not included, because they are going to be considered apart inside a specific chapter.

The positive impacts on the population include economic benefits, especially a short-term increase in employment associated with decommissioning activities and in long-term perspective it is creation of conditions for new industrial development of affected area in future.

The potentially major negative impacts of the respective activity on the affected population include nuisances (e.g. related to increase of traffic load in heavy vehicles, as well as noise and vibration associated with traffic and dismantling, fragmentation works and mechanical construction waste recycling), and also negative significant socio-economic effects that may result from the ending of plant operations on levels of employment (lower employment because number of workers at the installation will be smaller than during the operational phase), economic benefits (reduction in income from taxes in the area) and the appearance of auxiliary industries (problems associated with a downturn in the sectors supplying the installation).

4.3.2 Impacts on the geological environment, minerals, geodynamic phenomena and geomorphological conditions

Direct impacts on the geological environment or indirect impacts in the form of contamination are irrelevant for common operation due to the nature of the activity. The potential risk of contamination as a result of non-standard operating conditions (e.g. leakage of liquid radioactive materials due to leaking equipment or pipelines, accidents during the filling of packages, barrels, FCCs, etc.) can be prevented by emergency measures for all operating premises (sealed joints between floors and walls, water-proof floors and walls up to a reasonable height, sloped areas conducting to the active sewer system, storage of hazardous substances in accordance with Decree of the Ministry of Environment No. 100/2005 Coll., etc.).

The risk of contamination of the geological environment in relation to transport is prevented by observation of the legislative requirements for radiation control and transport requirements.

The risk of certain contamination of the soil layer by leakage of hazardous substances from vehicles (e.g. oil, gasoline), removable by common remediation works, appears to be the most realistic risk.

The mineral deposits are not affected by the activity.

The respective area is not located within a territory with active exogenous geodynamic phenomena (landslides, increased water or wind erosion, etc.), and the respective activity, given its nature, does not induce such phenomena at the affected location.

Given its location and nature, the proposed activity does not have any impacts on the local geomorphologic conditions.

Positive impact in this field will be granted by removing the source of current tritium contamination of ground water and surrounded rock environment. Spreading of contamination will be stopped and final remediation activity executed to solve this problem in complex.

4.3.3 Impacts on the climate conditions

The activity does not have an impact on the local micro-climate.

The assessed activity includes process which constitutes a source of carbon dioxide (CO_2), a greenhouse gas. Nevertheless, the significance of these sources is proportional to a small share of CO_2 emissions in relation to the overall emissions of greenhouse gases in the area.

4.3.4 Impacts on air

Decommissioning activities have the potential to significantly impact on the air quality of the affected area, adversely modifying air quality from emission of non-radiological and radiological pollutants. The activities may be direct, such as demolition of buildings, or indirect, such as transportation of materials and decommissioning workers to and from the site. These potential impacts will be considered as detectable if they cause a destabilizing measurable increase in the concentration of one or more regulated air pollutants that can be directly attributed to the activity and causes a change in the attainment status in air quality regulations. Besides using compliance with air quality standards from the relevant air protection legislation, impacts of the releases of gases can be assessed by comparison with the magnitude of potential releases during decommissioning with the magnitude of releases of the same or similar gases from other sources.

The potentially conventional adverse impacts identified on air quality potentially include:

- Degradation of air quality caused by emissions (e.g., NOx, CO, and hydrocarbons) from internal combustion engines.
- Increased particle loading of the atmosphere caused by the movement of vehicles and equipment, demolition of structures, dismantlement of systems, and operation of concrete batch plants.
- Alteration of other characteristics of the atmosphere (e.g., the ozone layer) by releases of gases used in plant systems (e.g., in fire suppression or refrigeration).

Potential radiological impacts on air quality are due to the gas emissions of waste air contaminated with radionuclides. There must be considered that many activities that take place during decommissioning (including decontamination of piping and surfaces in order to reduce the dose to nearby workers, removal of piping or other components, such as pumps and valves, and even large components, even such as heat exchangers) are similar to those that occur during normal operations and maintenance activities. However, some of the activities, such as removal of the reactor vessel or demolition of facilities, would be unique to the decommissioning process. Those activities would have the potential to result in exposures to workers who are close to contaminated structures or components, and to provide pathways for release of radioactive materials to the environment that are not present during standard operation.

Non-radiological impacts of 2nd Stage of V1 NPP decommissioning on air quality, due to the gas emissions containing common pollutants, are expected to be negligible. The principal air quality impacts would result from emissions from internal combustion engines (due to motor vehicles operated by workers for transportation on-site and for movement of people and materials to and from the site) and changes in atmospheric particle loading. No major air quality disturbance for demolition of the facilities on-site or temporary waste storage areas is anticipated.

Particular matter (PM) will be the most significant pollutant in the environment from the source activities like demolition, fragmentation, land scaping and, in particular, from construction waste recycling by shredder.

Most decommissioning activities would be conducted inside the V1 NPP site buildings. Because there would be a possibility of airborne releases of radioactivity within these buildings during decommissioning, releases to the ambient environment would be controlled and monitored.

4.3.5 Impacts on the water conditions

The water quality potential impacts expected from decommissioning are those associated with intended and accidental releases on surface water and groundwater of non-radioactive pollutants and radioactive material in liquid effluents. Water quality impacts during the 2^{nd} Stage of V1 NPP decommissioning process could derive of demolition works and certain operational activities, such of sanitary sewer operations. Impacts on hydrology and hydrogeology besides the water quality conditions of surface and groundwater could be related to water resources, the hydrological regime, aquatic habitats and aquifers contamination. Furthermore, water may act as a receiver of contaminants and information on the pollutant capacity and response should be collected, taking account of the likely use of the water. Because the decommissioning work force is likely to be smaller than those of the operational phase, no increase in water quality impacts is expected of sanitary sewer. Soil erosion and chemical spills associated with increased site activities during decommissioning have the potential to degrade water quality, but such effects are readily controllable.

Performance of the activity will be accompanied by the production of common sewage and rain waste waters at amounts corresponding to the area and the number of employees. Before being discharged to the recipient (Dudváh river for rain waters, and Váh river for sewage waters), the waste waters are treated at the mechanical and biological wastewater treatment plant of V1 NPP. Their activity will also be monitored to be sure that the limits set for chemical contamination of discharged waters will be observed. In other hand, measures to minimize occupational and public radiation exposure will also protect water quality.

The recipient of technological waste waters is the Váh river. Waste waters are drained to the Váh river after being treated to the required activity level in the (active) waste waters treatment plant (building 41) and monitored for tritium discharge. The potential risk of water contamination as a result of non-standard operating conditions will be prevented by the design of the operating premises (sealed joints between floors and walls, water-proof floors and walls up to a reasonable height, sloped areas conducting to the active sewer system) and by procedures forming part of the approved emergency plan.

Positive impact on ground water is connected to activity of solving the current tritium contamination of ground water and avoiding the spread of contamination spreading.

4.3.6 Impacts on soil

Factors to be assessed regarding impacts on soil on the site and in the adjacent areas which may be affected by release and dispersion of effluents will include land use, soil type and quality, terrain morphology, erosion potential, ecological risk and agricultural capacity.

The 2nd Stage of V1 NPP decommissioning process will be located within the existing buildings of the plant, so the impact on the occupation of new land is irrelevant.

With regard to the potential impacts induced by contamination, it can be assumed in relation to common pollutants that under normal operating conditions the decommissioning technology are not a source of common pollutants at amounts representing a risk to soil contamination. The potential risk of contamination as a result of non-standard operating conditions of common nature, such as transport (e.g. oil or gasoline leakage from motor vehicles into non-reinforced soil) can be solved by common remediation works.

The adverse impact connected to radioisotopes on soil in the vicinity was not detected during NPP V1 operation and will not be expected during decommissioning activities.

4.3.7 Impacts on the fauna, flora and their biotopes

Impacts to be assessed should include a study of the plant and animal species existing in the area surrounding the V1 NPP site, as well as of their habitats and distribution, as well as species assemblages in the vicinity of the NPP as well as the interaction of those organisms with each other and the environment. Incidence of species will be identified along with analysis of the nature of the habitats and ecosystems in the area, including plants and animals that are important, recreational activities, the area ecosystems, and those protected by endangered species regulations and legislation. Chapter 4.5 of the present Preliminary Environmental Study is specifically dedicated to data on anticipated impacts of the proposed activity on protected areas, showing that no relevant impact are expected about that issue.

The V1 NPP site has taken part of an industrial complex operating at the Jaslovské Bohunice location for decades. This complex is surrounded by a rural countryside with predominantly agricultural use. According to this, the expected occurrence of fauna and flora will be related to species residing on the edge of human settlements, and a poor species diversity could be anticipated.

Considering that Slovak legislation does not define any standards for the exposition of non-human organisms and the contribution of the activity to the radiation burden of the area is practically negligible taken into account operationally monitoring values, it can be assumed that 2nd Stage of V1 NPP decommissioning does not constitute a source of impact of major significance on the fauna, flora and their biotopes.

4.3.8 Impacts on the landscape and its ecological stability

The quality of the landscape should be considered an integral part of natural resources, including both objective and subjective assessment criteria in areas such as:

- Visibility, including the extent of the domain from which the installation is visible.
- The quality of the landscape, characterized by its morphology, vegetation, plant formations, lithology and presence of large bodies of water.
- Human presence, including the nature and extent of manmade structures and other influences (in this case, specially linked to agricultural use) on the landscape.

In the scope of the modifications to this environmental factor must be consider that in general the demolition of the buildings and structures will change the visual impact associated with an NPP. As have been exposed before, taken in consideration the industrial complex inside which is locate the V1 NPP, the impact of the activity on the landscape scenery, its image and structure is practically irrelevant. In addition to this, the amount of land required to support the 2nd Stage of V1 NPP decommissioning process is relatively small and is a small portion of the overall plant site, minimizing in this way the visual impact.

From the point of view of ecological stability, it must be considered that terrestrial habitats disturbed during the construction of the site will often continue to be of low habitat quality during plant operation and decommissioning. However, sensitive habitats can develop on the site or rare species can colonize the area disturbed during construction, and these habitats may be inhabited by sensitive species at the time of decommissioning. Even considering that habitat disturbance beyond the operational areas could be anticipated, the impacts can be predicted generically as not destabilizing as a consequence of site-specific conditions.

4.3.9 Impacts on the urban complex and land use

Taking into account that main objective of 2nd Stage of V1 NPP decommissioning is to fully achieve the planned level site for restricted usage (“brown field”), such as for a possible reindustrialization of the site, it is not expected a restoration of land for uses other than industrial. It is not going to be necessary any reduction in classified land on site (land which will be subject to restrictions on use). According to this, the dismantling and total removal of remained elements back to the bottom of the foundation does not have a net effect on current land use.

On the other hand, the 2nd Stage of V1 NPP decommissioning process will not affect the structure of the given urban units. It is not even going to be necessary to develop a new transport infrastructure at the affected area. Anyway, indirect potential impact on the agricultural usage can be anticipated due to modifications at the radiation burden of the area. This contribution will be, however, minimum.

Other possible source of impacts from the proposed activity arises from generation of conventional waste to be managed in the affected area. This effect could be anticipated with just minimally influencing the current municipal waste management.

No other impacts on the urban complex and land use are predictable.

4.3.10 Impacts on cultural and historic landmarks

The factors included in this chapter, including cultural heritage and archaeological remains depend on the site location. Cultural resources include any historic site and historic property having significant international, national or local importance.

No landmarks with a cultural or historic value as a source of interest to people living in the surroundings or to visitors to the affected region are found within the immediate vicinity of the area for decommissioning activities.

There are several buildings of cultural and historic value within the wider area. These buildings will not be affected by the performance of the proposed activity due to its nature and location.

4.3.11 Impacts on archaeological sites

No archaeological sites are found within the immediate vicinity of the area for decommissioning activities.

4.3.12 Impacts on paleontological sites and important geological localities

Neither paleontological sites nor important geological localities are found within the immediate vicinity of the area for decommissioning activities.

4.3.13 Impacts on intangible cultural values

No cultural values of tangible or intangible nature are found in the given area for decommissioning activities. The nature of the proposed activity excludes impacts on local traditions.

4.3.14 Other Impacts

The proposed activity will cause the significant socio – economical impact for the whole society as well as for surrounding population.

The adverse impact on the whole society may be connected to:

- significant cost for decommissioning activities
- gradual decrease of direct and indirect employment, especially the local human sources
- decrease of income from taxes, especially for affected municipalities

The positive impact may be connected to:

- creation of condition for long-term vision of future industrial use of affected area
- creation of conditions for employment in future
- increase of safety, consequently increase of life quality

No other impacts of the proposed activity than those presented and exposed above have been identified in the affected area that could influence the comfort and quality of life of the affected area.

4.4 Evaluation of health risks

Human health impacts are related to health risk connected to certain decommissioning activities. Human health risks for 2nd Stage of V1 NPP decommissioning are expected to be dominated by occupational injuries to workers engaged in activities such as construction, maintenance, and excavation.

In general, consideration may be given to the following risks as the most important factors associated with health risks:

- Exposure to ionizing radiation.
- Exposure to hazardous (toxic) products (e.g. aerosols containing lead, asbestos).
- Exposure to high concentrations of dust.
- Exposure to common pollutants.
- Falls, contact with electricity and other risks typical of construction works.
- Exposure to high noise levels.

Impacts on human health include then both radiological and non-radiological health effects both on those who are involved in or exposed to decommissioning activities.

4.4.1 Radiological health risks

The radiological impacts will be due to changes to the installation, as a result both of the activities involved in decontamination and dismantling operations and of the duration of decommissioning process. The health effects, expressed in terms of radiation dose, correspond firstly to the standard execution of the decommissioning process, and secondly to the effects of possible accidents.

Radioactive materials are present in the reactor and support facilities after operations cease and the fuel has been removed from the reactor core. Exposure to these radioactive materials during decommissioning may have consequences for workers. Members of the public may also potentially be exposed to radioactive materials that are released to the environment during the decommissioning process. All decommissioning activities will be assessed to determine their potential for radiation exposures that may result in health effects to workers and the public.

In assessing the radiological safety of dismantling, consideration needs to be given to three important routes of exposure: inhalation, ingestion and external irradiation. The most important route of exposure for the workers involved in dismantling will probably be external irradiation. The ingestion and inhalation routes must be minimised through application of the protection techniques normally used in these activities (surveillance and control of radiological conditions, filtration, containment, use of confined areas with controlled ventilation, protecting clothing and breathing apparatus).

Inhalation is likely to be the dominant route of exposure for the public, since external irradiation due to radioactive materials deposited on surfaces and ingestion should both be minimised as exposure routes during dismantling.

During the RAW transport to TSÚ RAO at Mochovce, application of the IAEA Safety Transport Regulations[4] as enacted in the Slovak Republic will ensure that inhalation and ingestion are eliminated as routes of exposure for the public and workers in standard (non-accidental) transport operations, leaving external irradiation as the dominant route.

During development of the EIA Report, a specific methodology for dose calculation for each of the exposure routes considered will be applied, taking into account contrasted[5] literature. The results obtained will be compared with the individual dose limits established in the applicable standards.

Radiological health risks will be specifically focused on workers activity, but risks to the public will be also established and documented, though it may be expected that these will be considerably lower than those existing during the operational phase of the of the V1 NPP.

As reference levels[6] for this indicator, the collective dose for the public and dose limits for workers included in recommendations of the International Commission on Radiological Protection for stochastic health effects such as development of cancer or genetic effects will be used. General radiation protection criteria to be implemented will also follow Act No 470 of December 5th, 2000 and Regulation No 12 of December 13th, 2000 on requirements for securing radiation protection form the radiation protection legislation in the Slovak Republic. According to the aforementioned regulations, dose limits to workers and public will be:

- Annual dose limit to workers 100 mSv/5 yrs. (max. 50 mSv/yr).
- Annual dose to the public: 1 mSv/yr.
- Dose constrain to the inhabitant living near nuclear installation : 0,25 mSv/yr

Considering as applicable health protection criteria from Public Health Authority License (1998) for TSÚ RAO at Mochovce, maximum doses to public (critical inhabitant) will be considered as follows:

- The effective dose should not be higher than 100 Sv in anyone year after the period of institutional control for evolution scenario (probability=1).

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[4] International Atomic Energy Agency (2012). Regulations for the safe transport of radioactive material: specific safety requirements. 2012 Edition. Vienna.

[5] U.S. Nuclear Regulatory Commission (1983). Radiological Assessment. A Textbook on Environmental Dose Analysis. NUREG/CR-3332 ORNL-5968. Washington, D.C.

[6] ICRP (2007). Recommendations of the International Commission on Radiological Protection. ICRP Publication 103. Annals of the ICRP 26, Ann. ICRP 1 (3).

- The effective dose should not be higher than 1000 Sv in anyone year after the period of institutional control for intruder scenario (low probability).
- The effective dose from liquid effluents released from the repository site should not be higher than 50 Sv/yr during the period of institutional control (300 years). Changed to 20 Sv/yr in 2011.

Radiation measurements (content of radionuclides and surface contamination) will be performed by JAVYS and supervised by the Public Health Authority.

As mentioned before, radiological impacts could correspond not only to the standard execution of the decommissioning process, but to the effects of possible radiological accidents. The likelihood of a large offsite radiological release that impacts public health in case of a facility as V1 NPP that has permanently ceased operation is considerably lower than the likelihood of a release from the previously operating reactor. This is because the potential accidents associated with reactor operation are no longer relevant after the reactor fuel has been removed. Considering separately design basis accidents (DBA) and severe accidents (beyond design basis), it is clear that DBA focus on reactor operation and are not applicable to plants undergoing decommissioning. The only severe accidents applicable to a decommissioning plant are then those involving the spent fuel, for instance as a consequence of structural failures due to the action of external agents (e.g. earthquakes, flooding, and sabotage). These postulated accidents have been assessed to establish the preventive and mitigation safety systems of the Interim Spent Fuel Storage (ISFS) facility.

4.4.2 Non-radiological health risks

Apart of radiological health risks, typical health risks of concern in the context of decommissioning activities can be grouped into the four following categories: chemical, physical, ergonomic and biological. The risk of decommissioning activities on health from hazardous or conventional materials will be considered detectable if injury rate during decommissioning exceeds regulations of the Government of the Slovak Republic on the minimum requirements for ensuring occupational safety and health protection (Act No. 393/2006 Coll.). The risk of decommissioning activities on occupational health issues will be considered destabilizing if injury rate during decommissioning becomes sufficiently large that decommissioning activities must be halted to address worker safety, and the decommissioning schedule is threatened.

4.4.2.1 Chemical health risks

Chemical hazards derived from handling of hazardous materials (non radioactive and toxic) generated during demolition of V1 NPP buildings (e.g. aerosols containing lead or asbestos) could have a significant effect on health of working force needed to decommissioning implementation as well as indirect impacts on health for public located on the environment. Risks to the public will be established and documented in the EIA Report, though it may be expected that these will be considerably lower than those existing during the operational phase of the plant.

Inhalation and dermal contact with hazardous chemicals are serious worker health risks. Ingestion is typically not a voluntary route of exposure but accidental ingestions (pipetting with mouth, siphoning gasoline, etc.) have been known to occur at the job site. Solvents and particulates are the two contaminants of greatest concern. Some of the key chemicals of concern found in building materials, paints, light bulbs, light fixtures, switches, electrical components, and high-voltage cables include asbestos, lead, polychlorobiphenyls (PCBs), and mercury. Other chemicals that have been found during decommissioning activities include low levels of potassium, sodium chromate, and nickel found in the suppression chamber. Also, quartz and cristobalite silica were detected during concrete demolition. Fumes, often including lead and arsenic, and smoke from flame cutting and welding are significant sources of chemical exposure during decommissioning.

Decommissioning involves many activities that expose workers to chemical hazards:

- Chemical decontamination of the primary loop.
- Removal of reactor components.
- Decontamination of the piping walls.
- Removal of contaminated soil.
- Removal of radioactive structures
- Removal of hydrocarbon fuel from storage.
- Removal of hazardous coatings.
- Removal of asbestos
- Removal of chemical-containing systems, such as demineralizers and acid and caustic containing tanks
- Removal of sodium and NaK residue.

In the other hand, the 2nd Stage of V1 NPP decommissioning with regard to risks for public health from conventional pollutants and wastes could be considered in essence as analogous to plant operation, and are related basically to small-scale pollution of non-radioactive nature, resulting from discharge of industrial and sanitary waste water into the environment, and to waste generation and management.

Emissions of conventional pollutants to the atmosphere will be performed with regard to the conditions, within the scope defined by air protection legislation. The previous environmental situation occurring during operation conditions will not change in essence in this aspect.

Management of conventional wastewater (sink waters and rain waters) will be also performed according to legal requirements and will be similar as under standard operation do not represent a source of major impacts on the affected population in terms of their significance. Waste waters will be treated and discharged to the recipient in compliance with the conditions set in current legislation.

4.4.2.2 Physical health risks

During the decommissioning process, the major sources of physical occupational risks involve the operation and use of construction and transportation equipment. Vehicles, grinders, saws, pneumatic drills, compressors, and torches are some of the more common equipment that can cause injury if improperly used. Heavy loads, which are often moved about by cranes and loaders, must be controlled to avoid injury. The majority of these hazards will be part of dismantlement. Workplace designs and controls should be the first line of defense when preventing workplace injuries. Hard hats and other Personal Protective Equipment (PPE) are also important interventions and can serve as a secondary protective measure should workplace controls fail.

Many activities during decommissioning, for example, the use of cutting torches, have the potential to initiate fires. These activities, which are common during construction and demolition, should be identified in advance. It is expected that precautions will be taken to minimize the likelihood of fires and that suitable measures will be available for dealing with fires should they occur.

Noise is also a physical hazard that will be significant during decommissioning. The majority of noise will come from equipment such as rivet busters, grinders, and fans. Although workplace controls and designs are the best methods for reducing noise, PPE (e.g., earplugs) can also be used to protect against hearing loss. If workers need to use PPE, their ability to communicate effectively is reduced and safety may be compromised.

Electrical hazards are a significant concern during decommissioning, especially if during stabilization, licensees rewire the site to eliminate unneeded electrical circuits or repower certain operations from outside. All of these activities, plus various other activities (operating cranes near power lines, digging near buried cables, etc.), could be significant electrical threats to workers. Proper precautions should be taken to avoid injury.

4.4.2.3 Ergonomic health risks

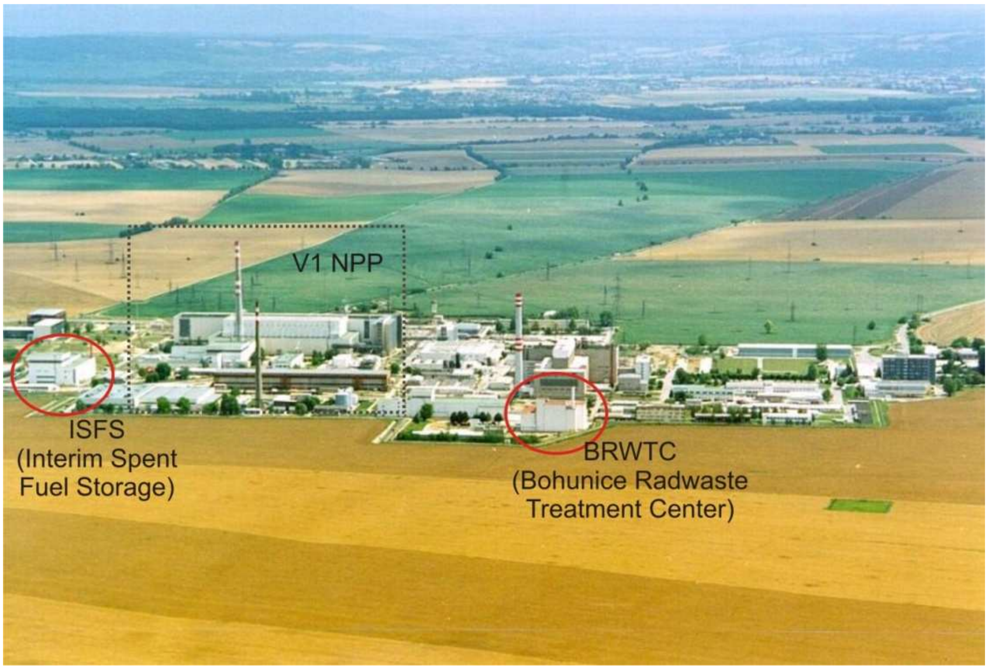
The physiological and psychological demands of decommissioning work will create ergonomic hazards in the workplace. Discomfort and fatigue are two indicators of ergonomic stress that can lead to decreased performance, decreased safety, and increased chance of injury. The typical sources of ergonomic stress during decommissioning activities include mechanical vibrations, lifting, and static work. Workplace designs, work shifts, and breaks should be planned accordingly to avoid ergonomic stress.

4.4.2.4 Biological health risks

Biological health risks hazards include any virus, bacteria, fungus, parasite, or living organism that can cause a disease in human beings. Typical sanitation practices can help avoid the obvious vectors for disease. Having clean, potable drinking water, marking no potable water, and providing cleansing areas are the most important elements of a sanitation system.

Given the age of part of the buildings and facilities of V1 NPP, there is an increased chance that workers will be exposed to molds and other biological organisms that grow in and on the buildings. Molds and fungus, when inhaled, can cause minor to serious pulmonary problems. Dermal contact could cause rash and/or irritation. A thorough inspection of the facility should be conducted and proper cleansing and PPE should be used when biological agents are identified.

Graph No. 7. Location of V1 NPP related to relevant decommissioning facilities at Jaslovské Bohunice nuclear complex site



4.5 Data on anticipated impacts of the proposed activity on protected areas

At present, nature protection in SR is regulated by the Act no. 543/2002 Coll. on Protection of Nature and Landscape. According to this Act, the affected area belongs to first level of protection, and no other categories of protected areas are located within the boundaries of the V1 NPP site. As previously mentioned (Chapter 3.2.3) the closest areas protected according to 543/2002 Act are located more than 6 km far from NPP and there is no expectation of any impact on them.

The main significant area from the areas protected under the European network of protected areas NATURA 2000 is **SPA SKCHVU054 Špačinsko-Nižnianske Polia**. The closest border is situated at an approximately distance of 1 km north from the V1 NPP site. It was declared to ensure a favourable state of habitat of a migratory bird and bird of European importance the jerfalcon (*Falco cherrug*). Other closest SPA are located farer than 7 km from NPP:

- **SPA SKCHVU026 Síňava**. Located approximately 7 km airline distance to the North-East from the V1 NPP site. Put under protection to ensure a favourable state of habitats of birds of European importance and of habitats of migratory birds like common tern (Sterna hirundo), Mediterranean gull (Ichthyaetus melanocephalus) and common gull (Larus canus).
- **SCI SKUEV0074 Dubník**. Situated in a distance of approximately 16 km to the South from the V1 NPP site. Serves the protection of Carpathian and Pannonian

oak-hornbeam forests, Euro-Siberian oak forests on sands and Pannonian-Balcan Quercus cerris forests.

- **SCI SKUEV0278 Brezovské Karpaty**. Situated 16 km to the North-West from the V1 NPP site. Established to protect xerophilic and calciphilous beech and debris forests.
- **SCI SKUEV0277 Nad Vinicami**. Located approximately 16 km to the West from the V1 NPP site. Has been put under protection in order to preserve xerophilic communities of lowland and submountain hay meadows.

With regard to the above-mentioned distances and the nature of the proposed activity, direct impact on the given subjects of protection is excluded.

As concerns indirect impacts from the point of view of the contribution to radiation burden, it can be anticipated that the correspondent impact is minimum and significantly smaller than it was during NPP operation.

4.6 Assessment of anticipated impacts with regard to their relevance and time behaviour of their effect

According to the preliminary assessment, the 2nd Stage of V1 NPP decommissioning, given its design and location, represents a source of low-significant negative impacts on the environment of the affected area.

All impacts depend on quantity and quality of inputs and outputs which are relevant to the proposed activity.

Regarding the inputs a large amount of energy, materials, human sources and finance is needed and from that point of view the proposed activity is source of adverse (significant ecological foot) and also positive impacts (safety, new opportunity for industry, new jobs).

As the most important adverse impact connected to 2nd stage of decommissioning the impact of radiation on employees and population was identified. This impact is connected to dismantling and fragmentation of primary circuit installation and equipment, in particular, and following RAW treatment. Simple evaluation of this impact can be done by comparison of radiation during NPP V1 operation and NPP V1 decommissioning. The difference is very significant not only because of extend but for duration of radiation as well; for proposed activity radiation is decreased by order of magnitude, at least, and duration of this impact is supposed to be 3,2 years.

The adverse impact is connected also to RAW and conventional waste treatment and disposal and transport requirements. This impact will be concentrated on place using such a treatment and disposal strategy which implements the principle of vicinity, self-sufficiency, safety and BATNEEC.

Less important adverse impact is expected in connection with demolition, landscaping, transport and conventional waste treatment/recycling. Primary and secondary dust (PM) generation is expected as well as noise and vibration. These impacts will be concentrated in the NPP complex and the closest vicinity, citizens in neighbouring municipalities will not be exposed to the impacts overstepping the relevant limit value set up for human health protection.

These adverse impacts caused by these activities can be mitigated by suitably defined mitigation and protective measures.

Regarding the time connected to proposed activities and consequently to expected impacts the following time schedule is planned. First 2-3 years only preparatory works will be implemented, then during about 3 years period dismantling and fragmentation activities focused on activated and contaminated objects and materials will be executed and decontamination and RAO handling will go on continuously. Last 2-5 years of decommissioning period will be focused on the survey, inspection, remediation and landscaping of the site.

On the other hand, the activity will have an important positive impact due to the significance of the decommissioning process for the complete and safe disposal of RAW generated by V1 NPP operation. Positive impact is also expected in socio-economic aspects either in short-term period (staff of NPP is used for decommissioning activities, new jobs opportunity appears) or long-term period (area will be prepared for a new industrial activity and new requirements of human recourses).

4.7 Anticipated transboundary impacts

As detailed previously assessed on Chapter 2.17, the proposed activity must be considered negligible for transboundary adverse impacts both environmental and for human health at all stages of the decommissioning activity. All impacts of radiological character are restricted to the site of the decommissioned power plant, with some non-radiological and socio-economic impacts extended to municipalities from a broader threatened area (districts of Trnava, Piešťany and Hlohovec). According to this, the proposed activity does not fall under the provisions of the Espoo Convention, because no significant are expected. Furthermore, the decommissioning is not in the Annex 13 of the Environmental Act as an activity that is obligatory to international assessment.

4.8 Induced interrelations that may result in impacts taking into account current environmental conditions in the concerned area (with regard to the type, form and level of the existing protection of nature, natural resources, historical landmarks)

Regarding to the type, form and level of the existing protection of nature, natural resources and historical landmarks, no conditions induced interrelations from the 2nd Stage of V1 NPP decommissioning have been identified.

4.9 Other potential risks associated with implementation of the proposed activity

Given the design of the decommissioning process of V1 NPP corresponding to the 2nd Stage, and especially considering the qualification and training of the personnel involved in the activity, no other potential risks for the human health and the environment to those already assessed on Chapters 4.3 and 4.4 are expectable under standard conditions of implementation. Under accidental conditions of operation, derived from initiation events caused both by internal (e.g. spread of contamination by loss of containment integrity, fire produced by thermal cutting techniques, or flooding due to leakage of liquid storage) and external factors (e.g. earthquakes or sabotage), taking into account the preventive and mitigation systems to be established, safety levels are not expected to be exceeded.

4.10 Measures to mitigate adverse effects of individual alternatives of the proposed activity on the environment

During 2nd Stage of V1 NPP decommissioning must be assumed that ongoing mitigation measures would continue (including those mitigation measures implemented during plant construction, operation and 1st Stage of decommissioning), as appropriate. Anyway, additional mitigation measures could be implemented during 2nd Stage of V1 NPP decommissioning whether significant benefits are considered as achievable. If an impact is likely and additional mitigation measures can be taken to avoid the impact, additional mitigation measures would be warranted. On the other hand, if mitigation of adverse impacts associated with an issue has been considered, and additional mitigation measures are likely not to be sufficiently beneficial to justify implementation, no mitigation program will be warranted in addition.

There are a number of occupational adverse effects likely to take mitigation actions to minimize impacts, especially in order to comply with local regulations. Common issues in decommissioning plans in this sense that could be considered are about dust (mitigation measures commonly used include watering and other soil stabilization measures, such as spraying sealants on the area and seeding, enclosure of dumping and unloading areas and conveyors, use of filters, and use of water sprays) and temporarily increase of noise levels (mitigation measures to mitigate noise levels will be based on engineering design and noise abatement procedures to reduce noise, particularly at night).

Further to the specific situation described above, it is recommended, in connection with the expected impacts and other possible risks associated with the implementation of the activity, to consider generic mitigation measures that can be taken, considering that 2nd Stage of V1 NPP decommissioning implies the performance of a series of measures to address the negative effects of the project. The scope and duration of these will depend on both the decommissioning project itself and on the characteristics of the V1 NPP site to be decommissioned.

These measures may be preventive if they remove the impact by modifying the project activity causing it, or mitigatory if they cancel, attenuate or modify the impact once it has been caused. Listed below is a generic set of measures designed to correct the possible negative impacts caused. These are applicable to the alternatives analysed, although the scope and duration will differ depending on the dismantling project:

- Minimization of exposure to radiation (according to the ALARA principle) and to hazardous contaminants through the effective performance of the programmes required by the radiological protection and occupational safety standards in force, which will have to be sufficiently rigorous and detailed, and through the use of remote handling and robot-based techniques.
- Minimization of atmospheric emissions of contaminants by means of the best and most cost-effective techniques available. These techniques should include the use of emission capturing systems, high efficiency filters, dust emission control systems

such as moving covers, confined enclosures, spraying with coagulant and fixing solutions and the careful planning of operations for the handling and transfer of dust-producing materials.

- Minimization of releases to surface waters and of concentrations of contaminants through the recycling and re-use of waste waters, the conditioning of solid radioactive wastes and/or their treatment using the best and most economical techniques available.

- Control of leachates in collecting areas and rubble tips.

- On-line control and tracking of the production and location of waste materials associated with methods promoting their recycling or re-use.

- Safe arrangement of the main areas used for the handling and storage of radioactive, hazardous and other waste materials. Those areas, in which the quantities of materials and the risk are highest, will need to incorporate construction characteristics and equipment preventing flooding, leakage, spillage and uncontrolled or inadvertent releases, and to achieve confinement and control if such events were to occur. The design of such areas should include measures preventing uncontrolled access and the risk of fires

- Minimization of the extent of land required for the storage of radioactive wastes and installations during the latency period. This will require the intensive use of waste production minimization techniques such as the following:

    - Detailed identification and characterization of materials prior to dismantling.

    - Classification at the point of origin, elimination of intermediate stages of and decontamination prior to dismantling.

    - Minimum secondary waste treatment.

    - Prevention of cross-contamination and recontamination through the control of contaminated materials and of transport vehicles.

    - Reduction of potential sources of risk, preventing the dispersion of materials from storage facilities and intermediate collecting areas and reduction of transport operations.

    - Re-use of materials from demolition and excavation operations for refilling and topographic restoration activities.

- Application of a flexible fire protection system. Flexibility is an essential element, given the changing nature of the situation of the plant during dismantling.

- General use of silencers on vehicles and machinery and the minimization or elimination of blasting operations.

- Adequate personnel training, for all the levels and areas of the organization.

- Truck washing station to prevent problems of mud on the roads.
- Periodic revision of obligatory safety elements, e.g. fire extinguishers and alarms.
- Maintenance of hygienic conditions in the toilets for the operations personnel and other users, and in the cafeteria and canteen areas if they exist.
- Modification of buildings, (e.g. size, shape and color) to minimize visual impact.
- Restoration of the natural morphology and replanting with native species if the site is not to be re-used.
- Measures to promote employment, including use of the available operations personnel and promotion of sub-contracting in areas around the plant
- Adherence to strict working hours and transport routes for movement of materials off-site and on-site.

All these measures, and others that might be specified in next steps of the decommissioning project, will be necessarily defined at the EIA Report to a degree of detail sufficient to demonstrate not only that attempts have been made to carry them out but also that further improvements would not be justified.

4.11 Assessment of the anticipated development of the area if the proposed activity was not carried out

If the proposed activity was not implemented, no related impacts would occur in the affected area. The objective of V1 NPP decommissioning, begun in April 2007 by issuance of the Final Statement of MoE, is to restore a radiologically contaminated facility to a condition such that there is no unreasonable risk from the decommissioned facility to the public health and safety. The only alternative to the action of decommissioning when 1st Stage of V1 NPP decommissioning should be do not continue decommission the facility. The option to restart the reactor is not considered to be an alternative to the proposed activity because the regulations do not allow the licensee to reload fuel and restart the facility after submitting a certification that the fuel has been removed from the reactor vessel.

The only alternative if the proposed decommissioning activity was not carried will be a "no action" alternative, implying that the licensee would simply abandon or leave a facility after ceasing ongoing operations. Anyway, the licensee will be required to comply with the necessary requirements for the operating license. As a result, the environmental impacts for maintaining the nuclear reactor facility will be considered to be in the bounds of the appropriate, previously issued Environmental Impact Statements. However, if the decommissioning process of V1 NPP were stopped, would result in negative environmental impacts and related risks. This will be relevant considering that disposal of low and medium activity RAW produced during V1 NPP operation would be deferred, remaining unsolved. Must be also highlighted that decommissioning process is already started with dismantling and demolition of not required equipment, systems and buildings, and working force and technological instruments are already available on site.

4.12 Assessment of conformance of the proposed activity with the physical-planning documentation in force and other relevant strategic documents

The proposed activity complies with the applicable land-planning documentation.

4.13 Further procedure of impact assessment identifying the most significant problems

In further assessment it is expected that decommissioning activities will be defined in more details.

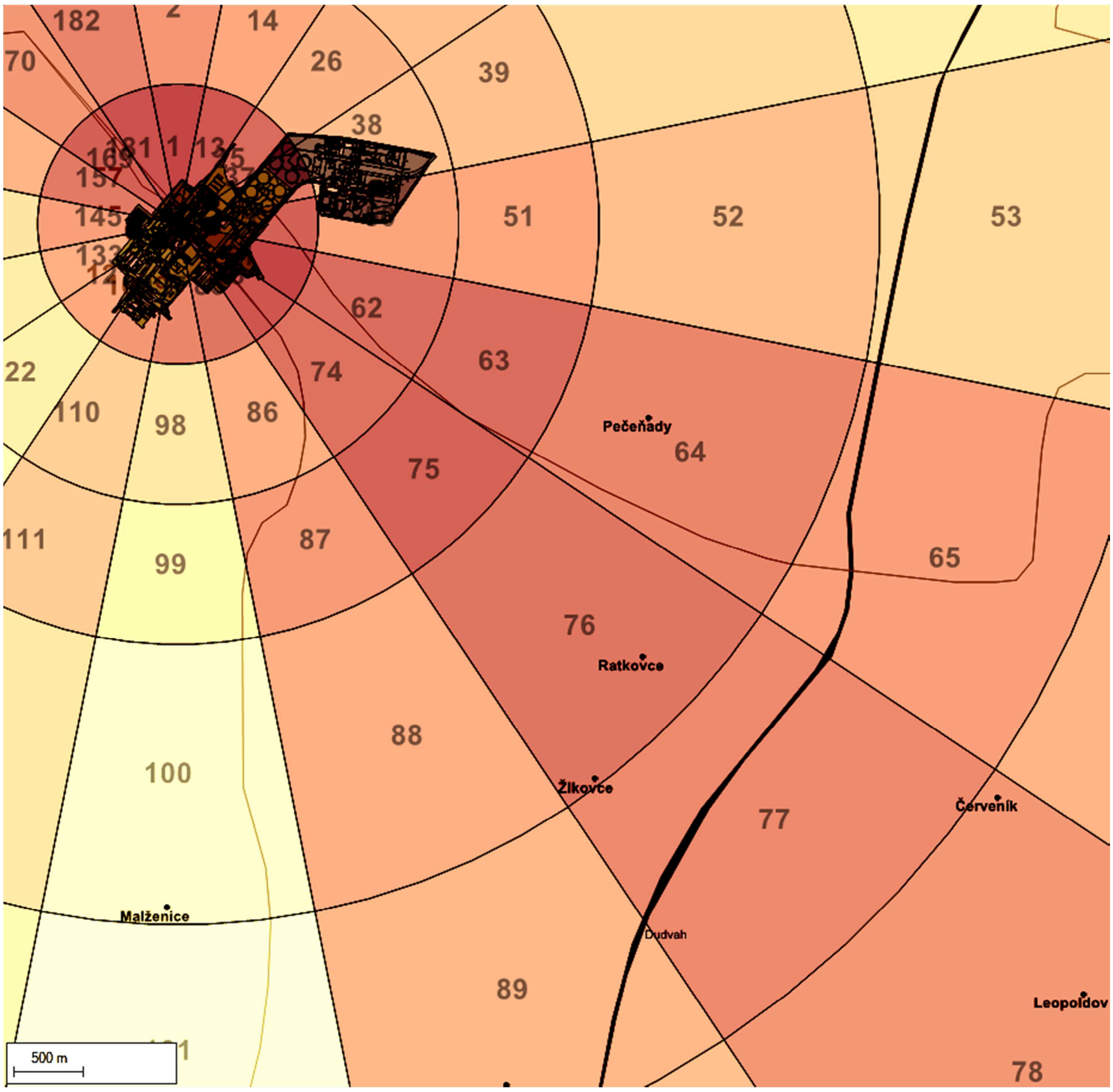
Outputs from proposed activities, in particular radiation should be evaluated more precisely and in connection to time of impact duration. The worst case scenario should be taken into consideration.

The ground water and rock contamination in the area of NPP A1 should be evaluated in interaction with NPP V1 decommissioning and mitigation measures currently applied and planned for future.

The requirements concerning the assessment of the given activity will be specified within the set scope of assessment on the basis of the opinions by the affected and approving authorities.

In order to assess the specific air quality impacts on the imission situation in the surroundings of the V1 NPP during decommissioning process, and to model dispersion of pollutants into atmosphere in connection to public of the affected municipalities, new calculations, conducted by qualified professionals, will be provided from the EBO ESTE AI software, which was developed for purposes of normal conditions of V1 NPP operation.

Graph No. 8. Map of affected area divided to the sectors defined for calculation of V1 NPP radiation impact


Pečeňady
Ratkovce
Žlkovce
Červeník
Malženice
Dudvah
Leopoldov
500 m

5 COMPARISON OF ALTERNATIVES OF THE PROPOSED ACTIVITY AND SELECTION OF AN OPTIMUM ALTERNATIVE (INCLUDING THE COMPARISON WITH A ZERO ALTERNATIVE)

5.1 Definition of a set of criteria for selection of an optimum alternative and specification of their importance

The definition of the assessment criteria has been based on the prediction that any activity within the given area can have an impact on the condition of any part of the environment, and on the ecological landscape features and socio-economic features of the given area

With regard to the character of the proposed activity, the impacts caused by the decontamination of dismantled equipments and building structures, and the treatment of RAW arising from the decontamination, dismantling and demolition can be in general defined as the most important assessment criteria. The importance of the proposed activity for the safety and complexity of the disposal of RAW is also a significant assessment criterion.

5.2 Selection of an optimum alternative or ranking of the assessed alternatives depending on their suitability

The proposed activity is presented for assessment purposes as one variant (Option 1), which includes the immediate and continuous dismantling of the equipment and facilities, the demolition of buildings back to the bottom of the foundation and the preparation of the site for other (industrial) use.

Pursuant to the law, the other option subject to assessment is the zero option (do nothing) representing the state where the proposed activity is not implemented in this moment and at the given area. In this specific case, Option 0 includes the execution of the previously assessed an approved Stage I for the Decommissioning, including according to this the dismantling of unrequired non-radioactive equipment and systems, and the demolition of unrequired non-radioactive buildings.

5.2.1 Description of Option 0

The Option 0 represents the status that would arise if Stage II of Bohunice V1 NPP Decommissioning will not be realised. In accordance with the Atomic Act, nuclear power plants must be operated to such an extent, that their radiation safety would be ensured and continuously monitored after the reactor final shutdown to the extent identified by the Decree of NRA SR No. 430/2011. Thus the zero alternative means the operation of the radioactive civil structures where radioactive process equipment (including reactor), requiring necessary and continual radiation situation monitoring, maintenance and monitoring the barrier impenetrability, is housed as well as ensuring energy resources and operational media in order to maintain the safe condition of these civil structures and process equipment.

With respect to the above, it is necessary to operate also some non-active civil structures that serve as technical support to operate the active structures concerned and the non-active structures that serve for the employee's social purposes (administrative, laboratory, workshops, canteen etc.), as well as some of auxiliary systems shall be in service, like ventilation systems, special drainage, radiation monitoring of process equipment and areas by stationary system and portable instruments, etc. Concurrently surveillance and maintenance of the above systems as well as for buildings shall be provided. The civil part maintenance shall be mainly focused on inspections and maintenance of the barriers.

The Option 0 implementation extends its duration to an indefinite period of time, determined by a spontaneous decay of radioisotopes in the shutdown power plant. According to this, Option 0 means the persistence of the status which will be reached after the shutdown without time limitation, in practical terms, where the radioactivity of radioactive substances present will decrease only due to the natural decay of radionuclides. It should last for so long until the possibility of releasing the equipment to environment due to natural radioactive decay is reached. With respect to the current values of the radioactivity inventory in V1 NPP and its character (presence of radionuclides with a long half-time, especially of alpha radionuclides), the time horizon of Option 0 can be estimated to be 10^4 – 10^5 years.

This option does not require investments for decommissioning however it is not time limited and puts off the horizon of the new site utilization to a very far future. In addition it extends hazards of possible radioactive substances leakages into the environment.

Radiological investigation confirmed that contamination of equipment located in V1 NPP buildings has potential of negative human impact for on-site workers (direct exposure). For off-site residents the negative health impact resulting from contaminants release is very low. Based on the calculation results it can be concluded that there's only limited health impact for off-site residents (maximal total effective dose from all pathways for infant (1 year) is $5.1 \cdot 10^{-3}$ mSv/year, and for adults is $5.0 \cdot 10^{-3}$ mSv/year at the distance of 1 km from V1 NPP).

The impact on the geological environment in a long term perspective is minimal, but only on condition that long-term continual inspections, water tightness of the civil structures and hermetic tightness of the technological equipment is ensured.

During operation of V1 NPP increased tritium levels in ground water were monitored. After shutdown of both V1 NPP units and fuel removal tritium activity in groundwater significantly decreased. However, even after decrease some activity fluctuations are still measured. This might indicate that some leakages are present. The origin of release source is not clear. The same leakage pathway might be cause of both tritium and ^{137}Cs occurrence in the groundwater. Unidentified release source potentially may result in future soil contamination under the building with radionuclides.

Significant contamination by oils and fuels was found in some locations (hot-spots). In some locations concrete is contaminated by oil to the range, that samples at the place of contamination represent potential hazard for humans performing localized activities, like maintenance.

In general, Option 0 presents lower risks in short term period compared to other alternatives involving dismantling of V1 NPP equipment. However in a long term perspective, aggregated risk is much higher due to the very long period needed for release of the existing equipment to the environment (estimated duration 10^4 – 10^5 years).

5.2.2 Order of suitability for assessed variants

Order of suitability of the proposed activity options: Option 1 - Option 0

The preliminary comparison of the assessed options of the proposed activity, comprising an overall assessment of the individual induced impacts and effects, implies that the existence of the activity seems to be a more optimal solution because it takes into account the anticipated development of the site from the point of view of creating the conditions for the utilisations of equipment, systems of buildings of V1 NPP for these purposes. This alternative is also the most suitable from the technical point of view, because it is linked to the current status of the site and to the provisions for decommissioning. An important aspect from the current perspective, based on existing experience of decommissioning, is the preservation of experience and knowledge of the actually involved technicians, whose could be effectively used for the successfully development of specific working procedures to achieve the final objective of the activity, minimising environmental impacts and social annoyances.

5.3 Substantiation of the selected optimum alternative

The environmental impact of the proposed decommissioning activity results mainly from the extent of operated equipment in controlled area and its mode of operation, the amounts of radioactive materials being dismantled and the management methods for radioactive wastes (RAW) generated during decommissioning. Anyway, must be specially taken into account that, during the power operation of V1 NPP (Unit 1 was shut down in 2006, and Unit 2 in 2008) the average value of the radioactivity of discharges was about 160 MBq for aerosols and about 65 MBq for corrosion and fission products in liquid discharges, values that represent about 0.1% and 0.2% of the permitted annual limits for the radioactivity of gaseous and liquid discharges for the Bohunice Nuclear Complex site as the whole. According to this, the estimated average annual radioactivity value arising from the Stage II of Decommissioning will represent about 5.6% of liquid discharges and the respective value for gaseous discharges will represent 0.1% of the appropriate annual values previously referred as measured for the V1 NPP operation.

The principal sources of radioactive discharges are the treatment and conditioning of RAW, decontamination of radioactive material and dismantling. Gaseous and liquid discharges are generated, depending on the technologies used. However, the chronological distribution of the amounts of discharges generated also depends on the final schedule of activities to be selected and adopted.

The continuity in decommissioning activities assumed in Option 1 clearly supposes the most adequate solution for the distribution of works. The advantage of this procedure is the possibility of starting with simpler cases of dismantling and decontamination activities whereby the practical experience is gained. This will later be used in the course of dismantling the most complicated parts such as the reactors and the most contaminated equipment. The advantage is the continuity of experience and knowledge of the buildings and equipment, which are most favourably evident in this option than in the zero option

(Option 0, do nothing). In addition to this, the development of specific working procedures during the partial decommissioning tasks can be effectively used for optimizing the continuity of knowledge of equipment and areas.

In terms of the economic costs, Option 1 is clearly most unfavourable than Option 0, because in this alternative the buildings are immediately decommissioned right back to the foundations. Nevertheless, considering that Stage I is restricted to non activated and no contaminated systems and buildings, Option 0 does not comprise a real decommissioning and therefore it does not reduce potential leakages of radioactive substances or the risk of accidents associated with the presence of radioactive materials in the facility (at the site) to the full extent. It really consists of maintaining the situation after NPP operation termination without any decommissioning activities beyond the dismantling of conventional elements, for an indefinite time period. Option 0 does not end up with the landscaping of the site and its release for further use. Due to these reasons, an objective comparison of costs and requirements for assessing the Option 0 in front of Option 1 is not possible. The Option 1 is in no way equivalent to the other.

However, the overall impact for Option 0 is biggest than for Option 1, considering only the immediate environmental impacts of the NPP decommissioning. As Option 0 does not represent an ultimate solution, the rejection of the Option 1 of the proposed activity would, sooner or later, very probably result in the re-assessment of the decision.

The Option 1 end up in the shortest possible time with the demolition of the non-utilisable buildings and the elimination of all impacts and risks resulting from their presence, including also include site landscaping and the release of the site for further use. The time scale is optimum, minimising the risk of loss of technical information on the equipment, reducing also as a matter of fact the loss of continuity of the operation and the resulting social and economic impacts on the population of the affected area. In spite of the slightly negative impact resulting from Option 1, related to radiation doses for the personnel and economic costs, this alternative achieves the most acceptable solution for the populations of the affected municipalities and for the affected area from the social, economic and environmental point of view. The aforementioned Option also adheres to the concept of sustainable development and to the basic principles for the safety of radioactive waste management.

6 MAPS AND OTHER PICTORIAL DOCUMENTATION

- Drawing 1: General location of the project area (cartographic base).
- Drawing 2: General location of the project area (ortophotographic base).
- Drawing 3: Natura Network Sites (cartographic base).

7 ADDITIONAL INFORMATION ON THE INTENTION

7.1 List of text and graphical documentation elaborated for the intention and list of main used materials

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7.2 List of statements and positions referring to the proposed activity invited before the intention is elaborated

By the date of submission of the Proposed Activity Plan, the affected and approving authorities have been to present alternatives option.

7.3 Other additional information on the hitherto procedure of proposed activity preparation and on assessment of its anticipated environmental impacts

Works (including Stage I of Decommissioning preparatory works) are currently performed to execute the changes described above in the understanding that the proposed changes would not have a significant negative impact on the environment.

8 PLACE AND DATE OF INTENTION PREPARATION

Madrid, Bratislava, May 2013.

9 CONFIRMATION OF DATA CORRECTNESS

9.1 Elaborators of the intention

Intention processor: Inypsa Informes y Proyectos S.A., General Díaz Porlier, 49, 28001 Madrid, Spain

Author:

....
Antonio Laguna
Consultant INYPSA

Approved:

....
Oscar Tejado
Environmental Consultancy & Engeneering Manager, INYPSA

Authorized representative of proposer:

....
JAVYS, a.s. Bratislava
Ing. Peter Ciznar
Chairman of the Board
and General Director

....
JAVYS, a.s. Bratislava
Ing. Miroslav Obert
Vice-chairman of the Board
and Director of division V1 and PMU

9.2 Confirmation of data correctness by a signature (stamp) of the elaborator of the intention and by a signature (stamp) of an authorised representative of the proposer

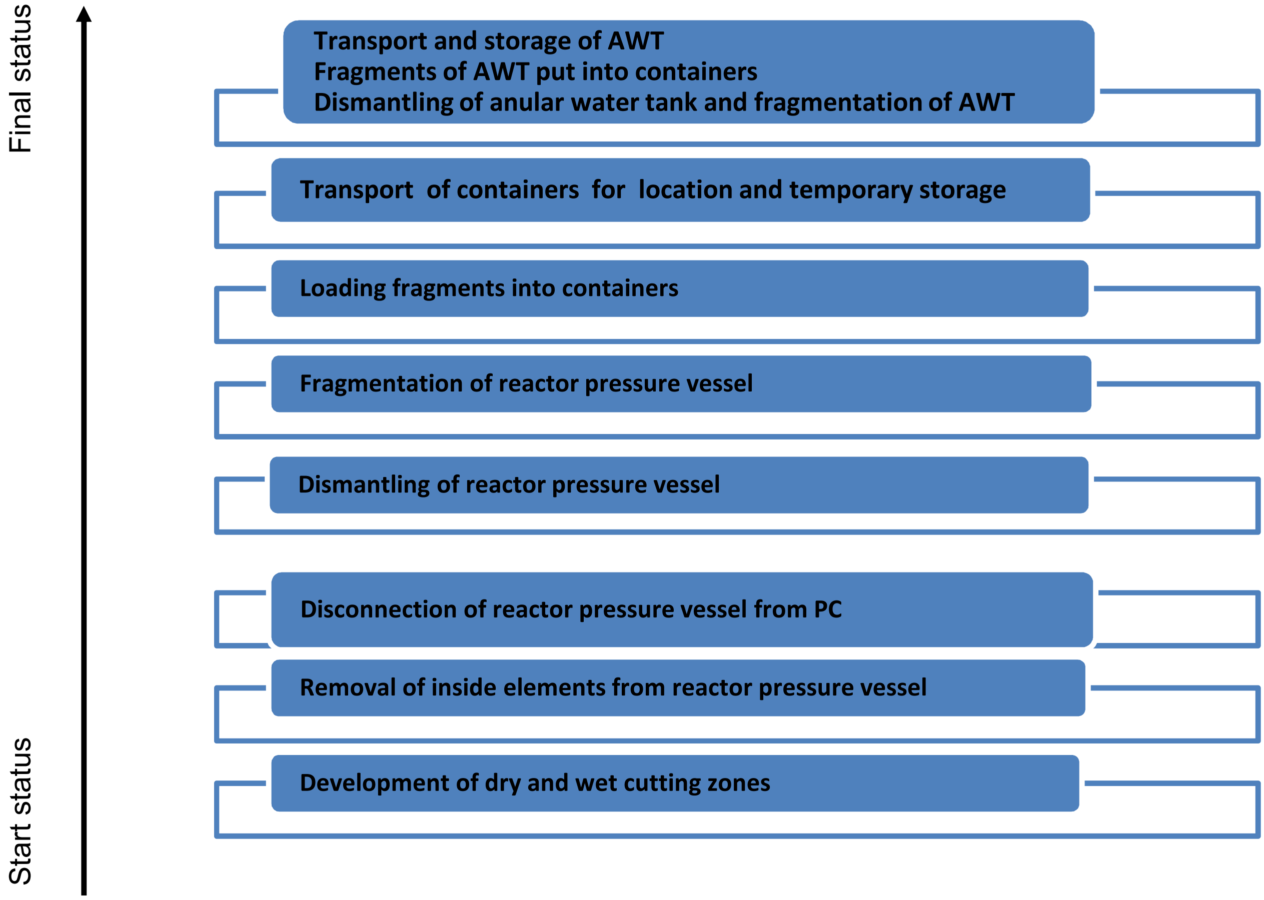
10 ANNEXES

1. **Dismantling and stages of activated material treatment**
2. **Dismantling and stages of contaminated material from PC treatment**
3. **Activities sequence of dismantling and activated materials treatment**
4. **Activities sequence of dismantling and contaminated materials treatment**
5. **2013/06889 NPP V1 decommissioning – abandon of request for proposed activity alternative solution (Document of MoE)**
6. **Layout of zone for reactor pressure vessel cutting**
7. **Location of inside reactor elements in RPV. Complex view on block of protective tubes**
8. **Typical configuration of reactor VVER 440 type V-230**

KIND OF FACILITIES	DESMANTLING AND WASTE TREATMENT STAGES (FROM LEFT TO RIGHT)					
	Dismantling of facility and manipulation				Transport In situ and storage	Final treatment, transport, storage
	Preparation	Dismantling	Size reduction	Treatment		
Reactor pressure vessel (RPV)	*Cutting off from all joints/connections* *Removal of internal elements*	*As the whole unit*	*Remote dry cutting*	*Separation LA RAW from MA RAW ;* *Loading of MA RAW into protective containers* *Loading LA RAW into FCC*	*LA RAW: Reactor hall -> out by lorry* *MA RAW: Reactor hall -> interim storage by a lorry*	*LA RAW : in RSRAW – in FCC by a lorry ;* *MA RAW: Storage in protective containers in interim storage facility*
Inside reactor elements	*Removal from RPV*	*Removal from PVR as the whole*	*Remote wet cutting*	*Separation LA RAW from MA RAW;* *Loading MA RAW into protective containers MA RAW* *Loading of LA RAW into FCC*	*LA RAW: Reactor hall -> out by lorry* *MA RAW: Reactor hall -> interim storage by a lorry*	*LA RAW : in RS RAW – in FCC by a lorry ;* *MA RAW: Storage in protective containers in interim storage facility*
Biological protection of the annular water tank	*Installation of shielding*	*Cutting off big fragments*	*In situ by steel rope in dry cutting zone*	*Separation of VLA RAW from LA RAW*	*Reactor hall*	*Into RS RAW– in ISO or FCC containers by a lorry*
Shielding sets in AZ	*No*	*Removal from spent fuel pool as a whole*	*No*	*Loading into protective containers (MOSAIK or similar)*	*Reactor hall -> interim storage by lorry*	*Storage in protective containers in interim storage facility*

KIND OF FACILITIES	DISMANTLING AND WASTE TREATMENT STAGES (FROM LEFT TO RIGHT)					
	Dismantling of facility and manipulation				Transport In situ and storage	Final treatment, transport, storage
	Preparation	Dismantling	Size reduction	Treatment		
Steam generator (SG)	*Cutting off from all joints*	*In situ cutting by thermal (the main) and mechanical (following) cutting*	*In situ*	*Ultrasound or electro-chemical decontamination in C7-A3 or C7-A2*	*Reactor hall ->C7-A3 by a crane Reactor hall -> C7-A2 by a lorry*	*release in environment – on pallet carrier by a lorry; in RS RAW-in FCC by a lorry*
Main circulation pumps	*Dismantling from deck of MCP*	*In situ cutting by thermal (the main) and mechanical (following) cutting*	*In situ*	*Ultrasound or electro-chemical decontamination in C7-A3 or C7-A2*	*Reactor hall ->C7-A3 by a crane Reactor hall -> C7-A2 by a lorry*	*release in environment – on pallet carrier by a lorry; in RS RAW-in FCC by a lorry*
Main shut-off valves	*Dismantling from deck of MCP*	*In situ cutting by thermal (the main) and mechanical (following) cutting*	*In situ*	*Ultrasound or electro-chemical decontamination in C7-A3 or C7-A2*	*Reactor hall ->C7-A3 by a crane Reactor hall -> C7-A2 by a lorry*	*release in environment – on pallet carrier by a lorry; in RS RAW-in FCC by a lorry*
Main loop pipes	-	*In situ cutting to get small fragments by circular cutter and other equipment*	*In situ*	*Ultrasound or electro-chemical decontamination in C7-A3 or C7-A2*	*Reactor hall ->C7-A3 by a crane Reactor hall -> C7-A2 by a lorry*	*release in environment – on pallet carrier by a lorry; in RS RAW-in FCC by a lorry*
Pressurizer	*Cutting off all joints Decontamination in a box of SG*	*In situ cutting to get small fragments*	*In situ*	*Not required*	*Reactor hall -> by a lorry*	*release in environment – on pallet carrier by a lorry;*
Spillway tank	*Demolition of constructions; Cutting off from all joints*	*In situ cutting to get large fragments*	*Following cutting in SG box*	*Not required*	*Reactor hall -> by a lorry*	*release in environment – on pallet carrier by a lorry;*
Mogilnik	*Preparation of temporary containment (tent) with ventilation over Mogilnik; demolition of concrete*	*As a whole*	*Mechanical cutting in SG box*	*Pipes: US or ECh decontamination in C7-A2; Concrete: abrading in C7-A3*	*Reactor hall ->C7-A3 by a crane Reactor hall -> C7-A2 by a lorry*	*release in environment - container of fragments/chips on pallet carrier in FCCs by a lorry in RS RAW;*
Reactor cover	*Preparation of temporary containment (tent) with ventilation of reactor hall*	*As a whole by a standard procedure*	*Concrete: pneumatic hammers; Metal: thermal cutting*	*Not required*	*By a crane in the reactor hall*	*release in environment - container of fragments/chips on pallet carrier in FCCs by a lorry*

Activities sequence concerning the dismantling and activated materials handling



Activities sequence concerning the dismantling and contaminated materials handling

Final status

Transfer of fragments not complying with conditions for a release in environment to storage,
Loading of fragments not complying with conditions for a release in environment into ISO containers

Transfer of pipelines for fragmentation and decontamination,
Loading of dismantled fragments into 40` ISO containers

Dismantling of Mogilnik constructions in the reactor hall

Transfer of fragments for cutting and measurement for evaluation to realese in environment,
Cutting of relieve tank into two pieces and take out from room R502,
Hole creation for dismantling of RT,
Sending elements for following fragmentation and decontamination (or directly for release)

Cutting KO into three pieces, creation of hole for KO dismantling

Sending parts for following fragmentation and decontamination, SG cutting on large fragments

Decontamination, sending parts for dismantling and following fragmentation

Loading elementsfrom MCP, MCA, MCP into ISO containers,
Dismantling of MCP, MCA, MCP

Sending parts to measurements for evaluation of possibility to release them in environment
Fragmentation of protective cover of reactor

Start status

2013/06889 2nd stage of decommissioning of NPP V1- abandonment of requirements for alterative solution of proposed activity

Ministry of Environment of the Slovak Republic complied with request of proponent to execute EIA for one alternative of proposed activity (Document No.5602/2013-3.4/hp dated May 17 2013)

Pre: 5100
Co: D-3009

2013/06889

24.6.13
Pre: 5130
27.05.2013

MINISTERSTVO ŽIVOTNÉHO PROSTREDIA SLOVENSKEJ REPUBLIKY
Sekcia environmentálneho hodnotenia a riadenia
Odbor environmentálneho posudzovania
Námestie Ľudovíta Štúra 1, 812 35 Bratislava

Jadrová a vyraďovacia spoločnosť, a.s.
Tomášikova 22, 821 02 Bratislava 2
Došlo: 23.05.2013
Počet príloh/listov príloh: | Ev. číslo: 2013/06889
Pridelené: 5000 | Č. spisu:

Jadrová a vyraďovacia spoločnosť, a. s.
Tomášikova 22
821 02 Bratislava

Váš list číslo/zo dňa	**Naše číslo**	**Vybavuje/☎**	**Bratislava**
2013/06228	5602/2013-3.4/hp	Ing. H. Ponecová +421 905 682 024	17. 05. 2013

Vec: „<u>Vyraďovanie jadrovej elektrárne V1 - II. etapa</u>"
<u>- upustenie od požiadavky variantného riešenia navrhovanej činnosti</u>

Vo Vašom liste č. 2013/06228, doručenom dňa 13. 05. 2013 ste sa na nás obrátili so žiadosťou o upustenie od požiadavky variantného riešenia navrhovanej činnosti **„Vyraďovanie jadrovej elektrárne V1 - II. etapa"** podľa zákona č. 24/2006 Z. z. o posudzovaní vplyvov na životné prostredie a o zmene a doplnení niektorých zákonov v znení neskorších predpisov.

Navrhovaná činnosť *„Vyraďovanie jadrovej elektrárne V1"* bola posúdená podľa v tom čase platného zákona NR SR č. 127/1994 Z. z. o posudzovaní vplyvov na životné prostredie v znení neskorších predpisov v rokoch 2002-2006.

V uvedenom procese posudzovania vplyvov na životné prostredie boli hodnotené tri možné varianty vyraďovania jadrovej elektrárne:

- ✓ Variant č. 1 - bezprostredné vyraďovanie JE V1,
- ✓ Variant č. 2 - odložené vyraďovanie JE V1 s uzavretím s dozorom na dobu 30 rokov,
- ✓ Variant č. 3 - odložené vyraďovanie JE V1 s ochranným uložením reaktora na dobu 30 rokov.

Na základe výsledkov komplexného posúdenia a výsledkov multikriteriálneho hodnotenia jednotlivých variantov v správe o hodnotení bol na realizáciu odporučený Variant č. 1 - bezprostredné vyraďovanie JE V1 (záverečné stanovisko MŽP SR, vydané pod č. 8935-3.5/hp dňa 07. 03. 2007).

Vplyvom zmeny všeobecne záväzných právnych predpisov MŽP SR, na žiadosť navrhovateľa, predĺžilo Rozhodnutím č. 2332/2010-3.4/hp platnosť záverečného stanoviska dňa 29. 11. 2010 o dva roky do termínu 30. 11. 2012. Uvedené rozhodnutie a pôvodné záverečné stanovisko, ktoré bolo neoddeliteľnou súčasťou uvedeného rozhodnutia boli podkladom pre vydanie povolenia ÚJD SR č. 400/2011 na I. etapu vyraďovania jadrového zariadenia „Jadrová elektráreň VI".

Realizácia vyraďovania JE V1 bola naplánovaná počas dvoch etáp, pričom uvedené povolenie na realizáciu I. etapy vyraďovania JE V1 je platné do 31. 12. 2014.

V súčasnosti rieši spoločnosť Javys, a. s., ako garant vyraďovania jadrových zariadení a materiálov, projekty na zabezpečenie realizácie II. etapy vyraďovania, medzi ktoré patrí aj projekt označený B6.7 *„Správa o hodnotení II. etapy vyraďovania JE V1 na životné prostredie“* Účelom projektu je vykonať hodnotenie vplyvov činností na životné prostredie, ktoré budú vykonávané počas II. etapy vyraďovania JE V1 pri realizácii už odporúčaného variantu bezprostredného vyraďovania JE V1.

Predmetné činnosti, vyžadované pre realizáciu II. etapy vyraďovania JE V1 boli detailnejšie špecifikované na základe aktuálnych potrieb spoločnosti JAVYS, a. s. vyplývajúcich z dokumentu *„Stratégia vyraďovania JE V1“*, vypracovaného pre potreby nadefinovania a zdôvodnenia súčasného a plánovaného čerpania finančných prostriedkov z medzinárodného podporného fondu na odstavenie reaktora V1 v Jaslovských Bohuniciach – fond BIDSF pre pokračovanie vyraďovacích prác a úspešné ukončenie vyraďovania JE V1.

Popis predmetu druhej etapy vyraďovania JE V1

Predmetom druhej etapy vyraďovania JE V1 je predovšetkým demontáž kontaminovaných a aktivovaných zariadení, systémov a všetkých zostávajúcich nevyužiteľných štruktúr, prípadne realizácia niektorých činností presahujúcich časové ohraničenie I. etapy vyraďovania JE V1.

Základnými podkladovými dokumentmi, definujúcimi jednotlivé činnosti, ktoré sa budú realizovať v rámci II. etapy vyraďovania, sú:

- B6.3-D5 „Koncepcia vyraďovania pre obdobie po ukončení schvaľovanej (povoľovanej) etapy vyraďovania"
- Stratégia vyraďovania JE VI J. Bohunice.

Na základe dokumentu *B6.3-D5 „Koncepcia vyraďovania pre obdobie po ukončení schvaľovanej (povoľovanej) etapy vyraďovania“* bude cieľom vyraďovania v období po ukončení I. etapy vyraďovania bude vyňatie jadrového zariadenia JE V1 spod pôsobnosti zákona č. 541/2004 Z. z. o mierovom využívaní jadrovej energie (atómový zákon) v súvislosti s vyradenie objektov hlavného výrobného bloku, budovy pomocných prevádzok a zostávajúcich pomocných objektov, ktoré neboli uvedené v pláne vyraďovania pre I. etapu, alebo boli vyradené len čiastočne.

Plánovaný koncový stav vyraďovania JE V1 umožní opätovné využitie lokality na priemyselné účely.

Hlavné skupiny činností v období po ukončení I. etapy vyraďovania JE V1 sú nasledujúce:

- príprava a demontáž reaktorov,
- príprava a demontáž zariadení primárneho okruhu,
- demontáž ostatných zariadení v kontrolovanom pásme,
- odstránenie kontaminácie zo stavebnej časti a radiačná kontrola stavebnej časti aktívnych objektov,
- demolácia pôvodne aktívnych objektov po základovú dosku,
- demontáž v neaktívnych objektoch,
- fragmentácia materiálov a zariadení,
- dekontaminácia,
- demolácia neaktívnych objektov po základovú dosku,
- úpravy terénu, uvoľnenie územia na ďalšie priemyselné využitie.

Uvedené činnosti budú riadené a podporované činnosťami ako sú:

- nakladanie s rádioaktívnymi odpadmi (transport, skladovanie, spracovanie, úprava, monitorovanie),
- nakladanie s neaktívnymi odpadmi (ostatné a nebezpečné),
- uvoľňovanie materiálov spod administratívnej kontroly,
- transporty,
- technická podpora,
- prevádzka pomocných systémov,
- radiačná ochrana,
- fyzická ochrana,
- bezpečnosť,
- údržba,
- kontrola a monitorovanie a ďalšie.

Jednotlivé činnosti vyplývajúce z hlavných skupín činností uvedených vyššie sú definované do projektov v dokumente „Stratégia vyraďovania JE VI", schválenej vedením spoločnosti JAVYS, a.s. v novembri 2012.

Činnosti zahrnuté v II. etape vyraďovania budú realizované formou projektov napr.:

D2.1	Dekontaminácia bazénov skladovania a ďalších kontaminovaných nádrží JE V1
D4.1	Modifikácia elektrárne a montáž nových zariadení
D4.2	Demontáž veľkorozmerných komponentov primárneho okruhu
D4.4B	Demontáž systémov v kontrolovanom pásme JE V1 - časť I.
D4.4C	Demontáž systémov v kontrolovanom pásme JE V1 - časť II.
D4.5	Dekontaminácia objektov reaktorov a budovy pomocných prevádzok
D4.6	Demolácia objektov a vyplnenie stavebných jám
D6.1	Uvedenie areálu JE V1 do pôvodného stavu
D6.2	Záverečný prieskum a uvoľnenie areálu
C14	Zneškodnenie „RH" odpadov z „mogilnika"
C12.2	Laboratórne vybavenie potrebné pre proces vyraďovania JE V1 - 2. Etapa.

Vašu žiadosť odôvodňujete najmä tým, že s ohľadom na proces posudzovania vplyvov činnosti na životné prostredie a zdravie ľudí, uskutočnený podľa vtedy platného zákona č. 127/1994 Z. z. bol na základe výsledkov komplexného posúdenia jednotlivých variantov v správe o hodnotení odporučený na realizáciu *Variant č. 1 - Bezprostredné vyraďovanie JE V1.*

Uvedený postup je v súlade so *„Stratégiou záverečne časti jadrovej energetiky v Slovenskej republike"*, ku ktorej bolo vydané záverečné stanovisko MŽP SR č. 5131/2007-3.4/hp.

Na základe vyššie uvedeného zdôvodnenia navrhujete riešiť proces posudzovania navrhovanej činnosti *„Vyraďovanie JE V1 - II. etapa"* jednovariantne s tým, že v dokumentácii budú popisované a hodnotené jednotlivé činnosti, ktoré sú plánované na realizáciu po ukončení I. etapy vyraďovania JE VI v možných alternatívach, resp. technologických postupoch (ak sa predpokladá ich realizovateľnosť, resp. použiteľnosť).

Vzhľadom na skutočnosť, že predmetom vyraďovania je existujúca jadrová elektráreň JE V1, ktorej prevádzka je ukončená, nie je možné uvažovať ani o inom lokalizačnom variante.

Činnosti budú realizované v areáli spoločnosti JAVYS, a. s., Jaslovské Bohunice vzhľadom na umiestnenie jadrovej elektrárne V1, ale aj jej úzke súvislosti s činnosťami, napr. nakladaním s RAO (úprava, spracovanie, skladovanie RAO), monitorovaním jadrových zariadení a pod...

Po zvážení argumentov uvedených vo Vašej žiadosti Vám oznamujeme, že podľa § 22 ods. 7 zákona č. 24/2006 Z. z. o posudzovaní vplyvov na životné prostredie a o zmene a doplnení niektorých zákonov v znení neskorších predpisov (ďalej len „zákon") **upúšťame od požiadavky variantného riešenia navrhovanej činnosti *„Vyraďovanie jadrovej elektrárne V1 - II. etapa"*.**

Zámer vypracovaný podľa § 22 a prílohy č. 9 zákona bude obsahovať jeden lokalizačný variant činnosti, ako aj nulový variant, t.j. variant stavu, ktorý by nastal, ak by sa navrhovaná činnosť neuskutočnila.

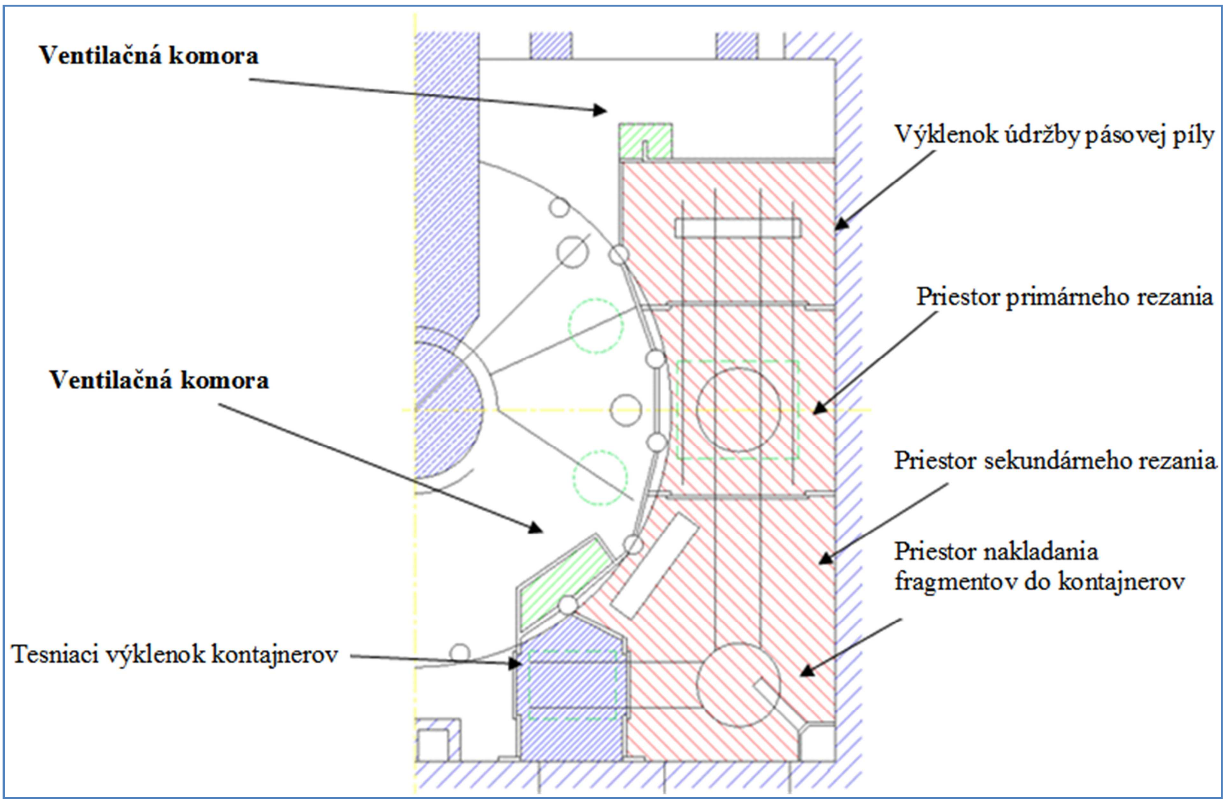
Zároveň Vás upozorňujeme, že pokiaľ z pripomienok predložených k uvedenému zámeru vyplynie potreba ďalšieho reálneho variantu činnosti, bude táto skutočnosť zohľadnená pri stanovení rozsahu hodnotenia a časového harmonogramu.

S pozdravom

MINISTERSTVO ŽIVOTNÉHO PROSTREDIA SR
nám. Ľudovíta Štúra 1
812 35 BRATISLAVA
77

RNDr. Gabriel N i ž ň a n s k ý
riaditeľ odboru

Figure No. 1 Layout of zone for cutting of reactor pressure vessel



Explanations:

Ventilačná komora – ventilation chamber

Tesniaci výklenok kontajnerov – sealing niche of containers

Výklenok údržby pásovej píly – niche of band saw maintenance

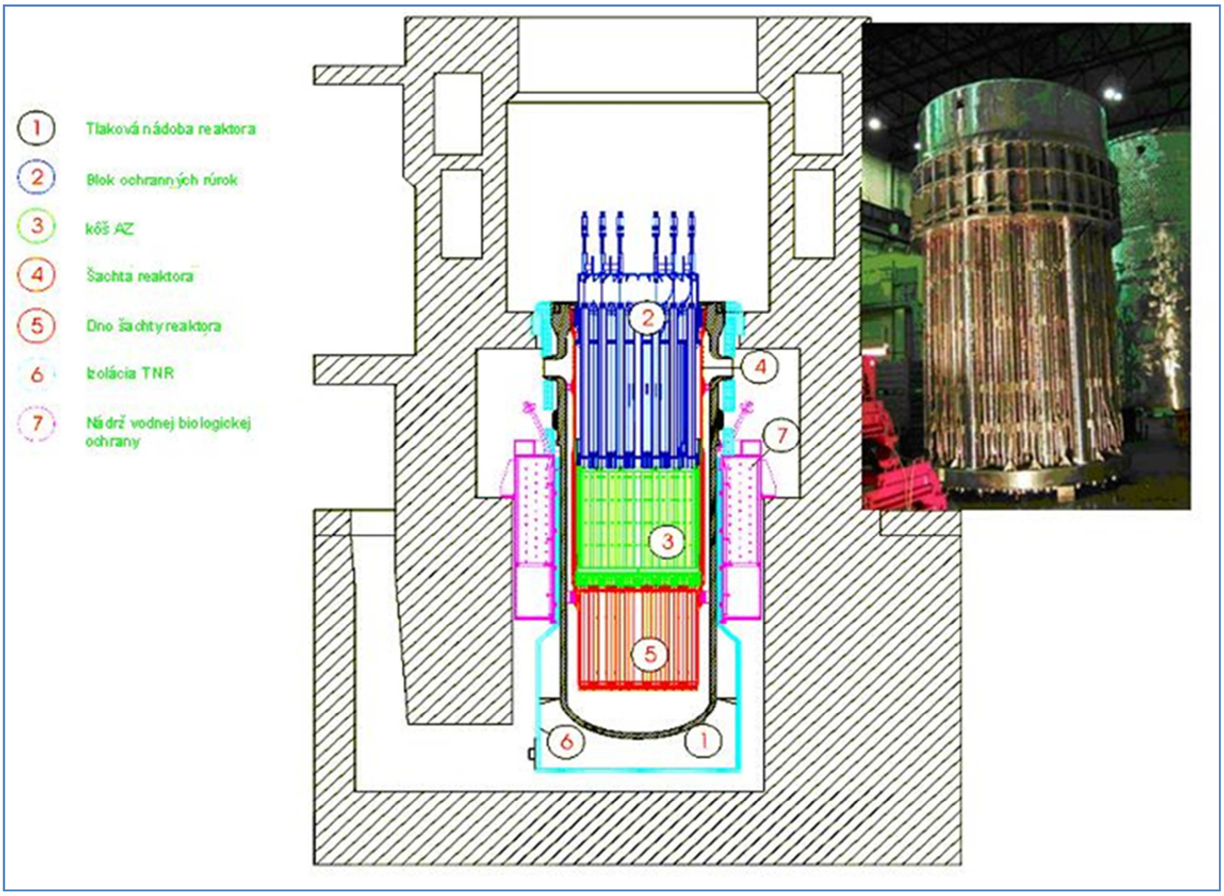
Priestor primárneho rezania – space of primary cutting

Priestor sekundárneho rezania – space of secondary cutting

Priestor nakladania fragmentov do kontajnerov – space for loading of containers with fragments

Figure No. 2 Location of reactor inside elements in RPV

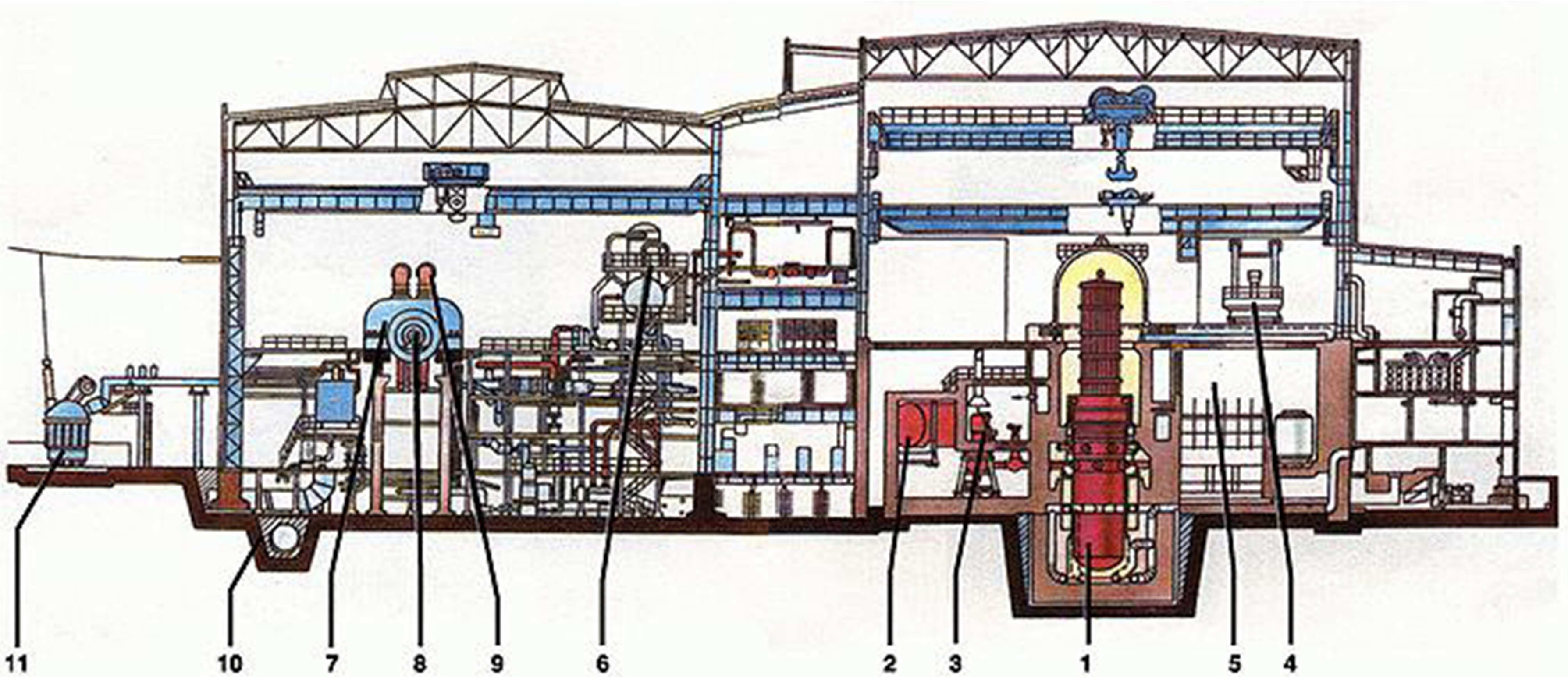
Complex view on block of protective tubes



Explanations:

1. Reactor pressure vessel
2. Block of protective tubes
3. AZ basket
4. Reactor shaft
5. Bottom of reactor shaft
6. Insulation of RPV
7. Annular water tank

Figure No.3 Typical configuration of reactor VVER 440 type V-230



Legenda: 1. Reaktor, 2. Parogenerátor, 3. Hlavné cirkulačné čerpadlo, 4. Zavážací stroj, 5. Chladiaci bazén, 6, Deaerátor, 7. Parná turbína, 8. Generátor, 9. Parné potrubie, 10. Potrubie chladiacej vody, 11. Transformátor

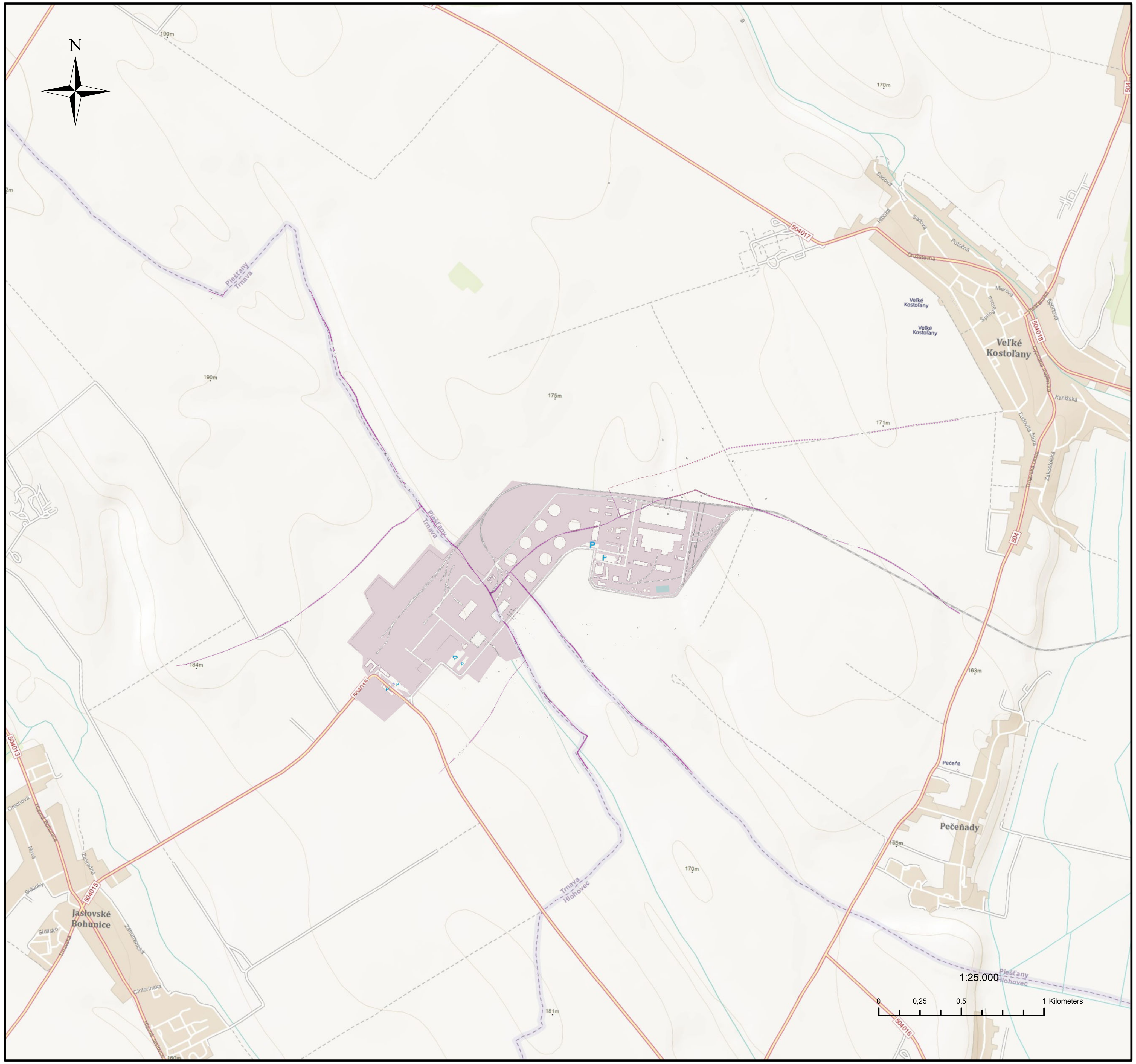
Legend: 1. reactor, 2. Steam generator, 3. Main circulation pump, 4. Machine of loading, 5. Cooling pool, 6. De-aerator, 7. Steam turbine, 8. Generator,9. Steam pipelines, 10. Cooling water pipelines, 11. Transformer

DRAWINGS

Drawing 1: General location of the project area (cartographic base)

PROJECT B6.7 ENVIRONMENTAL IMPACT ASSESSMENT REPORT OF 2ND STAGE OF V1 NPP DECOMMISSIONING

PRELIMINARY ENVIRONMENTAL STUDY



DRAWING 1
GENERAL LOCATION OF THE PROJECT AREA
(Cartographic Base)

May, 2013

PROPONENT
Jadrová a Vyraďovacia Spoločnosť, a.s.
Tomášikova 22
821 02 Bratislava
SLOVAK REPUBLIC

javys jadrová a vyraďovacia spoločnosť

CONSULTANT
Inypsa Informes y Proyectos, S.A.
General Díaz Porlier, 49
28001 Madrid
SPAIN

inypsa

Drawing 2: General location of the project area (ortophotographic base)

PROJECT B6.7 ENVIRONMENTAL IMPACT ASSESSMENT REPORT OF 2ND STAGE OF V1 NPP DECOMMISSIONING

PRELIMINARY ENVIRONMENTAL STUDY

DRAWING 2
GENERAL LOCATION OF THE PROJECT AREA
(Ortofotographic Base)

May, 2013

PROPONENT
Jadrová a Vyraďovacia Spoločnosť, a.s.
Tomášikova 22
821 02 Bratislava
SLOVAK REPUBLIC

javys jadrová a vyraďovacia spoločnosť

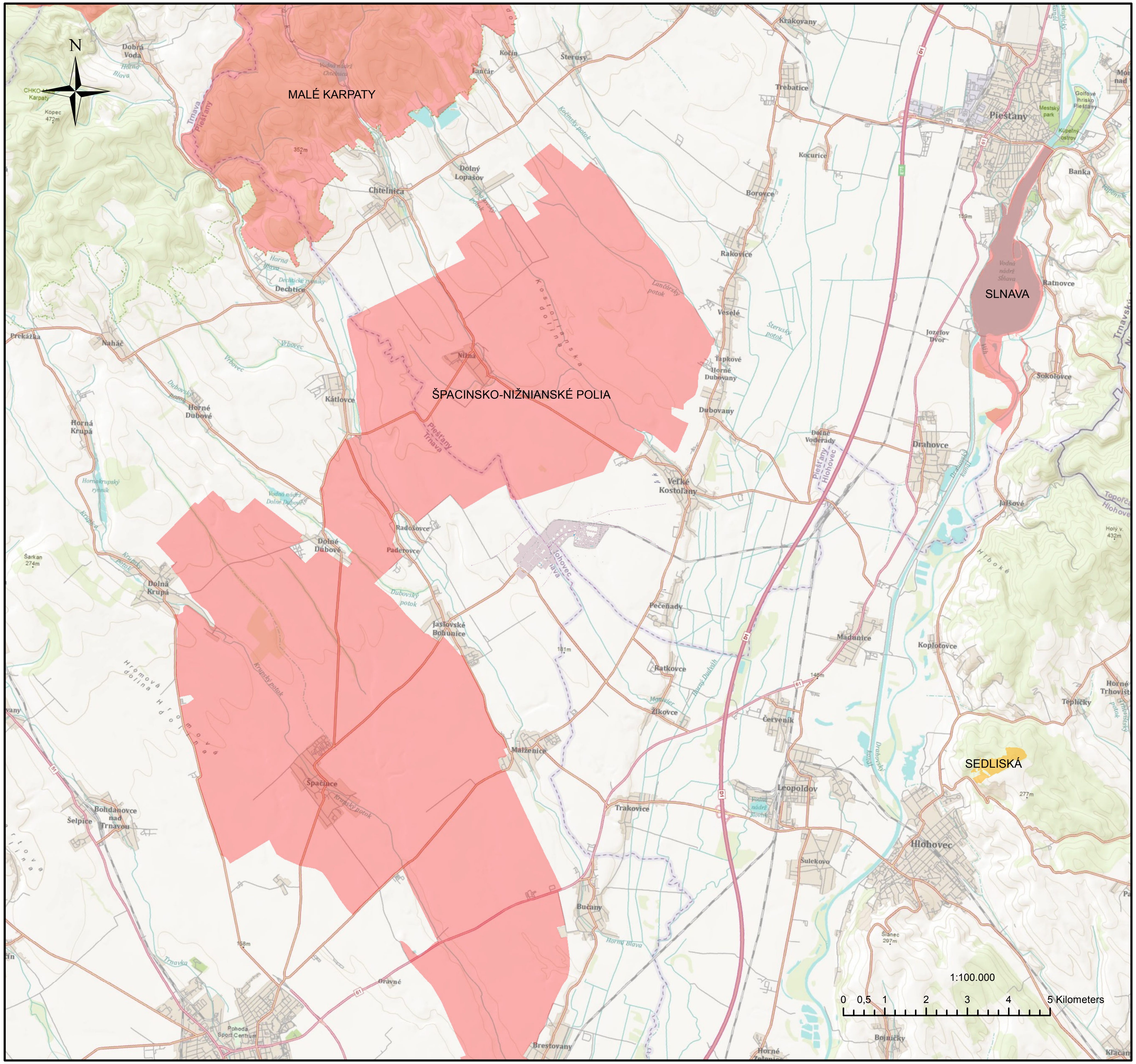
CONSULTANT
Inypsa Informes y Proyectos, S.A.
General Díaz Porlier, 49
28001 Madrid
SPAIN

inypsa

Drawing 3: Natura Network Sites (cartographic base)

PROJECT B6.7 ENVIRONMENTAL IMPACT ASSESSMENT REPORT OF 2ND STAGE OF V1 NPP DECOMMISSIONING

PRELIMINARY ENVIRONMENTAL STUDY



DRAWING 3
NATURA NETWORK SITES
(Cartographic Base)

Special Protection Areas (SPA, Birds Directive)

Sites of Community importance (SCI, Habitats Directive)

May, 2013

PROPONENT
Jadrová a Vyraďovacia Spoločnosť, a.s
Tomášikova 22
821 02 Bratislava
SLOVAK REPUBLIC

javys jadrová a vyraďovacia spoločnosť

CONSULTANT
Inypsa Informes y Proyectos, S.A.
General Díaz Porlier, 49
28001 Madrid
SPAIN

inypsa