Expansion of storage capacity of the interim spent fuel storage facility at Jaslovské Bohunice

ASSESSMENT REPORT

in accordance with Act of the National Council of the Slovak Republic No. 24/2006 Coll. on environmental impact assessment as amended

Revision: 0
Date of preparation: 1/2015
# Table of Contents

**Table of Contents** .................................................................................................................. 2

**Introduction** ......................................................................................................................... 9

**A. Basic Data** ......................................................................................................................... 10

I. Basic Data on the Proposer .................................................................................................... 10
   I.1. Name ............................................................................................................................ 10
   I.2. ID Number .................................................................................................................. 10
   I.3. Registered Office ......................................................................................................... 10
   I.4. Proposer's Authorised Representative ....................................................................... 10
   I.5. Contact Person ............................................................................................................ 11

II. Basic Data on the Proposed Activity .................................................................................... 12
   II.1. Name ........................................................................................................................ 12
   II.2. Purpose ..................................................................................................................... 12
   II.3. User ........................................................................................................................... 13
   II.4. Siting of the Proposed Activity .................................................................................. 13
   II.5. General Layout of the Siting of the Proposed Activity ........................................... 14
   II.6. The Reason for Siting at the Proposed Site ............................................................... 14
   II.7. Date of Beginning and Completion of Construction and Operation of the Proposed Activity ................................................................. 15
   II.8. Brief Description of Technical and Technological Solution .................................... 15
   II.9. Variants of the Proposed Activity .............................................................................. 16
   II.10. Total Informative Costs ............................................................................................ 27
   II.11. Affected Municipality ............................................................................................... 27
   II.12. Affected Self-Governing Region .............................................................................. 27
   II.13. Affected Authorities .................................................................................................. 27
   II.14. Permitting Authority ................................................................................................ 28
   II.15. Departmental Body .................................................................................................... 28
   II.16. Type of Required Permit for the Proposed Activity Pursuant to Special Regulations ............................................................................................................................. 28
   II.17. Statement on the Cross-Border Impacts of the Proposed Activity .......................... 28

**B. Data on the Direct Impacts of the Proposed Activity on the Environment Including Health** .................................................................................................................. 30

I. Requirements for Inputs ........................................................................................................ 30
   I.1. Land ............................................................................................................................. 30
   I.2. Water ........................................................................................................................... 33
   I.3. Raw Materials ............................................................................................................. 36
   I.4. Energy Sources ........................................................................................................... 37
   I.5. Demands for Transport and Other Infrastructure ....................................................... 38
   I.6. Manpower Demands .................................................................................................... 39

II. Data on Outputs ..................................................................................................................... 40
   II.1. Air .............................................................................................................................. 40
      II.1.1. Point Sources ....................................................................................................... 40
      II.1.2. Non-Point Pollution Sources .............................................................................. 43
      II.1.3. Line and Mobile Sources ................................................................................... 43
   II.2. Waste Waters .............................................................................................................. 44
   II.3. Wastes ......................................................................................................................... 46
II.4. NOISE AND VIBRATIONS .................................................................................................................. 52
II.5. RADIATION AND OTHER PHYSICAL FIELDS .................................................................................. 53
II.6. SMELL AND OTHER OUTPUTS ........................................................................................................ 55
II.7. ADDITIONAL DATA .......................................................................................................................... 55
II.8 INTERIM SF STORAGE FACILITY DECOMMISSIONING IMPACTS .................................................... 57

C. COMPLETE CHARACTERISTICS AND ENVIRONMENTAL IMPACT ASSESSMENT INCLUDING HEALTH IMPACTS .................................................................................................................. 59

I. SPECIFICATION OF THE BOUNDARIES OF THE AFFECTED TERRITORY ............................................. 59
II. CHARACTERISTICS OF THE CURRENT STATE OF THE ENVIRONMENT IN THE AFFECTED AREA ........................................................................................................................................................................ 59
II.1. GEOMORPHOLOGICAL CONDITIONS .................................................................................................. 59
II.2. GEOLOGICAL CONDITIONS ................................................................................................................ 61
II.3. SOIL CONDITIONS .................................................................................................................................. 70
II.4. CLIMATIC CONDITIONS ......................................................................................................................... 71
II.5. AIR POLLUTION CONDITION ............................................................................................................ 74
II.6. HYDROLOGICAL CONDITIONS ............................................................................................................ 75
II.7. FAUNA AND FLORA ............................................................................................................................ 77
II.8. LANDSCAPE STRUCTURE, LANDSCAPE, SCENERY, LANDSCAPE STABILITY AND PROTECTION ................................................................................................................................. 77
II.9. PROTECTED AREAS PURSUANT TO SPECIAL REGULATIONS AND THEIR PROTECTION ZONES ......................................................................................................................................................... 78
II.10. TERRITORIAL SYSTEM OF ECOLOGICAL STABILITY ....................................................................... 80
II.11. POPULATION ........................................................................................................................................ 81
II.12. CULTURAL AND HISTORICAL MONUMENTS AND SITES ................................................................ 89
II.13. ARCHAEOLOGICAL SITES .................................................................................................................. 89
II.14. PALAEONTOLOGICAL AND SIGNIFICANT GEOLOGICAL SITES ....................................................... 89
II.15. CHARACTERISTICS OF THE EXISTING SOURCES OF ENVIRONMENTAL POLLUTION AND THEIR ENVIRONMENTAL IMPACTS ........................................................................................................ 89
II.16. COMPLETE EVALUATION OF CURRENT ENVIRONMENTAL ISSUES ............................................ 106
II.17. GENERAL ENVIRONMENTAL QUALITY – SYNTHESIS OF POSITIVE AND NEGATIVE FACTORS ......................................................................................................................................................... 106
II.18. ASSESSMENT OF THE EXPECTED DEVELOPMENT OF THE TERRITORY IF THE PROPOSED ACTIVITY IS NOT EXECUTED .................................................................................................................. 109
II.19. COMPLIANCE OF THE PROPOSED ACTIVITY WITH THE VALID LAND-USE PLANNING DOCUMENTATION ............................................................................................................................................... 110

III. ASSESSMENT OF EXPECTED ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTIVITY INCLUDING THE IMPACTS ON HEALTH AND THEIR ESTIMATED SIGNIFICANCE ................................................................................................................................. 110
III.1. IMPACTS ON THE POPULATION .......................................................................................................... 110
III.2. IMPACTS ON THE ROCK MASS, MINERAL RESOURCES, GEODYNAMIC PHENOMENA AND GEOMORPHOLOGICAL CONDITIONS ........................................................................................................ 115
III.3. IMPACTS ON CLIMATIC CONDITIONS ................................................................................................. 116
III.4. IMPACTS ON THE AIR ........................................................................................................................ 116
III.5. IMPACTS ON WATER CONDITIONS .................................................................................................... 116
III.6. IMPACTS ON SOIL ............................................................................................................................... 117
III.7. IMPACTS ON FAUNA, FLORA AND THEIR BIOTOPES ...................................................................... 117
III.8. IMPACTS ON THE LANDSCAPE .......................................................................................................... 118
III.9. IMPACTS ON THE PROTECTED AREAS AND THEIR PROTECTION ZONES .... 118

III.10. IMPACTS ON THE TERRITORIAL SYSTEM OF ECOLOGICAL STABILITY ...... 119

III.11. IMPACTS ON THE URBANISED AREA AND LAND USE ........................................ 120

III.12. IMPACTS ON CULTURAL AND HISTORICAL MONUMENTS .................................. 120

III.13. IMPACTS ON ARCHAEOLOGICAL SITES .......................................................... 121

III.14. IMPACTS ON PALEONTOLOGICAL AND SIGNIFICANT GEOLOGICAL SITES 121

III.15. IMPACTS ON IMMATERIAL CULTURAL VALUES ............................................. 121

III.16. OTHER IMPACTS .......................................................................................... 121

III.17. SPATIAL SYNTHESIS OF ACTIVITY’S IMPACTS IN THE TERRITORY .......... 122

III.18 COMPREHENSIVE ASSESSMENT OF THE EXPECTED IMPACTS IN TERMS OF THEIR SIGNIFICANCE AND THEIR COMPARISON WITH THE VALID LEGAL REGULATIONS.............................................................................................................. 124

III.19. OPERATING RISKS AND THEIR POSSIBLE IMPACT ON THE TERRITORY ..... 130

IV. MEASURES PROPOSED FOR THE PREVENTION, ELIMINATION, MINIMISING AND COMPENSATION OF THE PROPOSED ACTIVITY’S IMPACTS ON THE ENVIRONMENT AND HEALTH ................................................................. 140

IV.1. LAND-USE PLANNING MEASURES ........................................................................... 140

IV.2. TECHNICAL MEASURES ...................................................................................... 141

IV.3. TECHNOLOGICAL MEASURES ............................................................................ 142

IV.4. ORGANISATIONAL AND OPERATING MEASURES ............................................. 143

IV.5. OTHER MEASURES ........................................................................................... 146

IV.6. STATEMENT ON THE TECHNICAL AND ECONOMIC FEASIBILITY OF THE MEASURES ........................................................................................................................................ 146

V. COMPARISON OF PROPOSED ACTIVITY’S VARIANTS AND PROPOSAL OF THE OPTIMAL VARIANT (INCLUDING THE COMPARISON WITH THE ZERO VARIANT) ......................................................................................................................... 146

V.1. CREATION OF THE SET OF CRITERIA AND DETERMINATION OF THEIR IMPORTANCE FOR OPTIMAL VARIANT SELECTION ........................................................................................................................................ 146

V.2. SELECTION OF AN OPTIMAL VARIANT OR SPECIFICATION OF SUITABILITY ORDER FOR THE VARIANTS UNDER ASSESSMENT ........................................................................................................................................ 146

V.3. SUBSTANTIATION OF OPTIMAL VARIANT PROPOSAL ........................................... 149

VI. PROPOSAL OF MONITORING AND POST-DESIGN ANALYSIS .......... 150

VI.1. PROPOSAL OF MONITORING FROM THE BEGINNING OF CONSTRUCTION, DURING THE CONSTRUCTION, DURING OPERATION AND AFTER THE END OF OPERATION OF THE PROPOSED ACTIVITY .......... 150

VI.2. PROPOSAL OF CONTROL OF SET CONDITIONS OBSERVANCE .................. 153

VII. METHODS USED IN THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS FOR THE PROPOSED ACTIVITY AND THE WAY AND SOURCES OF ACQUISITION OF THE DATA ON THE CURRENT STATE OF THE ENVIRONMENT, WHERE THE PROPOSED ACTIVITY IS TO BE EXECUTED 153

VIII. KNOWLEDGE SHORTCOMINGS AND EQUIVOCATIONS OCCURRED DURING THE ASSESSMENT REPORT PREPARATION .......................................................... 154

IX. ANNEXES TO THE ASSESSMENT REPORT (GRAPHIC, MAP, TABULAR AND PHOTO DOCUMENTATION) ................................................................................................................. 154

X. GENERAL COMPREHENSIBLE FINAL SUMMARY .............................................. 155

XI. LIST OF SOLVERS AND ORGANISATIONS THAT TOOK PART IN THE ASSESSMENT REPORT PREPARATION ................................................................. 171
XII. LIST OF SUPPLEMENTARY ANALYTICAL REPORTS AND STUDIES AVAILABLE AT THE PROPOSER’S PLACE THAT WERE USED AS SUPPORTING DOCUMENTS FOR THE ASSESSMENT REPORT PREPARATION .................. 171
XIII. DATE AND CONFIRMATION OF CORRECTNESS AND COMPLETENESS OF DATA BY THE SIGNATURE (STAMP) OF THE ASSESSMENT REPORT AUTHOR’S AUTHORISED REPRESENTATIVE AND PROPOSER .................... 173
Abbreviations used and certain terms:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>BRWTC</td>
<td>Bohunice Radioactive Waste Treatment Centre</td>
</tr>
<tr>
<td>SFSP</td>
<td>Spent fuel storage pool</td>
</tr>
<tr>
<td>EBO</td>
<td>Bohunice Power Plant</td>
</tr>
<tr>
<td>EIA</td>
<td>Environmental impact assessment</td>
</tr>
<tr>
<td>HBU</td>
<td>Institute of Hydrobiology</td>
</tr>
<tr>
<td>MRB</td>
<td>Main reactor building</td>
</tr>
<tr>
<td>PLA</td>
<td>Protected landscape area</td>
</tr>
<tr>
<td>PDA</td>
<td>Protected deposit area</td>
</tr>
<tr>
<td>PBA</td>
<td>Protected bird area</td>
</tr>
<tr>
<td>PA</td>
<td>Protected area</td>
</tr>
<tr>
<td>IRAWS</td>
<td>Integral radioactive waste storage facility</td>
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<tr>
<td>JAVYS, a.s.</td>
<td>Jadrová a vyraďovacia spoločnosť, a.s.</td>
</tr>
<tr>
<td>NPP, NEI, NI</td>
<td>nuclear power plant, nuclear energy installation, nuclear installation</td>
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<tr>
<td>CA</td>
<td>Controlled area</td>
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<tr>
<td>LRAW</td>
<td>Liquid radioactive wastes</td>
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<tr>
<td>KZ</td>
<td>Compact cask</td>
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<tr>
<td>LPF</td>
<td>Forest land fund</td>
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<tr>
<td>IAEA</td>
<td>International Atomic Energy Agency</td>
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<tr>
<td>MSK-64</td>
<td>Macroseismic Medvedev–Sponheuer–Karnik 12-degree scale</td>
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<tr>
<td>ISFS</td>
<td>Interim spent fuel storage facility</td>
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<tr>
<td>MZ SR</td>
<td>Ministry of Health of the Slovak Republic</td>
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<tr>
<td>MZP SR</td>
<td>Ministry of Environment of the Slovak Republic</td>
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<tr>
<td>NaRK</td>
<td>Start-up and standby boiler room</td>
</tr>
<tr>
<td>NR SR</td>
<td>National Council of the Slovak Republic</td>
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<tr>
<td>NV SR</td>
<td>Government Order of the Slovak Republic</td>
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<tr>
<td>OS</td>
<td>Packaging set</td>
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<tr>
<td>PPF</td>
<td>Agricultural land fund</td>
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<tr>
<td>FA</td>
<td>Fuel assembly</td>
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<tr>
<td>PS</td>
<td>Elementary system</td>
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<tr>
<td>RA</td>
<td>Radioactive</td>
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<tr>
<td>RAS, RS</td>
<td>Radioactive substances</td>
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<tr>
<td>RAW</td>
<td>Radioactive wastes</td>
</tr>
<tr>
<td>NRWR</td>
<td>National RAW Repository</td>
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<tr>
<td>RUSES</td>
<td>Regional territorial system of ecological stability</td>
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</table>
ionising radiation - the radiation transmitting energy in the form of particles or electromagnetic waves with a wavelength of up to 100 nm or with a frequency of $3.10^{15}$ Hz or higher, which is able to create ions, directly or indirectly

irradiation - exposure to ionising radiation

natural source of ionising radiation - a source of ionising radiation of natural earth or cosmic origin

radiation protection - protection of people and of the environment against irradiation and its effects including the means for achieving it

radioactive contamination - contamination of any material, surface, environment or individual by radioactive substances. For human body, radioactive contamination shall mean external contamination of skin and internal contamination regardless of the way in which radionuclides are received.

radioactive substance - every substance containing one or more radionuclides whose activity or mass activity or volume activity is not negligible in terms of radiation protection

radioactive source - a radioactive substance whose activity and mass activity exceed the values of activity and mass activity included in Annex No. 2 to Government Order of the Slovak Republic No. 345/2006 Coll.

RAW treatment - the activity focused on separation of radionuclides from radioactive wastes, on the change of their composition and on the reduction of their volume with the objective to increase safety and economic efficiency of their disposal

artificial source of ionising radiation - a source of ionising radiation other than natural source of ionising radiation.
RAW conditioning – the activity leading to an output in the form of packed radioactive wastes, ready for safe handling, storage, transport and disposal in compliance with requirements.
INTRODUCTION

The subject matter of this environmental impact assessment report is to describe the methods of providing sufficient storage capacity of spent nuclear fuel produced by Slovak nuclear power plants with the title “Expansion of storage capacity of the interim spent fuel storage facility at Jaslovské Bohunice”, which is to be located in the vicinity of the existing structure 840M on the premises of Jadrová a vyrad'ovacia spoločnost', a.s. at Jaslovské Bohunice. The proposed activity will supplement the present way of spent fuel storage in the structure 840M with additional rooms interconnected with the structure 840M, which will provide long-term storage of SF.

The report has been prepared according to the requirements of assessment scope issued by the Ministry of Environment of the Slovak Republic No. 6640/2014-3.4/hp dated 31 December 2014.

Taking into account the character of the activities, which can be considered a change of the existing activity – "SF storage“ at Jaslovské Bohunice and in relation to the current nuclear installation "Interim spent fuel storage facility“, the activity is proposed in only one site variant in three technological SF storage variants.

Pursuant to Article 3 (9) of Act No. 541/2004 Coll., the Proposer of this installation – Jadrová a vyrad'ovacia spoločnost', a.s. with its registered seat at Bratislava is a legal entity established and authorised by the Ministry of Economy of the Slovak Republic and provides for SF storage pursuant to Article 10 (3) of Act No. 541/2004 Coll., which states: "In the interest of provision of nuclear safety and prevention of ungrounded accumulation of radioactive wastes and spent nuclear fuel, the licence holder is obliged, during nuclear installation commissioning and operation, to hand over the radioactive wastes, no later than within 12 months from their production, and spent fuel, immediately after the fulfilment of requirements for its safe transport and storage, to the legal entity established in Article 3 (9) for further management.“

Pursuant to Act No. 24/2006 Coll. on environmental impact assessment and on the amendment to certain acts, the change of the proposed activity is assigned to Annex No. 8 to Category 2 Energy Industry, Item 9 "Facilities for storage (planned for more than 10 years) of spent nuclear fuel or radioactive waste in a place other than the place of production“.
A. BASIC DATA

I. BASIC DATA ON THE PROPOSER

I.1. NAME

Jadrová a vyradovacia spoločnosť, a.s.

I.2. ID NUMBER

Comp. ID No.: 35 946 024

I.3. REGISTERED OFFICE

Tomášikova 22
821 02 Bratislava

I.4. PROPOSER'S AUTHORISED REPRESENTATIVE

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Address: Jadrová a vyraďovacia spoločnosť, a.s.
Tomášikova 22
821 02 Bratislava
II. BASIC DATA ON THE PROPOSED ACTIVITY

II.1. NAME

Expansion of storage capacity of the interim spent fuel storage facility at Jaslovské Bohunice

II.2. PURPOSE

The purpose of the activity under assessment is to expand the existing storage capacity of spent nuclear fuel for at least 18,600 fuel assemblies. Two stages of storage capacity expansion are planned; during the first stage, the storage capacity will be expanded by at least 10,100 pieces of SF, during the second one, by at least 8,500 pieces of SF.

At present, SF is stored in structure 840M "Interim spent fuel storage facility", which provides "wet storage".

The expansion of spent fuel storage capacity will serve for long-term storage of the SF produced by all nuclear power plants in the Slovak Republic taking into account that pursuant to Article 3 (9) of Act No. 541/2004 Coll. the company JA VYS, a.s. is a legal entity established and authorised by the Ministry of Economy of the Slovak Republic and provides for SF storage pursuant to Article 10 (3) of Act No. 541/2004 Coll., which states:

"In the interest of provision of nuclear safety and prevention of ungrounded accumulation of radioactive wastes and spent nuclear fuel, the licence holder is obliged, during nuclear installation commissioning and operation, to hand over the radioactive wastes, no later than within 12 months from their production, and spent fuel, immediately after the fulfilment of requirements for its safe transport and storage, to the legal entity established in Article 3 (9) for further management."

Spent fuel assemblies can be stored in several ways, which implies the three submitted technological variants:

1. Wet SF storage capacity expansion by expanding the storage capacity of SF storage pools and enlarging the current building of ISFS using the current storage casks KZ-48 for 48 pieces of SF.

2. SF storage capacity expansion using dry storage with the architectural interconnection with the current ISFS building using the transport and storage containers for maximum 84 pieces of SF placed on the hard surface in the storage hall of the SF storage facility.

3. SF storage capacity expansion using dry storage with the architectural interconnection with the current ISFS building using the storage containers (canisters) for maximum 85 pieces of SF placed in the ferro-concrete storage modules of the SF storage facility.
II.3. USER

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

II.4. SITING OF THE PROPOSED ACTIVITY

Region: Trnava
District: Trnava
Municipality: Jaslovské Bohunice
Cadastral territory: Bohunice
Structure No.: 840M
Parcel No.: Zero Variant

Variant No. 1
701/50 – hall
701/51 – interim spent fuel storage facility

Variant No. 2
701/9 – built-up area and courtyard
701/46 – built-up area and courtyard
701/87 – built-up area and courtyard

Variant No. 3
701/9 – built-up area and courtyard
701/46 – built-up area and courtyard
701/87 – built-up area and courtyard

Spent nuclear fuel storage capacity expansion for all the assumed variants is proposed at the site Jaslovské Bohunice with the interconnection with the existing ISFS building as part of the nuclear installation "Interim spent fuel storage facility".

The mentioned parcels are owned by the Proposer, registered as built-up areas and courtyards, out of the built-up territory of the municipality.
II.5. GENERAL LAYOUT OF THE SITING OF THE PROPOSED ACTIVITY

II.6. THE REASON FOR SITING AT THE PROPOSED SITE

In compliance with the Atomic Act in force, JAVYS, a.s. holds the licence for the transport and storage of the SF produced in the Slovak Republic. It operates a wet interim SF storage facility with a capacity of 14,112 fuel assemblies. At present, about 80% of the storage facility are full. The free storage capacity will be sufficient approximately till 2022. JAVYS, a.s. is responsible not only for the storage of fuel assemblies from the shut down units of the V1 NPP (5143 fuel assemblies), it also provides for the storage of the SF owned by the company SE, a.s. operating the nuclear units in the Slovak Republic. To ensure the operation of all nuclear units in the Slovak Republic and taking into account the construction of a new nuclear source that is under preparation at Jaslovské Bohunice, the ISFS storage capacity needs to be expanded. Moreover, the reason for the siting of the proposed variants is that the selected site:

- allows to use the infrastructure, utility networks and services (e.g. the source of electric energy, water, inputs etc.) available at the site;
has been recently assessed several times in terms of safety and environmental impacts, i.e. geology, ground bearing capacity, topography, hydrology, external climatic influences (earthquakes, floods, wind, rain, snow, ice) and civil aspects, including accessibility and possibility of occurrence of consequences of various external emergency events,

provides for the storage of SF in the Slovak Republic already now.

Moreover, the advantages of the site solution at Jaslovské Bohunice include the utilisation of the synergistic effect of stock relocation from the wet to the dry interim storage facility and the subsequent wet storage of the SF produced by units’ operation after partial heat removal in the SFSP. Till the end of operation of the wet interim storage facility, the fuel from the storage pools will be gradually relocated to the dry interim SF storage facility. In terms of strategy and security, the fuel would be concentrated at one site before it is finally disposed, for example, in a deep repository or by reworking.

Relevant factors for the site of Jaslovské Bohunice also include the planned construction of a new nuclear source with a planned power of max. 2400 MW of electric energy.

### II.7. DATE OF BEGINNING AND COMPLETION OF CONSTRUCTION AND OPERATION OF THE PROPOSED ACTIVITY

| Expected date of construction commencement: | 03/2018 |
| Expected date of construction completion:   | 03/2020 |
| Expected date of operation commencement:    | 01/2021 |
| Expected date of operation end:             | 2121    |

### II.8. BRIEF DESCRIPTION OF TECHNICAL AND TECHNOLOGICAL SOLUTION

The proposed activity is submitted for assessment in one site variant, zero variant and in three technological variants:

- **Site variant:** JAVYS, a.s. Jaslovské Bohunice
- **Variant No. 0:** SF wet storage in the existing ISFS (structure 840M).
- **Variant No. 1:** Expansion of SF wet storage capacity by building four additional pools with the use of storage casks KZ-48.
- **Variant No. 2:** SF storage capacity expansion using dry storage with the architectural interconnection with the current ISFS building using the transport and storage containers for maximum 84 pieces of SF placed on the hard surface in the storage hall of the SF storage facility.
- **Variant No. 3:** SF storage capacity expansion using dry storage with the architectural interconnection with the current ISFS building using the storage containers (canisters) for maximum 85 pieces of SF placed in the ferro-concrete storage modules of the SF storage facility.
II.9. VARIANTS OF THE PROPOSED ACTIVITY

**Variant No.0 - Zero Variant**

It is defined as the condition resulting from non-execution of the activity. The nuclear installation "Interim spent fuel storage facility" was built in 1983-1987 on the basis of the building permit with Ref. No. Výst.164/83 dated 1 March 1983 and commissioned based on the certificate of occupancy with Ref. No. Výst. 235/88-Va dated 22 February 1988 as the so-called "wet storage facility" for spent nuclear fuel. It is storage of the spent fuel assemblies in the casks in the water pools with a relatively low volume utilisation of the pools where water as a storage medium provides for the residual heat removal and also acts as shielding against radioactive radiation. Wet storage is a method of SF storage verified in the long term in most countries with nuclear programmes. The main advantage of wet storage systems is the fact that the stored fuel is easily accessible and controllable. A relatively large quantity of fuel can be stored in storage pools at the same time. The water environment allows better heat removal in view of a higher heat conductivity of water in comparison with the air.

In 1997-2000, the project of "Seismic retrofitting and expansion of the ISFS storage capacity" was implemented. This activity was assessed pursuant to Act No. 127/1994 Coll. and the Ministry of Environment of the Slovak Republic issued its final opinion dated 19 February 1997. The building permit for reconstruction was issued under Ref. No. KÚ-OŽP-2/03349/97/Ec-A on 29 October 1997. After the execution of the reconstruction, the operating licence was issued for the reconstructed ISFS – Decision of the NRA SR No. 152/2000 dated 30 November 2000, which was valid till 31 December 2010. Another permit for operation continuation was issued by Decision of the NRA SR No. 444/2010 dated 9 December 2010 on the basis of the periodical assessment of nuclear safety, which is valid till 31 December 2020.

The ISFS is a detached building on the premises of JAVYS, a.s. at the site Bohunice. The building is entered and exited through the access to controlled area, the ISFS rooms have a character of controlled area. According to the degree of radiation situation, they are divided into service, periodic-service and non-service areas.

As regards technology, the ISFS building is divided to two parts: the container and the storage part. The container part consists of the container hall serving for container handling, decontamination and tests and of the siding corridor for container unloading and loading to transport railway carriages. Fuel is transported from the storage pool from the reactor hall to the ISFS in the cask placed in the TK C-30 type container. The container is transported by a special railway carriage.

The storage part consists of four storage pools with the dimensions 23.4 x 8.4 x 7.2m. One pool is a spare one in case that it is necessary to remove the fuel from the permanently filled pools. The storage pools are mutually interconnected by a transport corridor. The pool bottom is at a level of ±0.000m, the pool covering is at a level of +7.200m. The level of cooling water is permanently maintained at a level of +6.300m. The casks are transported at a max. height of 600mm above the bottom of the transport pool and storage pools. The technical solution of SF storage is executed so that the spent fuel assemblies are stored under the water surface in the storage pools in vertical position in the storage cask T-12, KZ-48 or T-13. The storage casks are designed in a way as to ensure the subcriticality of the stored fuel and integrity of the fuel assemblies in case of an earthquake. The spent fuel is shielded by the water surrounding the fuel assemblies and the concrete walls of the pools. Water ensures residual heat removal from the spent fuel and along with the concrete walls, it also provides a sufficient biological protection against radioactive radiation. The T-12 or KZ-48 casks for the intact fuel assemblies and the T-13 casks for the untight fuel assemblies placed in hermetic boxes are used for storage. In each storage pool, 98 KZ-48 type compact casks can
be stored (in 14 rows with seven casks in each of them), each cask can contain 48 fuel assemblies. The walls have double lining. The internal lining, which is contact with the medium, is made of stainless steel, the outer lining is made of carbon steel. The pools and other devices with pool water have been tight for the entire period of current ISFS operation, no leaks have been observed. The maximum designed ISFS storage capacity after the reconstruction and seismic retrofitting is 14,112 fuel assemblies. At present about 80% of the wet ISFS are full, the free storage capacity will be sufficient approximately till 2022.

The ISFS structure has its own cooling and treatment station. The cooling station is operated according to the need of pool water cooling and temperature maintaining within the required values. The treatment station serves to maintain the necessary quality parameters of pool water by means of mechanical filtration and ion exchange. The radiation monitoring system ensures radiation situation monitoring inside the ISFS and in its surroundings and the monitoring of personnel’s individual doses.

The air-conditioning systems provide for the ventilation and air-conditioning of the ISFS rooms in order to fulfil the conditions for operators in terms of radiation safety as well as in terms of suitable working conditions for the personnel. The ventilation stack of the ISFS is 35 m high. Four filtration stations are available for the filtration of the air exhausted by the ventilation systems from Ra-aerosols, the stations are connected as needed to form a route for various air flows.

In handling the spent fuel, the task of exhaust ventilation systems is to prevent activity leakage in other way than through the aerosol filters. The monitoring of released activity in the ventilation stack takes place continuously.

**Fig. No. 1: Storage hall of the existing wet ISFS**
Fig. No. 2: Diagram of the container and storage part of the existing ISFS (floor +7.2 m)

Fig. No. 3: SF in the KZ-48 compact casks
The zero variant represents the preservation of the actual state, i.e. the storage capacity of the existing ISFS will not be expanded. Act No. 143/2013 Coll., Article (9) states that: "Radioactive wastes or spent nuclear fuel may be disposed on the basis of a permit from the Authority only by a legal entity founded, established or authorised by the Ministry of Economy of the Slovak Republic". The legal entity according to the first sentence must hold a licence for repository operation and the Slovak Republic must hold a 100% ownership interest in the entity and, at the same time, the entity must not hold a licence for nuclear installation operation pursuant to Article 2 (f) of the first item" and Article 10 (3) states that: "In the interest of provision of nuclear safety and prevention of ungrounded accumulation of radioactive wastes and spent nuclear fuel, the licence holder is obliged, during nuclear installation commissioning and operation, to hand over the radioactive wastes, no later than within 12 months from their production, and spent fuel, immediately after the fulfilment of requirements for its safe transport and storage, to the legal entity established in Article 3 (9) for further management" (in the conditions of the Slovak Republic, the legal entity is JA VYS, a.s.), it is obvious that in case of a failure to provide a storage capacity for spent nuclear fuel, after the exhaustion of the storage capacity of the existing ISFS, all the Slovakia's nuclear power plants in operation will have to be shut down. The ISFS's capacity at Jaslovské Bohunice is sufficient approximately till 2022.

**Variant No. 1: Expansion of SF wet storage capacity by building four additional pools with the use of storage casks KZ-48**

The technical solution consists in the expansion of the storage capacity of the existing wet storage facility in the ISFS at Jaslovské Bohunice operated by JA VYS, a.s. The expansion of the storage capacity for SF in the Slovak Republic is requested in two stages. In the first stage, the storage of 10,100 fuel assemblies is requested, and in the second stage, the storage capacity should be expanded by additional 8,500 fuel assemblies. In case of wet expansion of the interim SF storage facility, both stages would have to be executed in one building step so that no division to further dilatation units would occur. It would be very difficult to seal the units and ensure uniform settlement. Therefore, it would be necessary to execute one unit for the storage of 18,600 fuel assemblies. To ensure the system's synergy with the original solution, it is expected that the fuel will be stored in the pools in the KZ-48 compact casks with 48 fuel assemblies each. Therefore, there is a need to build four new pools for 388 pieces of KZ-48 casks.

The above solution has the following consequences:

- an increase in the cooling capacity corresponding to four new pools with a requested 100% backup;
- requirements for a modification of the existing technological systems, changes of technological modes and operating checks;
- prior to the beginning of construction, during the construction and after the completion, it is necessary to perform extended monitoring of settlement and inclination of crane tracks and based on the performed measurements, to take measures against excessive settlement;
- during the capacity expansion process, to keep the present concept of the pools with the expanded organised collection of leakage from the lining in the intermediate space;
• to perform the analysis and expansion of the ventilation system in the proposed annex building of the ISFS (pools + rooms) and to perform a modification of the existing ventilation systems;
• an expansion of the crane track and equipping the ISFS cranes for the operation of the newly constructed part of the interim storage facility.

The advantages of this variant include in particular a smaller storage area, easier accessibility and check of the state of the fuel assemblies. The disadvantages include in particular considerable demands of the building expansion of the pools (maintaining the tightness, resistance and uniform settlement of the structures) and the expansion of the technological systems and transport technology.

*Fig. No. 4: Diagram of the container and storage part of the ISFS (floor +7.2 m) with four additional pools*

**Variant No. 2: SF storage capacity expansion using dry storage with the architectural interconnection with the current ISFS building using the transport and storage containers for maximum 84 pieces of SF placed on the hard surface in the storage hall of the SF storage facility**

The technical solution consists in the expansion of the storage capacity by building a module of dry storage facility in the ISFS at Jaslovské Bohunice operated by JAVYS, a.s. The expansion of the storage capacity for SF in the Slovak Republic is requested in two stages. In the first stage, the storage of 10,100 fuel assemblies is requested, and in the second stage, the storage capacity should be expanded by additional 8,500 fuel assemblies. This variant considers the direct insertion of spent fuel at the reactor unit to a dry type transport and storage packaging set. The fuel assemblies are stored in the dry inert atmosphere. This concept of SF storage solution requires a modification of the affected technology at all units in operation at nuclear power plants in the Slovak Republic. To provide for SF handling, transport and storage in the Slovak Republic, a suitable transport and storage container must be approved according to the valid Atomic Act for the currently used VVER-440 type fuel with a perspective of its approval also for the fuel enriched in $^{235}$U (up to 5%).
The following technological systems will be required for the storage facility operation:

- auxiliary and energy sources and systems (for the case of sudden power supply failure and failure of auxiliary systems);
- the system of monitoring (of the tightness of container's internal spaces, of the temperature of the outer casing);
- systems for decontamination, maintenance and repairs of the containers (for the prescribed checks of packaging sets, monitoring system, removal of dust from the surface of the containers etc.);
- ventilation system (intended for the limitation of the possibility of radionuclide leakage to the environment and residual heat removal);
- control and instrumentation systems;
- fire protection system;
- waste management system;
- systems of environment and people monitoring (radiation monitoring).

The fuel will be inserted into the containers:

- in the main reactor building in the container shaft near the spent fuel storage pool in the reactor building of the respective unit of the nuclear power plant. The containers will be decontaminated in the main reactor building in the decontamination shaft. The containers will be transported from the reactor building to the storage facility by a railway carriage.
- in the wet part of the ISFS in the receiving pool. The containers will be decontaminated in the decontamination shaft of the ISFS. The containers will be transported from the area of the wet part of the ISFS to the dry part of the ISFS through a building interconnection.

In the receiving area of the ISFS, the container will be lifted by a crane from the transport means and placed into the preparatory zone in a vertical position. After the performance of the required checks and manipulations, the container will be transported to its storage position in the area and connected to the system monitoring the gas pressure in the container (check of container's tightness).

The containers with SF will be stored in the building, whose primary function will be to protect the containers against weather impacts. The building's design must also enable passive heat removal from the surface of the transport containers. Additional biological shielding will be a secondary but not necessary function. The interim storage facility building will be equipped with necessary handling means. The heat released from the stored SF will be removed from the containers by natural ventilation.

The building of the interim storage facility will consist of the technical zone, receiving area and storage area. The technical zone will consist of the entrance hall, changing rooms and sanitary rooms, electrical switchgear and storage room. The room for the storage of transport means will also be situated here. The receiving area will consist of the zone for the storage of empty containers and the zone for the preparation and check of the containers. The receiving area will be dimensioned for receiving the railway carriages able to transport the container. The crane parking position will be situated in the receiving area.

The fuel will be placed in the fuel basket made of premium boron steel providing for the fuel subcriticality. The container will be protected against the leakage of radioactive substances by a
double sealing system. The structural material of the container will provide for the shielding of ionising radiation.

The container will consist of the following components:
- storage basket (cask);
- the vessel of the container;
- shielding against gamma radiation and neutron radiation;
- surface treatment of the container against weather impacts;
- connection lines for the monitoring systems;
- the system of pins and clips for packaging set handling.

The advantages of using the transport and storage containers include lower initial investment costs taking into account lower demands of the civil structure of the interim storage facility. However, the gradual purchase of packaging sets according to the requirements resulting from SF production represents higher financial demands.

The main disadvantages include the price and requirements of the currently valid Atomic Act for periodical approval of the transport equipment type.

*Fig. No. 5: Transport and storage container for VVER-440 type SF*
Fig. No. 6: Hall of storage of transport and storage containers

Variant No. 3: SF storage capacity expansion using dry storage with the architectural interconnection with the current ISFS building using the storage containers (canisters) for maximum 85 pieces of SF placed in the ferro-concrete storage modules of the SF storage facility

The technical solution consists in the expansion of the storage capacity by building a module of dry storage facility in the ISFS at Jaslovské Bohunice operated by JAVYS, a.s.

The expansion of the storage capacity for SF in the Slovak Republic is requested in two stages. In the first stage, the storage of 10,100 fuel assemblies is requested, and in the second stage, the storage capacity should be expanded by additional 8,500 fuel assemblies.

This variant solution considers the siting of the dry interim SF storage facility building behind the existing structure of the interim spent fuel storage facility (structure 840M), on the south-eastern side. The structure of the dry interim storage facility will be interconnected with the existing ISFS by a connecting corridor leading to the operating part and it will create one closed structure. The architecture of the storage part of the wet storage facility will not be affected. The technical solution of the dry storage facility will be executed in the form of building interconnection with the existing civil structure of the ISFS. By modifying the existing and supplementing the new transport corridor, another technical zone will be added, i.e. the receiving area and the storage area of the dry storage facility.

The interim storage facility building is interconnected with other facilities at the site by means of internal roads and a railway siding. Electric energy will be supplied from the existing facilities. The structure will be connected to the fire-fighting water circuits on the premises of JAVYS, a.s. In the technical zone, a zone with a storage space for packaging sets for the purpose of check and maintenance will be created.

The receiving area is intended for the handling equipment, which is designed for packaging sets handling in the transport corridor. The crane parking position is situated in this area.
The SF produced by NPP operation should be transported in compliance with the transport conditions for TK C-30 and stored using the wet method in the ISFS at Jaslovské Bohunice. SF storage in the ISFS storage pools will ensure active cooling needed for the fuel with high burn-up and initial enrichment. After a sufficient cooling period, it will be possible to provide for effectively its long-term storage using the dry method and passive cooling system. The storage capacity of the wet interim storage facility will be gradually vacated by relocating the oldest stored SF from the stock of the existing ISFS after the fulfilment of the limit parameters for the canisters for dry fuel storage. All manipulations and activities related to fuel relocation to dry storage will be carried out in the structure of the existing wet storage facility. The necessary technology will be delivered for that purpose. It will be designed in a way as to not affect the activities of wet storage carried out at the same time. For that reason, only the technical solutions conforming to the dimensions, design and layout of the receiving and relocating pool of the ISFS, as well as to the parameters of the handling and transport devices, are considered.

The dry storage system in civil structures (the "vault" system) is considered as an underground ferro-concrete cell-type structure. Heat will be removed by means of natural air circulation through the input and output inner walls of the cells and the ventilation stack. Shielding will be provided by the design of the storage cell itself. Each storage cell will contain several metal canisters containing the stored SF. The vertical metal canisters will be placed in concrete modules on beds adapted for cooling air circulation preventing the cumulation of precipitated water, if any. The upper part of the canisters will be equipped with a massive plug embedded in the upper vault structure, which will be designed in a way as to be resistant to the load during the insertion of the canister into the cell as well as in case of a heavy object fall into the storage space. The canister will be a cylindrical steel vessel with the internals consisting of absorption boxes of the same design as for the compact casks with a
defined number of fuel assemblies. The absorption boxes will provide for both the fixation of fuel assemblies and subcriticality of the stored fuel. The fuel assemblies will be stored in the dry inert atmosphere and the canister must provide for the following main functions:
- safe retention of radioactive substances;
- provision of subcriticality of the stored fuel;
- provision of fuel cooling and residual heat removal;

*Figure No. 8: Storage canister for VVER-440 type SF*

Main advantages of this solution include in particular the utilisation of the existing operated systems of the ISFS and experienced service personnel, relatively low demands for the size of the storage area, which consist in particular in the utilisation of the self-shielding ability, when fuel is stored in a vault chamber. Equally with all solutions on the basis of canisters, in this case too, only a minimum number of transport packagings to be approved pursuant to the valid Atomic Act is necessary.

As regards architecture, the advantages include the building interconnection of the wet and dry parts of storage allowing different settlement of the buildings; in terms of seismic resistance, the advantages include the fact that the hall for dry storage has a simple structure, partially embedded into the terrain, and it contains no complex technological devices. The disadvantages include more complicated canister handling, placing the canisters into the shielding cylinder and placing the canisters into the underground cell.
Fig. No. 9: Section of the SF storage structure in civil structures (the "vault" system)

Fig. No. 10: Placement of the canisters with SF in a ferro-concrete storage module
II.10. TOTAL INFORMATIVE COSTS

The informative costs of the expansion of SF storage capacities at Jaslovské Bohunice were determined on the basis of a feasibility study, which contained the preparation and evaluation of variants for building and technical, technological and economic solutions of the expansion of SF storage capacities. The informative costs are priced on the basis of a calculation using the surrounded space with the average budget price index to the specific and purpose units of budget indices of civil structures for 2014. The costs include the survey and design work, elementary systems, civil structures, budget reserve, secondary budget costs and costs covered by non-capital costs.

For **Variant 1** – expansion of the existing ISFS and utilisation of KZ 48 compact casks for wet storage, the informative costs amount to €15,566,759.00.

For **Variant 2** – building interconnection of the dry storage facility with the existing ISFS, using the transport and storage containers placed on the hard surface in the storage hall of the SF storage facility, the informative costs amount to €49,317,692.00.

For **Variant 3** - building interconnection of the dry storage facility with the existing ISFS, using the canister for the relocation of fuel assemblies, the informative costs amount to €45,887,990.00.

*Note: The difference between the informative costs of Variant No. 1 and Variants No. 2 and 3 is caused by the fact that two stages of dry storage facility execution are expected, where the second stage of construction will be carried out after 2040 and the annual inflation amounting to 1% is taken into account in the estimated costs.*

II.11. AFFECTED MUNICIPALITY

The municipalities situated in the territory defined for the needs of this report as affected:

Trnava District: Jaslovské Bohunice, Radošovce, Malženice, Dolné Dubové
Piešťany District: Veľké Kostoľany, Pečeňady, Nižná
Hlohovec District: Ratkovce, Žlkovce

II.12. AFFECTED SELF-GOVERNING REGION

Trnava self-governing region

II.13. AFFECTED AUTHORITIES

Trnava District Office
Piešťany District Office
Hlohovec District Office
Regional Fire and Rescue Corps Directorate Trnava
II.14. PERMITTING AUTHORITY

Nuclear Regulatory Authority of the Slovak Republic
Public Health Authority of the Slovak Republic

II.15. DEPARTMENTAL BODY

Ministry of Economy of the Slovak Republic

II.16 TYPE OF REQUIRED PERMIT FOR THE PROPOSED ACTIVITY
PURSUANT TO SPECIAL REGULATIONS

The respective approvals and permits pursuant to Article 54 of Act No. 50/1976 Coll. on land-use planning and building rules as amended:
- building permit (permit for a change of nuclear installation building),

The respective approvals and permits of Article 5 of Act No. 541/2004 Coll. on peaceful use of nuclear energy (Atomic Act) and on the amendment to certain acts as amended:
- permit for a change of nuclear installation,
- nuclear installation commissioning licence,
- nuclear installation operating licence.

The respective permit pursuant to Article 45 of Act No. 355/2007 Coll. on public health protection, support and development and on the amendment to certain acts
- decision on the proposal for nuclear installation siting and construction pursuant to Article 13
- approval of a building and technological change in accordance with Article 13

II.17. STATEMENT ON THE CROSS-BORDER IMPACTS OF THE PROPOSED ACTIVITY

In accordance with Article 40 (1) (b) of Act of the National Council of the Slovak Republic No. 24/2006 Coll. on environmental impact assessment, the subject of the cross-border impact assessment includes the activities proposed in the territory of the Slovak Republic listed in Annex No. 13 or the proposed activities listed in Annex No. 8, which can have serious cross-border environmental impacts.
In accordance with Item No.3 of Annex No. 13, the assessment shall include the "Facilities intended exclusively for nuclear fuel production or enrichment, for spent fuel reworking or storage, as well as for radioactive waste disposal and treatment."

Taking into account the purpose of the activity under assessment, i.e. SF storage, and on the basis of the decision of the Ministry of Environment of the Slovak Republic, the activity was notified to the Points of Contact of the ESPOO Convention of the countries bordering the Slovak Republic. The Republic of Poland, Hungary and the Republic of Austria have confirmed their interest in participating in the cross-border assessment of the activity's environmental impacts.

Despite the fact that the SF storage technologies under assessment will be the source of only minimum impacts affecting limited areas in the close surroundings of the activity's location (see II.4.), in accordance with Act of the National Council of the Slovak Republic No. 24/2006 Coll. on environmental impact assessment, the activity is subject to international assessment. However, in this context it must be stated that the current operation of SF wet storage in the structure 840M (nuclear installation "Interim spent fuel storage facility") is, along with the other nuclear installations operated by JAVYS, a.s. at the site Jaslovské Bohunice, evaluated as stable and reliable with a negligible radiological impact on the environment assessed by the programme ESTE AI, approved by the supervisory authority in the area of radiation protection.

The data on the outputs to the environment during the operation of individual variants of the proposed expansion of SF storage capacities show that the authorised limits set for the current operations of the NIs RAW TCT, A1 NPP, ISFS, and V1 NPP will not be exceeded. The limits for radioactive substance releasing into the air and waters from nuclear installations of JAVYS, a.s. are set so that the effective dose of a representative person from the population does not exceed a limit of 32µSv. It means that the radiation load on the population in the surroundings (on the boundary of the protection zone and thus also at a distance exceeding 40 km) will be non-significant.

There are three neighbouring countries in the surroundings of the NI Bohunice inside the circle with a radius of 100 km:
- Czech Republic - at a distance of approximately 40 km to the N and NNW
- Austria - at a distance of approximately 75 km to the W, WSW and SW
- Hungary - at a distance of approximately 75 km to the SSW, S and SSE.

As regards the influence of discharges - for 2013, the maximum individual effective dose of a representative person from the affected population for all Proposer's installations at this site (to a distance of 5 km) was calculated at a level of $2.20 \times 10^{-8}$ Sv, which represents 0.069 % of the annual limit.

Thus, based on the above brief summary of the conclusions of environmental impact assessment it can be stated that no negative cross-border impacts are expected for the respective activity.
B. DATA ON THE DIRECT IMPACTS OF THE PROPOSED ACTIVITY ON THE ENVIRONMENT INCLUDING HEALTH

I. REQUIREMENTS FOR INPUTS

I.1. LAND

Zero variant:

The zero variant does not consider any expansion of SF storage capacities and for the mentioned purpose, the existing technology of the NI ISFS as a detached building on the premises of JAVYS, a.s. with the following parameters will serve:

Basic data on the structure:
- Built-up area: 3255 m², 45x70 m
- Total surrounded space: 96,000 m³
- Useable area: 7549 m²
- Flooring: 8298 m²
- Max. height of the structure: 30.5 m
- Ventilation stack height: 35 m

No requirements for further land occupation will come into existence in case of the Zero Variant.

Variant No. 1, 2, 3:

For all the three variants, taking into account the possibility of building interconnection with the existing ISFS at Jaslovské Bohunice, the use of the existing receipt hall of the storage facility and its technological equipment and system of water supply and sewerage necessary for the operation of the storage facility (access to the control area with the changing rooms and sanitary facilities, offices and control room for radiation monitoring) is considered.

The needed size of built-up area for the solved variants is included in the following table:

<table>
<thead>
<tr>
<th>Variant designation</th>
<th>Stage I (m²)</th>
<th>Stage II (m²)</th>
<th>Total capacity (pcs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variant No. 1</td>
<td>1060</td>
<td>-</td>
<td>18,816</td>
</tr>
<tr>
<td>Variant No. 2</td>
<td>2,760</td>
<td>1698</td>
<td>18,816</td>
</tr>
<tr>
<td>Variant No. 3</td>
<td>3,319</td>
<td>2,042</td>
<td>18,870</td>
</tr>
</tbody>
</table>

Table No. B. I.1/01
Variant No. 1

The ISFS can be expanded by building additional pools in the direction of the storage hall. With the connection to the existing building structure including the crane tracks.

Built-up area: 1060 m² for the annex building of Stage I and II
Surrounded space: 41,339 m³ for the annex building of Stage I and II
Built-up area: 0 m² for the connecting corridor
Surrounded space: 0 m³ for the connecting corridor

Fig. No. 11: Location of the wet storage area expansion

Variant No. 2

SF storage capacity expansion using dry storage with the architectural interconnection with the current ISFS building using the transport and storage containers for maximum 84 pieces of SF placed on the hard surface in the storage hall of the SF storage facility.

With this variant, it will be also necessary to build a new railway siding about 260 m long. A new rail switch would be added to the existing area siding, which would lead the new siding route to the dry interim storage facility. Specification of size of the storage area is based on the dimensions of the packaging sets. The following size of built-up area is required for the requested capacity of the storage facility in individual stages of construction:

Built-up area: 2,760 m² for Stage I
Surrounded space: 56,113 m³ for Stage I
Built-up area: 1,698 m² for Stage II
Surrounded space: 33,743 m³ for Stage II
Built-up area: 766 m² for the connecting corridor
Surrounded space: 7,845 m³ for the connecting corridor

**Fig. No. 12: Location of the dry storage area expansion (Variant No.2)**

**Variant No. 3**

SF storage capacity expansion using dry storage with the architectural interconnection with the current ISFS building using the storage containers (canisters) for maximum 85 pieces of SF placed in the ferro-concrete storage modules of the SF storage facility

Built-up area: 3,319 m² for Stage I
Surrounded space: 66,127 m³ for Stage I
Built-up area: 2,042 m² for Stage II
Surrounded space: 40,684 m³ for Stage II
Built-up area: 766 m² for the connecting corridor
Surrounded space: 7,845 m³ for the connecting corridor
Fig. No. 13: Location of the dry storage area expansion (Variant No.3)

I.2. WATER

Drinking water

Zero variant:

During the operation of the current ISFS structure, drinking water consumption is related only to the needs of employees for drinking and hygiene. Drinking water supplies to employees on the premises of the Proposer's company are provided through the drinking water distribution systems owned by the Proposer. With the Zero Variant, no increase in the number of employees is expected, thus, the drinking water consumption would not change considerably.

The average consumption of drinking water in the ISFS amounts to 0.3 L/s, the maximum consumption amounts to 1.1 L/s. In 2013, the total drinking water consumption in the structure amounted to 443 m$^3$.

Variant No. 1, 2, 3:

As the drinking water consumption is only related to the needs of the employees for drinking and hygiene purposes and it is also expected that the current number of employees will remain the same, to meet the hygienic requirements it will not be necessary to increase the drinking water consumption in comparison with the Zero Variant.
Fire-fighting water

Zero variant:

The existing fire-fighting system is connected to the existing fire hydrants in the structure connected to the fire-fighting water supply system on the premises. The maximum amount of water needed for internal fire protection of the structure ISFS amounts to 16.7 L/s for the biggest fire section.

Variant No. 1, 2, 3:

The provision of fire-fighting water is sufficient for the needs of the proposed variants of the interim SF storage facility. The consumption of fire-fighting water is calculated according to STN 92 0400. The capacity and pressure conditions of the point of supply are sufficient to solve the required fire protection for all the variants. One wall-mounted hydrant needs Q=0.3 L/s of fire-fighting water. Fire-fighting water point of supply will be on the main piping DN200. The pressure conditions in the network of the fire-fighting water supply line are provided by fire pumps ensuring a head of approx. H=60-90 m; 0.6-0.9 MPa; Q=90 l/s.

Cooling water

Zero variant:

Pool water of the existing ISFS is cooled by the cooling station containing two plate exchangers and pumps providing pool water circulation in the cooling station. The flow of pool water through the cooler depends on the number of cooled pools, it ranges from 120 to 240 m³/hour. Service cooling water is used for cooling; its sources are as follows:

- NI V1 NPP,
- autonomous cooling circuit in the ISFS structure.

The flow of service cooling water through the cooler is max. 430 +5% m³/hour. In 2013, water consumption amounted to 57,422 m³.

Variant No. 1:

For cooling the fuel in the fully occupied storage pool, the quantity of cooling water about 150 m³/hour is considered. For the additionally built four SF storage pools, it would be necessary to increase the cooling station capacity by about 600 m³/hour.

Variant No. 2, 3:

Cooling water needs are not considered for the mentioned variants.

Demineralised water

Zero variant

Demineralised water is used for wet storage (the storage pools are filled with demineralised water - the volume of water in the pool – 1238 m³), for pool water volume make-up and for the needs of the treatment station for disintegration, regeneration, washing and charging of new filling for pool water.
treatment. If necessary, it is used for the preparation of decontamination solutions for decontamination of rooms, transport equipment etc. The consumption of decontamination solution and demineralised water amounts to 30 L/m² of the pool washing surface. For room decontamination, the consumption of the acid decontamination solution amounts to 2 L/m² of the washing surface, the consumption of demineralised water amounts to 3 L/m².

The design annual demineralised water consumption amounts to about 8400 m³/year. In 2013, water consumption amounted to 6,328 m³.

**Variant No. 1:**

With this variant, the quantity of demineralised water needs increasing, total volume of 4x1238 m³ = 4952 m³ (to fill four storage pools). The design annual consumption with the above variant would increase by about 100% in comparison with the Zero Variant, i.e. to about 16,800 m³/year.

**Variant No. 2, 3:**

Demineralised water needs are not considered for the mentioned variants.

**Heating water**

**Zero variant:**

Heating water is supplied to the ISFS through the hot water connection line by the piping channel from the new exchanger station from structure 562 (Central Heat Supplies JAVYS).

Parameters:
- pressure 1.6 MPa,
- temperature 130 / 90 °C.

Heating water heat supplies:
- hot water heating 180 kW,
- hot service water heating 30 kW,
- air-conditioning including the screen 1549 kW.

Total heat supplied by heating water amounts to 1759 kW. The consumption of heat supplied by heating water in 2013 amounted to 2,970,902 kWh.

**Variant No. 1, 2, 3:**

For the above variants, the consumption of heating water would increase only slightly and the current sources mentioned in the Zero Variant will be sufficient.

**Steam**

**Zero variant:**
Steam for the ISFS needs is supplied through the DN 80 piping from the main steam route among the V1 NPP, V2 NPP, A1 NPP by the piping channel within the elementary subsystem DPS M4.01 and through the reducing station it is distributed in the ISFS structure. Max. steam consumption amounts to about 150 t/year, it is used as necessary by DPS M2.03-R.

In 2013, no steam was used for the needs of the ISFS.

**Variant No. 1, 2, 3:**

No increase in steam consumption is considered for the mentioned variants.

**Cooled water**

**Zero variant:**

Cooled water with the operating parameters 6/12 °C serves as a cooling medium for the coolers of intake and circulating units of ISFS air-conditioning. It is supplied to the structure through the DN 80 piping by the piping channel from the V1 NPP source and it is distributed in the ISFS structure. Consumption of cold supplied by the cooled water amounts to 455 kW.

**Variant No. 1:**

With this variant, the cooled water consumption would increase only slightly.

**Variant No. 2, 3:**

No increase in cooled water consumption is considered for the mentioned variants.

**I.3. RAW MATERIALS**

**Packaging sets**

**Zero variant:**

In 1997, the reconstruction of the ISFS started, providing seismic retrofitting and increase in the storage capacity of the original building, based on the building permit issued on 29 October 1997 under No. KU-ŐZP-2/03349/97/Ec-A. The change of storage way in the pools increased the capacity to 14,112 pieces of fuel assemblies (1694 t of SF). Fuel assemblies are stored in compact casks for 48 fuel assemblies, total in 294 compact casks, 98 pieces in one storage pool.

**Variant No. 1:**

The use of KZ-48 storage casks for 48 SF pieces placed in the additionally built storage pools of the SF storage facility.

For the considered variant of interim SF storage facility expansion, to fill the whole storage capacity for Stage I and Stage II, 392 KZ-48 storage casks with one cask capacity of 48 fuel assemblies would have to be supplied. Thus, total 18,816 fuel assemblies could be stored.
Variant No. 2:

The use of transport and storage containers for maximum 84 pieces of SF placed on the hard surface in the storage hall of the SF storage facility. 
The variant considers a storage facility with a total capacity for Stage I: 8x16 = 128 containers, 84 fuel assemblies each – during Stage I it will be possible to store total 10,752 fuel assemblies. If the interim storage facility is full, it will be possible to expand it with additional storage areas. In Stage II, it would be possible to store 6x16=96 containers, 96 x 84 = 8064 fuel assemblies. Thus, total 10,752+ 8064 = 18,816 fuel assemblies could be stored.

Variant No. 3:

The use of storage containers (canisters) for maximum 85 SF pieces placed in ferro-concrete storage modules of the SF storage facility.
For the considered variant of the dry interim SF storage facility, to fill the whole capacity, it would be necessary to supply for Stage I, 120 packaging sets with a capacity of 85 fuel assemblies and for Stage II, 102 packaging sets. Total, for the both stages it would be necessary to supply 222 packaging sets with a capacity of 85 fuel assemblies for one set. Thus, total 10,200+ 8670 = 18,870 fuel assemblies could be stored.

I.4. ENERGY SOURCES

Electric energy

Zero variant:

Electric energy supplies are necessary for drives operation and support activities, such as control systems, air-conditioning, lighting, monitoring etc. The ISFS is supplied by two supplies from the 6KV in-plant consumption switchboards from two independent sources. The total installed capacity supplied from 6/0.4 kV transformers - 1669.84 kW. In 2013, the consumption amounted to 767,904 kWh. For the case of blackout in the ISFS and for the case of a seismic event, a diesel generator is installed at the entrance to the ISFS building on a separate seismically resistant concrete foundation to provide for the operation of the most necessary technologies ensuring the conditions for safe spent fuel storage. The power of the diesel generator is 350kW and it is connected to both sections of the 9CA section switchboard.

Variant No. 1:

To provide for the operation of the electrical equipment in the structure of the Interim Spent Fuel Storage Facility, i.e. lighting, connection of single-phase and three-phase appliances necessary for operation and maintenance, air-conditioning and technological equipment, the current installed capacity mentioned in the Zero Variant is sufficient.

Variant No. 2,3:
To provide for the operation of the electrical equipment for the mentioned variants, i.e. lighting, connection of single-phase and three-phase appliances necessary for operation and maintenance, and technological equipment, the current installed capacity mentioned in Variant 0 is sufficient.

**Compressed air and nitrogen**

**Zero variant:**

For the needs of the elementary systems PS M 1-R, PS M2-R and PS M 3, compressed air and nitrogen are supplied to the ISFS. Compressed air is supplied to the ISFS by two compressors 9TP40D01 and 9TP40D02, each with a capacity of 189 m$^3$/h. In nominal operation, one compressor is running, it is selected as the working one. The compressed air consumption (0.85 MPa) varies depending on the quantity of technological operations under way. Nitrogen is supplied from the nitrogen reducing station. Nitrogen is supplied from working bundles, i.e. the cylinder pressure module. The nitrogen reducing station is in automatic operation. The nitrogen consumption in the ISFS amounts to about 500 m$^3$/year.

**Variant No. 1, 2, 3:**

For the mentioned variants, the consumption of the above media will increase only slightly and the currents sources will be sufficient.

**I.5. DEMANDS FOR TRANSPORT AND OTHER INFRASTRUCTURE**

**Zero variant:**

For the operation of the nuclear installations, the road connection of the NI premises at Jaslovské Bohunice is solved from two directions – through Jaslovské Bohunice to Trnava, and through the municipality Žlkovce to the Class I road Bratislava – Trenčín. The connection with the railway track is solved as an independent siding 8.1 km long, which was originally built for the needs of the A1 NPP and today, it serves for the whole premises. The siding is connected to the railway track in the direction Piešťany – Trnava – Bratislava and is terminated in the railway station Veľké Kostoľany with a holding track for its operation. Passenger and material freight transport to the Proposer's premises at Jaslovské Bohunice is carried out on the above roads and tracks. In terms of technical infrastructure, the ISFS structure is connected to the existing technical infrastructure of the V1 NPP, e.g. electric energy and steam distribution systems, drinking water supply systems, to the sink water and rainwater sewage system, to the sewerage system removing low-level waste waters to the V1 NPP auxiliary service building. The ISFS is interconnected with the internal roads of the JAVYS, a.s. premises by means of the railway siding and road. The internal roads and tracks of the JAVYS, a.s. premises are connected with the roads specified above. A specially modified C-30 transport container on special railway carriages is used to transport spent fuel assemblies from individual nuclear power plants to the ISFS on the railway siding. For the transportation, the operating regulations and respective regime measures of structure protection also governing the SF transportation are in place.
At present, SF is transported in accordance with the contract of nuclear services provision according to the requirements of SE, a.s. Total four transportations per year are carried out from V2 NPP Units 3 and 4, one transportation per year is carried out from SE-EMO Units 1 and 2. After the commissioning of SE-EMO Units 3 and 4, the current volume of transportations will be increased by one transportation per year.

**Variant No. 1:**

The construction of further SF storage pools will not increase demands for transport or infrastructure, the roads and utility networks of the existing structure 840M will be utilised.

**Variant No. 2:**

The dry part of SF storage of the structure 840M will be connected to the road near the structure and to the newly built railway siding connected to the existing area siding.

**Variant No. 3:**

The construction of another structure will not increase demands for transport or infrastructure, the roads and utility networks of the existing structure No. 840M will be utilised.

**Variant No. 1, 2, 3:**

For all the variants, no higher demands for the current transport loading will come into existence, taking into account that SF is transported based on SF production, or transportation can be carried out only after meeting the requirements for SF transportation from individual power plants in operation at the Mochovce and Jaslovské Bohunice sites and they are carried out by train.

### I.6. MANPOWER DEMANDS

**Zero variant:**

The operation of the existing ISFS is provided by the Department of SF Management having currently 18 employees, and employees of other departments, such as the Department of NI Mechanical Technology and Construction, Department of Chemical Regime Inspection, Department of Radiation Protection and others take part in other activities, such as monitoring, administration, maintenance etc.

**Variant No. 1:**

The operation of SF wet storage in Variant 1 is provided by the same number of employees as for the Zero Variant.

**Variants No. 2, 3:**

To ensure the necessary manpower for Variants 2 and 3, no increase in the number of employees for the operation of the additionally built technological equipment is expected.
II. DATA ON OUTPUTS

As the interim SF storage facility is a non-production structure, this chapter describes in particular the environmental impacts, such as noise, dust, smell, radiation and waste production, which are negligible for all the interim SF storage facility variants under consideration.

Since in all the variants under assessment, it is essentially the same activity with the sources of ionising radiation, their specific outputs are also identical or slightly different. Therefore, this chapter describes the outputs from the proposed activity jointly for all the variants under consideration.

The outputs are described for all the stages of nuclear installation service life, starting from the design and construction, through operation, end of operation and decommissioning.

In case that for the site and technological variants under consideration, different outputs are produced (e.g. liquid waste production), they are pointed out in the respective subchapters, which allows their mutual comparison.

II.1. AIR

II.1.1. POINT SOURCES

Zero variant:

ISFS nuclear installation operation at the site Jaslovske Bohunice is not an air pollution source defined in accordance with the air protection legislation. No pollutants are released into the air during SF storage. The structure rooms are equipped with the air-conditioning system providing cooling or ventilation and hot-air heating of the interior of the structure. The system of ventilation is solved according to the principles and requirements of nuclear safety and it provides for:

- radiation protection conditions by gaseous fluid directional flow in the direction of possible activity increase,
- hygienic, safety and working conditions for the operating staff,
- operating parameters of the ISFS technology,
- removal of gaseous fluid with efficient filtration into the ventilation stack and environment,
- operation of the air-conditioning equipment with an operating reserve, service life and seismic resistance,
- automatic regulation of the set values,
- air-conditioning of selected rooms with permanent operation (control room),
- emergency forced ventilation of protected escape ways in case of fire.

The air-conditioning systems and respective devices are divided to:

- intake ones,
discharge ones,
- circulating ones,
- air-conditioning ones

and they provide the operating parameters – temperatures in the workplaces and ISFS rooms:
- in winter min. + 18/22 °C,
- in summer min. + 26/28 °C.

The gaseous fluid is exhausted from the storage area and the air-conditioning system removes it to the air through the ventilation stack 35 m high. A part of the equipment for clean area ventilation has the exhaust pipe situated directly above the ISFS roof. The total air flow through the ventilation stack is 66,070 to 71,690 m³/h. The removed exhausted gaseous fluid may be contaminated by the radionuclides trapped by high-efficiency HEPA filters. The activity of aerosols is continuously monitored in the ISFS ventilation stack. Permanent air offtake through fixed filters is also provided for the purpose of balance evaluation of the activity of radionuclides in the released air.

According to the decision of the Public Health Authority of the Slovak Republic, the following parameters from ISFS operation are monitored for the purposes of balancing:
- mixture of radionuclides: $^{54}$Mn, $^{57}$Co, $^{60}$Co, $^{65}$Zn, $^{110m}$Ag, $^{134}$Cs, $^{137}$Cs, $^{144}$Ce, $^{51}$Cr, $^{59}$Fe, $^{58}$Co, $^{97}$Zr, $^{103}$Ru, $^{106}$Rh, $^{141}$Ce, $^{124}$Sb, $^{95}$Nb
- 90Sr,
- the radionuclides emitting alpha radiation $^{238}$Pu, $^{239+240}$Pu, $^{241}$Am,
- tritium

The limit is set for a mixture of radionuclides – $3 \times 10^8$ Bq.

In 2013, the values included in the tables were measured for the monitored radionuclides:

<table>
<thead>
<tr>
<th>Aerosols [MBq]</th>
<th>$^{53}$Cr</th>
<th>$^{54}$Mn</th>
<th>$^{59}$Fe</th>
<th>$^{57}$Co</th>
<th>$^{58}$Co</th>
<th>$^{60}$Co</th>
<th>$^{65}$Zn</th>
<th>$^{95}$Nb</th>
<th>$^{99}$Zr</th>
<th>$^{103}$Ru</th>
<th>$^{106}$Rh</th>
<th>$^{110m}$Ag</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharge [kBq]</td>
<td>0.030</td>
<td>0.005</td>
<td>0.010</td>
<td>0.003</td>
<td>0.004</td>
<td>0.029</td>
<td>0.011</td>
<td>0.013</td>
<td>0.007</td>
<td>0.003</td>
<td>0.053</td>
<td>0.005</td>
</tr>
<tr>
<td>% of annual limit</td>
<td>4.90E+08</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Table No. B. H.I.I/01**
The above values prove that ISFS operation's contribution to the environment and population through the gaseous discharges is negligible.

**Variants No. 1, 2, 3 – outputs during the construction:**

During the SF storage facility construction, there is no influence of radiation factors on the population and environment. Construction activities include road traffic of moving trucks, building mechanisms and the use of various building materials. These activities produce noise, vibrations and pollute the air and the environment by the building dust, i.e. dust particles with the size 2.5 -10 µm. The workers near the building site will be temporarily exposed to the influence of dust and exhaust gases from building machines and trucks and to an increased level of noise and vibrations.

During construction harmful emissions and particulate matters and other pollutants will be released into the air due to the use of heavy building mechanisms.

**Table No. B. II.I.I/02: Impacts on the air during constructions**

<table>
<thead>
<tr>
<th>Emissions of building machines</th>
<th>Emissions ( kg)</th>
<th>NO&lt;sub&gt;x&lt;/sub&gt;</th>
<th>N&lt;sub&gt;2&lt;/sub&gt;O</th>
<th>CH&lt;sub&gt;4&lt;/sub&gt;</th>
<th>CO</th>
<th>NMVOC</th>
<th>PM</th>
<th>NH&lt;sub&gt;3&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excavator</td>
<td>3.60</td>
<td>0.09</td>
<td>0.01</td>
<td>0.75</td>
<td>0.33</td>
<td>0.28</td>
<td>0.0005</td>
<td></td>
</tr>
<tr>
<td>Truck</td>
<td>4.32</td>
<td>0.11</td>
<td>0.02</td>
<td>0.90</td>
<td>0.39</td>
<td>0.33</td>
<td>0.0006</td>
<td></td>
</tr>
<tr>
<td>Crane</td>
<td>2.16</td>
<td>0.05</td>
<td>0.01</td>
<td>0.43</td>
<td>0.19</td>
<td>0.16</td>
<td>0.0003</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Exhaust gases concentration (mg/m&lt;sup&gt;3&lt;/sup&gt;)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excavator</td>
</tr>
<tr>
<td>Truck</td>
</tr>
<tr>
<td>Crane</td>
</tr>
</tbody>
</table>
In general it applies that the stage of construction is temporary and has no important impact on the air quality. During the construction of the storage facility, the influence of exhaust gases of building machines and of dust from earthworks on the air will be temporary, short-time and reversible.

**Variants No. 1, 2, 3 – outputs during the operation:**

No air pollution will occur during both wet and dry SF storage. In case of wet storage, the air from the structure will be filtered and released into the air. In case of dry storage, the storage hall structure will be ventilated in the natural way. In addition to fuel assemblies covering, the leakage of radioactive substances into the environment is prevented by the system of SF storage in hermetically closed packaging sets.

**II.1.2. NON-POINT POLLUTION SOURCES**

All the gaseous fluids from the controlled area is exhausted and released in an organised way. Thus, all the potential non-point contamination sources become point sources of air pollution, which are equipped with respective cleaning and monitoring in accordance with the above information.

**II.1.3. LINE AND MOBILE SOURCES**

**Zero variant:**

As the ISFS structure is not a production-character operation, which would require raw material import for its operation, the influence of transport means is not connected with the ISFS operation. SF is transported by railway.

C-30 transport containers transported on special railway carriages are used to transport spent fuel assemblies from individual nuclear power plants to the ISFS on the railway siding. The transport equipment is approved by the NRA SR. All SF transportations are approved by the NRA SR, Public Health Authority of the SR as well as Ministry of Transport, Construction and Regional Development of the SR. Operating regulations and respective regime measures of physical protection are prepared for the transportation.

**Variant No. 1, 2, 3:**

An increase of transits of the trucks transporting building material for the construction of further storage facilities is expected during construction. The existing roads will be used for transport. The expected transport impact will affect in particular the neighbouring municipalities of the premises in the surroundings of Jaslovské Bohunice: Špačince, Malženice, Žlkovce, and Bučany because the roads lead through these municipalities.

After the completion of the storage spaces, no increase in the current number of road vehicle transits is anticipated.

At present, SF transportations are carried out in accordance with the contract of nuclear services provision pursuant to the requirements of SE a.s. Total four transportations per year are carried out from V-2 NPP Units 3 and 4, one transportation per year is carried out from SE-EMO Units 1 and 2.
After the commissioning of SE-EMO Units 3 and 4, the current volume of transportations will be increased by one transportation per year.

II.2. WASTE WATERS

Construction impacts on water conditions:

The storage facility construction will require water for drinking, cleaning and for the work performed on site, such as concreting, wet processes, i.e. during the construction, water consumption will increase.

The quantity of needed water will not represent a significant change in the consumption of water necessary for other operations at Jaslovské Bohunice. A limited quantity of waste waters will be produced during construction. The pollutants will include in particular insoluble substances. It will not represent a significant load for the waste water treatment plant. The influence will be temporary and the waste waters produced during construction will not affect the quality of the water water courses in the surroundings.

Operation impacts on water conditions:

Rainwater

Zero variant:

Rainwater is removed from the surface run-off from the roof of the ISFS structure, from roads and hard surfaces through the rainwater sewerage system. After the dosimetry check it flows into the retention tanks and from there, through the open channel Manivier to the water body Dudváh (termination after the municipality Žlkovce in the river km 10.1).

Variants No. 1, 2, 3:

The quantity of waste water from the surface run-off will be increased by the quantity of rainwater removed from the roof of the new building and connecting bridge.

Sink waters

Zero variant:

Sink waters are removed from the structure through the foul sewer to the mechanical and biological waste water treatment plant MB WWTP of V1 NPP (BIOCLAR). The treated waste waters are discharged to the piping collector SOCOMAN.

Variants No. 1, 2, 3:

The quantity of sink waters will not change in comparison with the Zero Variant because no increase in the number of employees is expected.
Active waste waters

Zero Variant:

Active waste waters from the ISFS include:

- used decontamination solutions
- rinsing waters
- primary circuit floor drainage removal
- waste water from laboratories

The primary circuit floor drainage removing water from the controlled area is terminated in the collecting tank in the ISFS structure, which is pumped to the V1 NPP for further treatment. The waste waters from filters regeneration, disintegration, and decontamination are collected in the ISFS in the drainage tanks. From the drainage tanks, they are pumped to the VI NPP for further treatment.

After the loss of the filtration and exchanging capacity, the fillings of ion exchanger filters from the ISFS treatment plant (mechanical, cation exchanger and anion exchanger) are pumped to the VI NPP for further treatment.

The liquid RAW from the liquidation of the taken samples and from the laboratories is along with other wastes (gaseous fluid condensate, filters and air-conditioning stack) led to the collecting tank of the primary circuit floor drainage.

The waste water from the access to the control area is removed to the primary circuit floor drainage, the daily production amounts to about 0.5 m$^3$. The total annual quantity ranges from 300 to 600 m$^3$, the total activity does not exceed $6.7 \times 10^6$ Bq.

The collected active waste waters are removed to the auxiliary service building of the V1 NPP, where they are treated by evaporating with additional treatment of vapour condensates at the ion exchanger filtration station.

Variant No. 1:

The treatment of pool waters and possible decontamination of the controlled area rooms can produce the quantity of waters comparable with the Zero Variant.

Variant No. 2, 3:

No contaminated waste water will be produced with dry SF storage. During possible decontamination of the controlled area, a negligible water quantity can be produced – max. 30 m$^3$ per year.

Pool water:

Zero variant:

Limits of pool water activity -

- tritium $<3.7 \times 10^9$ Bq/m$^3$ (i.e. $3.7 \times 10^5$ Bq/dm$^3$),
- summary beta, gamma activity of radionuclides $<4.1 \times 10^7$ Bq/m$^3$ (i.e. $4.1 \times 10^4$ Bq/dm$^3$).

In fact, the activity of pool waters ranges within the values included in the table:
Table No. B. II.2/01

<table>
<thead>
<tr>
<th>Value</th>
<th>Dimension</th>
<th>2005 - 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>volume activity of tritium</td>
<td>[Bq/m³]</td>
<td>6.2.10⁴ - 2.31.10⁵</td>
</tr>
<tr>
<td>summary volume β activity</td>
<td>[Bq/m³]</td>
<td>2.54.10⁵ - 9.02.10⁵</td>
</tr>
<tr>
<td>summary volume γ activity</td>
<td>[Bq/m³]</td>
<td>2.07.10⁵ - 8.43.10⁵</td>
</tr>
</tbody>
</table>

Variant No. 1:

In comparison with the Zero Variant, a double quantity of pool water will be necessary for wet SF storage. Its parameters will be similar to the parameters of pool waters of the Zero Variant.

Variant No. 2, 3:

No pool water is produced with dry SF storage.

II.3. WASTES

II.3.1 Radioactive wastes

Construction impacts on waste management:

No radioactive waste will be produced during site preparation and construction.

Operation impacts on waste management:

Zero Variant:

During ISFS operation, radioactive wastes are produced by the radioactive media, from which unusable substances are produced during technological operations. The operations include: pool water handling, pool water treatment, decontamination of transport means and other technological parts, gaseous fluid filtration etc.

Radioactive wastes in the ISFS include:
- the products of decontamination activities during the ISFS operation,
- saturated filter fillings and liquid media from pool water treatment,
- liquid wastes from the drainage system and primary circuit floor drainage system,
- solid wastes from the operation of the air-conditioning system filtration station, wastes from repairs and maintenance and PPE use.

The ISFS does not have any technological equipment for radioactive waste treatment. Liquid RAW is led through the piping in a shielded channel to the V1 NPP. Solid RAW is transported to the nuclear installation RAW TCT - BRWTC structure for further treatment.
Radioactive media participating in RAW production

The sources of radioactive substances (fission and corrosion products), which are released to the technological media during ISFS operation (storage pool coolant, ion exchanger fillings of filtration stations, air-conditioning filters etc.) and participate in RAW production, include:

- spent fuel assemblies from the VVER reactors,
- water in the transport container during SF transportation.

Solid RAW

Solid wastes are produced during routine operation and maintenance of the technological equipment in the ISFS and during the activity of the air-conditioning system filtration devices.

In addition to the above-mentioned wastes, further RAW is produced during ISFS operation. These include in particular the protective equipment contaminated during maintenance and repairs of the equipment, contaminated parts from repairs of various devices, such as parts of valves, pumps, pipeline parts, further the cleaning textile material, contaminated paint from the containers, etc.

The expected quantity of the wastes:

- incinerable wastes 1.3 m³/year,
- non-incinerable wastes 2.0 m³/year.

The above wastes are sorted in the ISFS and subsequently transported for treatment and conditioning to the NI RAW TCT.

Table No. B.II.3/01: Production of solid RAW in the NI ISFS in 2011-2013

<table>
<thead>
<tr>
<th>Waste type</th>
<th>Summary beta + gamma activity ranging from 10⁵ to 10⁷ Bq/cask</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Year 2011</td>
</tr>
<tr>
<td></td>
<td>[kg]</td>
</tr>
<tr>
<td>Incinerable RAW</td>
<td>387</td>
</tr>
<tr>
<td>Compactable RAW</td>
<td>65</td>
</tr>
<tr>
<td>Solid RAW to be sorted</td>
<td>97</td>
</tr>
<tr>
<td>Used air-conditioning filters</td>
<td>30</td>
</tr>
</tbody>
</table>
**Liquid RAW**

They are produced during operation of pool water treatment system (the saturated ion exchangers, filter disintegration and regeneration), during the decontamination work, from operations with the transport containers, from the operation of the access to the control area.

**Ion exchangers:**

Ion exchangers are regenerated, disintegrated or replaced. Their replacement by washing represents about 26 m$^3$ and disintegration represents about 38 m$^3$ of liquid RAW. Last time, the ion exchanger fillings were replaced in 1999. There has been no need to regenerate or disintegrate and wash the ion exchangers since the last replacement.

**Waste from the drainage tank (wastes from decontamination of the container, pools and ISFS rooms):**

At present, the ISFS produces about 300 to 600 m$^3$ of low-level waste waters, which are thickened in the V1 NPP auxiliary service building and subsequently treated on the RAW TCT lines.

**Table No. B. II.3/02: Production of liquid RAW, NI ISFS in 2011-2013**

<table>
<thead>
<tr>
<th>Waste type</th>
<th>Year 2011</th>
<th>Year 2012</th>
<th>Year 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid RAW</td>
<td>587</td>
<td>382</td>
<td>1457*</td>
</tr>
</tbody>
</table>

*out of 1457 m$^3$, the amount of 1250 m$^3$ was represented by low-level pool waters released within the framework of regular cleaning of pools

**Gaseous RAW**

Gaseous RAW result from the releasing of radioactive substances into the air either directly from the space above the surface of the storage pools in the mode of fuel charging and removal of leaked nitrogen, if any, during the container pressure test, during the exhaustion of the decontamination boxes and boxes with periodic check, during the removal of air from the non-service areas. The gaseous RAW exhausted by the air-conditioning systems are cleaned by the O-16 and O-17 systems, which serve for aerosol filtration. Their task is the removal of the air from the ISFS ventilated rooms, creation of underpressure in them and the controlled air flow and transport of possible radioactive substances contained in it. The volume activity of aerosols is measured by continual control in the system of radiation monitoring of the gaseous fluid in the ventilation system.

**Liquid RAW management**

The liquid RAW including the saturated ion exchangers coming from the operation of the ISFS are treated along with the wastes from the V1 NPP. The concentrates and saturated ion exchangers are treated and then conditioned into the form of a cement product filled into the FCC in the NI RAW
TCT. The conditioned RAW in the FCC are then disposed in the National RAW Repository at Mochovce.

**Solid RAW management**

Solid wastes produced during normal operation of the ISFS mostly consist of contaminated materials from the decontamination point, used PPE and other incinerable waste and compactable waste.

**Variants No. 1, 2, 3:**

**Solid RAW**

During wet and dry SF waste storage in the expanded capacity of SF in accordance with Variants No.1 to 3, solid radioactive waste will be produced during the activities of routine operation, SF manipulations, maintenance of ISFS technological equipment, and for the wet variant, also during the activity of air-conditioning system filtration devices.

**Expected production of solid RAW:**

Variant No. 1:
- incinerable wastes 1.5 m$^3$/year,
- non-incinerable wastes 2.0 m$^3$/year.

Variant No. 2 and 3:
- incinerable wastes 1.5 m$^3$/year,
- non-incinerable wastes 1.0 m$^3$/year.

Active wastes will be managed in compliance with the valid legislation. This will include the following activities:
- collection and sorting;
- radiation monitoring prior to removal for conditioning and treatment;
- removal for treatment and conditioning to the NI RAW TCT;
- treatment and conditioning along with other wastes produced from the operation and decommissioning of nuclear installations;
- placing the conditioned RAW to the NRWR Mochovce.

**Liquid RAW**

**Variant 1**

During wet SF storage operation, liquid RAW will be produced during operation of pool water treatment system (the saturated ion exchangers, filter disintegration and regeneration), during the decontamination work, from operations with the transport containers, from the operation of the access to the control area. Its estimated quantity will amount to 1.6 times the production of the Zero Variant.
Variant 2 and 3
Liquid wastes can only come from the operation of the access to the control area, which will be common with the Zero Variant, or from possible decontamination operations.

*Gaseous RAW*

**Variant 1**

The causes of gaseous RAW production will be identical with the Zero Variant. With the expansion of the existing wet storage capacities with conservative approach taking into account the currently real values of limit usage, the maximum assumption of annual limit usage is at the level of 0.2 %.

**Variant 2 and 3**

Taking into account the storage technology, gaseous RAW production is not expected.

*II.3.2 Inactive wastes*

*Operation impacts*

**Zero Variant:**

Substances are considered inactive wastes only if they meet all the following conditions:

a) they meet the criteria according to Annex No. 2 to Government Order No. 345/2006 Coll., Table No. 1 and 2,

b) surface activity for radionuclides of 1st class of radiotoxicity must be lower than $3.10^3$ Bq/m$^2$, which is $0.3$ Bq/cm$^2$ (Annex No. 8 to Government Order No. 345/2006 Coll. Table No. 1 and No. 2),

c) the mass activity of radioactive contamination must be lower than $3.10^2$ Bq/kg radionuclides of 1st class of radiotoxicity.

The wastes, which do not meet all the points a, b, c, are radioactive wastes. The waste meeting these criteria is collected out of the controlled area in containers intended for inactive waste. The ISFS operation produces reasonable quantities of common (inactive) operating wastes, such as mixed municipal waste (200301, O), various packaging wastes (e.g. mixed packaging 150106, O, plastic packaging PET 150102, O, paper and cardboard packaging 150101, O), administration wastes (e.g. waste printing toner containing dangerous substances 80317, H), wastes from maintenance of equipment and rooms (e.g. packaging containing residues of or contaminated by dangerous substances, 150110, H), etc. The Proposer manages all the wastes in accordance with the respective legislation with the emphasise on production prevention and preferable recycling. Wastes are collected in the collecting yard, sorted and short-time stored by individual types (defined in the catalogue of wastes), or according to the way of disposal. Disposal will be provided by the specialised organisations holding respective authorisations for this type of activity. All the wastes released from the company's premises are monitored for contamination by radionuclides before removal and additional control monitoring is at the freight gate house.
Table No. B.II.3/03: Production of wastes in the ISFS in 2009 – 2013

<table>
<thead>
<tr>
<th>Waste type</th>
<th>Year 2009</th>
<th>Year 2010</th>
<th>Year 2011</th>
<th>Year 2012</th>
<th>Year 2013</th>
<th>The way of management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Municipal waste [kg]</td>
<td>about 1300</td>
<td>about 1100</td>
<td>about 1050</td>
<td>about 1100</td>
<td>about 800</td>
<td>Dumped</td>
</tr>
</tbody>
</table>

Variants No. 1, 2, 3:

During the use of the proposed SF storage technology, waste quantities comparable with the Zero Variant will be produced. A total approximate quantity of 1 tonne of inactive waste from periodical maintenance and routine operation of the structure is anticipated. During the operation of the storage facility, the Proposer's waste management will manage the wastes.

*Construction impacts on waste management:*

The storage capacity will be expanded using the common building procedures and construction materials. Common building and municipal waste, demolition waste, painting material waste or other wastes characteristic for building and fitting work will be produced during construction. The table shows the informative summary of wastes produced during storage facility construction.

Table No. B. II.3/04

<table>
<thead>
<tr>
<th>Code</th>
<th>Category</th>
<th>Name</th>
<th>Quantity (t)</th>
<th>source</th>
<th>Possible method of disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>08 01 11</td>
<td>H</td>
<td>waste paint and varnish containing organic solvents or other dangerous substances</td>
<td>0.1</td>
<td>construction</td>
<td>Dumping</td>
</tr>
<tr>
<td>15 01 01</td>
<td>O</td>
<td>paper and cardboard packaging</td>
<td>1</td>
<td>construction</td>
<td>Secondary utilisation</td>
</tr>
<tr>
<td>15 01 02</td>
<td>O</td>
<td>plastic packaging</td>
<td>0.5</td>
<td>construction</td>
<td>Secondary utilisation</td>
</tr>
<tr>
<td>15 01 03</td>
<td>O</td>
<td>wooden packaging</td>
<td>1</td>
<td>construction</td>
<td>Secondary utilisation</td>
</tr>
<tr>
<td>15 01 04</td>
<td>O</td>
<td>metallic packaging</td>
<td>0.5</td>
<td>construction</td>
<td>Secondary utilisation</td>
</tr>
<tr>
<td>15 01 10</td>
<td>H</td>
<td>packaging containing residues of or contaminated by dangerous substances</td>
<td>0.5</td>
<td>construction</td>
<td>Dumping, incineration in the incineration plant</td>
</tr>
<tr>
<td>15 02 02</td>
<td>H</td>
<td>absorbents, filter materials (including oil filters not otherwise specified), wiping cloths, protective clothing contaminated by dangerous substances</td>
<td>0.1</td>
<td>construction</td>
<td>Dumping, incineration in the incineration plant</td>
</tr>
<tr>
<td>17 01 01</td>
<td>O</td>
<td>concrete</td>
<td>0.1</td>
<td>Demolitions</td>
<td>Secondary</td>
</tr>
<tr>
<td>Reference</td>
<td>Type</td>
<td>Description</td>
<td>Utilisation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>------</td>
<td>------------------------------------------------------------------------------</td>
<td>------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 02 01</td>
<td>O</td>
<td>wood</td>
<td>0.05 construction Secondary utilisation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 02 02</td>
<td>O</td>
<td>glass</td>
<td>0.05 construction Secondary utilisation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 02 03</td>
<td>O</td>
<td>plastic</td>
<td>0.1 construction Secondary utilisation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 03 02</td>
<td>O</td>
<td>bituminous mixtures other than those mentioned in 17 03 01 (asphalt)</td>
<td>0.5 Demolitions, relocations Dumping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 04 05</td>
<td>O</td>
<td>iron and steel</td>
<td>0.25 Secondary utilisation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 04 11</td>
<td>O</td>
<td>cables other than those mentioned in 17 04 10</td>
<td>0.1 Demolitions, relocations Secondary utilisation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 05 04</td>
<td>O</td>
<td>soil and stones other than those mentioned in 17 05 03</td>
<td>20 Demolitions, relocations dumping, use in the foundations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 05 06</td>
<td>O</td>
<td>dredging soil other than those mentioned in 17 05 05</td>
<td>30000 construction demolition, use in the embankment s</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 06 04</td>
<td>O</td>
<td>insulation materials other than those mentioned in 17 06 01 and 17 06 03</td>
<td>0.1 construction Dumping, incineration in the incineration plant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17 09 03</td>
<td>H</td>
<td>other construction and demolition wastes (including mixed wastes) containing dangerous substances</td>
<td>5 construction Dumping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 01 21</td>
<td>H</td>
<td>fluorescent tubes and other mercury-containing waste</td>
<td>0.01 construction Secondary utilisation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20 03 01</td>
<td>O</td>
<td>mixed municipal waste</td>
<td>10 construction Dumping</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**II.4. NOISE AND VIBRATIONS**

**Zero Variant:**

The ISFS operation does not produce noise and vibrations. In case of a power supply failure, the diesel generator would be put into operation, which would produce noise in the emergency situation - combustion engines. The transport means during SF transportation emit low-significant noise; all work hygiene requirements are met.

**Variants No. 1, 2, 3:**

SF wet and dry storage does not represent a significant source of noise or vibrations affecting considerably work hygiene or municipal hygiene.
Similarly to the Zero Variant, the transport means during SF transportation will emit low-significant noise; all work hygiene requirements will be met.

**Impacts during construction:**

The workers taking part in the construction must observe the safety requirements. The impact of the working environment will be direct, temporary and reversible. The building activity could have an indirect temporary impact on workers on the premises, such as dust, noise, vibrations and an increased risk of accidents. The main sources of noise, vibrations and dust will include the building machines and equipment, transport means, performance of building work.

The respective noise levels are included in the following table.

<table>
<thead>
<tr>
<th>Building machines</th>
<th>Typical noise level ( dB (A))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulldozer</td>
<td>97-105</td>
</tr>
<tr>
<td>Excavator</td>
<td>80-91</td>
</tr>
<tr>
<td>Automobile crane</td>
<td>91-98</td>
</tr>
<tr>
<td>Building mixer</td>
<td>85</td>
</tr>
<tr>
<td>Compressor</td>
<td>86-99</td>
</tr>
<tr>
<td>Pull cylinder</td>
<td>85-90</td>
</tr>
</tbody>
</table>

During construction, noise levels exceeding 90 dB can be expected on site. Noise assessment can be performed after the submission of the Contractor's project implementation plan. The building machines and equipment utilised will be evaluated according to the conditions of the Government Order laying down the details on technical requirements and procedures of noise emission conformity assessment for the equipment used in the exterior. The vibrations produced during construction relate to specific activities on site. Noise and dust during construction are limited in the area of construction and have no environmental impacts. Only the noise impacts from the vehicles transporting the building materials can occur in the radius of 30 km.

**II.5. RADIATION AND OTHER PHYSICAL FIELDS**

**Zero Variant:**

The principle of SF storage facility's technical solution in terms of radiation protection is to minimise the adverse impacts of ionising radiation to the level as low as reasonably achievable taking into account the economic and social factors (ALARA principle, i.e. as low as reasonably achievable in relation to the regulation of the exposure of workers with the sources as well as the population).

The maximum threshold, which must not be exceeded, are the limits of irradiation and limits of dose rate equivalent set by Act No. 355/2007 Coll. on public health protection, support and development and on the amendment to certain acts as amended in Government Order of the Slovak Republic No. 345/2006 Coll. on basic safety requirements for the protection of health of workers and inhabitants against ionising radiation and Regulation of the Ministry of Health of the Slovak Republic No. 545/2007 Coll. laying down details on the requirements for radiation protection provision during the activities leading to irradiation and activities important in terms of radiation protection.
For the dry storage facility, the basic safety barrier is the packaging set (transport and storage container or the storage pool), whose material and thickness significantly reduces the flow of ionising radiation produced by radioactive material storage. For the wet storage facility, the basic safety barrier is the fuel assembly or the hermetic box.

In Decision No. OOZPŽ/7119/2011 dated 21 October 2011, the Public Health Authority of the Slovak Republic specified the condition for the ISFS operation (along with the RAW TCT and A1 NPP decommissioning) to ensure that "the effective dose of a representative person from the population caused by RAS released into the air and surface waters" does not exceed the basic limit of 12 µSv/year (i.e. 12.10^{-6} Sv/year).

In Decision No. OOZPŽ/3760/2011 dated 1 July 2011, the Public Health Authority of the Slovak Republic specified the condition for the V1 NPP under decommissioning to ensure that "the effective dose of a representative person from the population caused by RAS released into the air and surface waters" from the nuclear power plant V1 does not exceed the basic limit of 20 µSv/year (i.e. 20.10^{-6} Sv/year).

The data on the discharges for 2013, which release radionuclides into the air for the Zero Variant, are included in Chapter II.I.I.

Government Order of the Slovak Republic No. 345/2006 Coll. on basic safety requirements for health protection of workers and inhabitants against ionising radiation is also applied to radiation protection of the employees. The controlled area is specified where the irradiation effective dose could exceed 6mSv or the equivalent doses could exceed 3 tenths of the respective limits of workers irradiation (Article 21 (1)).

The activity under assessment is not a relevant source of any other radiation or physical field.

**Variant No. 1:**

With this variant, the basic protection against ionising radiation is a sufficient quantity of the liquid medium also serving to remove residual heat. The minimum levels and transport processes with a defined height at manipulations are based on the safety reports. If they are observed, it is not possible to violate the respective legislative provisions regarding the protection against ionising radiation and thus, to use higher dose loads on the personnel.

**Variant No. 2:**

With this variant, the basic protection against ionising radiation effects is the material of the container itself and in no case it may exceed the set legislative requirements for the values of dose rates on the surface or at the prescribed distances. This is guaranteed by the certified equipment itself, which was designed for this way of storage. In comparison with Variant No.3, the disadvantage is that the occurrence of radiation field in the immediate surroundings of such containers in the storage area, where the service personnel can be present.

**Variant No. 3:**

With this variant, the basic protection against ionising radiation effects is the material of the building structure of the storage area and the service personnel will not be present in the SF storage areas, only on the specified ways above the storage level.
II.6. SMELL AND OTHER OUTPUTS

Zero Variant:

SF storage does not produce emissions of pollutants to the municipal environment changing then smell situation in the surroundings.

Variants No. 1, 2, 3:

Nor the expansion of SF storage areas according to Variants No.1, 2 and will produce smell.

II.7. ADDITIONAL DATA

The main risk factors for the employees taking part in the construction of the SF storage facility include work with chemical substances and building material. The hazardous substances, with which the workers will come into contact during the construction of the SF storage facility, are included in the following table.

Table No. B. II.7/01: Hazardous substances, chemicals and materials during the dry storage facility construction

<table>
<thead>
<tr>
<th>Chemical substance</th>
<th>Hazardous influence</th>
<th>Adverse health impact</th>
<th>Risk of exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>carbon monoxide</td>
<td>Very flammable, toxic</td>
<td>Very flammable, toxic when inhaled - it causes hypoxia and hypoxemia. It degrades the nervous system, cardiovascular system and haematogenesis. Toxic for reproduction</td>
<td>From exhaust gas emissions, risk of anaemia, headaches, weakness</td>
</tr>
<tr>
<td>carbon dioxide</td>
<td>Suffocation – it replaces oxygen in the air. It destroys the nervous system</td>
<td></td>
<td>From exhaust gas emissions, headaches,</td>
</tr>
<tr>
<td>dioxide nitrogen</td>
<td>Toxic, harmful</td>
<td>It causes damage to the lungs. At high concentrations, it causes pulmonary oedema, alveolitis. It irritates the respiration system, eyes, skin, causes, chronic bronchitis</td>
<td>From exhaust gas emissions, chronic bronchitis, bronchial pneumonia</td>
</tr>
<tr>
<td>sulphur dioxide</td>
<td>Toxic, caustic</td>
<td>Toxic when inhaled – it destroys the respiration system and nervous system, heart. At high concentrations it causes chemical burns. It irritates the respiration system, eyes, and skin. It has strong unpleasant smell Hazardous to the environment.</td>
<td>From exhaust gas emissions, chronic bronchitis, bronchial pneumonia</td>
</tr>
<tr>
<td>Diesel oil</td>
<td>Harmful,</td>
<td>Dangerous cumulative effect. Allergen.</td>
<td>Chronic effects, if the</td>
</tr>
<tr>
<td>Hazardous to the environment</td>
<td>Adverse health effect</td>
<td>Risk of exposure</td>
<td></td>
</tr>
<tr>
<td>------------------------------</td>
<td>-----------------------</td>
<td>------------------</td>
<td></td>
</tr>
<tr>
<td>Cement</td>
<td>Irritant, allergen</td>
<td>Chronic effects, if the work is carried out safely, there are no effects.</td>
<td></td>
</tr>
<tr>
<td>Mature</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asphal</td>
<td>Toxic</td>
<td>Chronic effects, if the work is carried out safely, there are no effects.</td>
<td></td>
</tr>
<tr>
<td>Polyurethanes and epoxides</td>
<td>Irritant allergen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dust from construction materials and soil</td>
<td>It causes acute and chronic diseases, allergic reactions of the respiration system and skin</td>
<td>It must be used according to the data sheet and instructions for use.</td>
<td></td>
</tr>
</tbody>
</table>

Table No. II.7/02: Adverse impacts on health during construction

<table>
<thead>
<tr>
<th>Adverse factors</th>
<th>Adverse health effect</th>
<th>Risk of exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk factors of the working environment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Noise and vibrations from the building machines, trucks, building work</td>
<td>Damaged hearing at high frequencies, neurosis, hypertension, Disturbed immunity and metabolism</td>
<td>Work with old, unserviced equipment, poor roads, failure to use hearing protection,</td>
</tr>
<tr>
<td>Microclimate out of the comfort zone</td>
<td>Work outdoors, catching cold, influenza, damage to the cardiovascular system, musculoskeletal system</td>
<td>Unsuitable working clothes and equipment, unsuitable rest place</td>
</tr>
<tr>
<td>Physiological and environmental factors of the working environment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lifting weights</td>
<td>Damaging to joints and skeletal system, cardiovascular problem</td>
<td>Work during construction</td>
</tr>
<tr>
<td>----------------</td>
<td>---------------------------------------------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>Physical fatigue and stress</td>
<td>Damaging to joints and skeletal system, cardiovascular problem</td>
<td>Work during construction</td>
</tr>
<tr>
<td>Mental and sensory load</td>
<td>Neurosis, stress, neurasthenia, cardiovascular problem</td>
<td>Work during construction</td>
</tr>
<tr>
<td>Forced work positions</td>
<td>Damaging to joints and skeletal system</td>
<td>Specific work during construction</td>
</tr>
<tr>
<td>Failures and accidents</td>
<td>Fall from height, trauma from heavy machinery</td>
<td>Specific work during construction</td>
</tr>
<tr>
<td>Fires and explosion</td>
<td>Burns, trauma, suffocation, electric shock</td>
<td>Unsuitable storage of oil products and fuels, insufficient securing of electric distribution systems</td>
</tr>
<tr>
<td>Traffic accidents</td>
<td>Traumas, burns, damages caused by fuels,</td>
<td>Large-size transport of construction material</td>
</tr>
</tbody>
</table>

II.8 INTERIM SF STORAGE FACILITY DECOMMISSIONING IMPACTS

The concept of SF management in the Slovak Republic included in the Strategy of Back-End of Nuclear Energy Peaceful Use in the Slovak Republic approved by Government Resolution No. 26/2014 dated 15 January 2014 considers long-term storage of fuel for 50 years with the possibility to extend the storage to 100 years. In compliance with this strategy and Regulation of the NRA SR No. 30/2012 Coll., the stage of SF management ends by SF final disposal in the deep geological repository. Decision of the NRA SR No. 497/2014 approved the document "Update of the Conceptual Plan of ISFS NI Decommissioning", which specifies the possible variants of ISFS decommissioning (immediate dismantling, postponed dismantling with shutdown and supervision for a period of 15 years), the time period and work procedures in the stage of ISFS operation termination and in the stage of decommissioning.

The following input preconditions have been adopted for both above variants of ISFS decommissioning:
- all the fuel is removed from the ISFS premises,
- in the stage of operation termination, all the technological systems (storage pools, cooling systems, decontamination systems and demineralised water systems, drainage tanks, leakage tanks, primary circuit floor drainage), operating distribution systems and empty, drained and dry pipelines, or empty, i.e. without operating fluids,
- RAW (both solid and liquid) from the stage of ISFS operation are treated before the beginning of decommissioning or they are transported to the place of treatment,
- during the ISFS decommissioning, the systems providing supplies of drinking and fire-fighting water, the system of sink and rain water sewerage, the heating system, the selected air-conditioning systems, dosimetric systems, weak-current systems and power supply systems
remain in serviceable condition. The above systems are finally shut down prior to the beginning of demolition of the structures.

Based on the analysis of the calculated parameters, the conceptual decommissioning plan prefers the variant of decommissioning applying immediate dismantling of the ISFS immediately after the removal of fuel from the ISFS premises.

The main objective of the variant of immediate dismantling is the immediate and smooth execution of the ISFS decommissioning activity right after the termination of NI operation, assuming complete removal of all technological systems of the ISFS (both active and inactive), demolition of the building part of the structures to the level of foundation plate with the following release of the site from under the control of the supervisory authority for further use, i.e. achievement of the end state "green meadow". The treatment, conditioning and disposal of all RAW from decommissioning and recycling of all usable materials, disposal or recycling of other and hazardous wastes is also anticipated. The above activities will be carried out based on the required detailed plans taking into account radiation safety, ALARA principles and environmental protection.

The actual radiation situation at the time of decommissioning will be obtained shortly before the activities off decommissioning and described in the updated and newly prepared documentation (Plan of ISFS Decommissioning Stage, Work Programmes etc.). In terms of the type of radionuclides and the way of their production, the ISFS may contain the materials contaminated by activated corrosion products of storage pool materials and impurities in the pool waters. In such case, the pre-dismantling decontamination will be used, which can use the methods of chemical, electrochemical and mechanical decontamination. The dismantling of technological equipment and systems (mechanical and thermal processes) during the decommissioning process also includes their disassembly and relocation from the original premises to the premises determined for storage or treatment. After the decontamination of contaminated equipment it can be assumed that it will be possible to use most of the materials as a secondary raw material. The part with the contamination higher than the releasing level will be treated like radioactive waste. In terms of ISFS operation history, no significant contamination of ISFS building surfaces is expected. The existing contamination will be removed using the mechanical and chemical methods. It is expected that the result of the decontamination work will be the reduced surface contamination to the level of values set for the release into the environment, i.e. less than 0.3 Bq.cm⁻². After the evaluation of radiation monitoring of the building surfaces and after independent check measurements, these will be classified as inactive and in the next stage it will be possible to demolish them along with the other inactive NI structures.

Both ISFS NI decommissioning variants consider the decommissioning as far as the foundation plate. The underground parts of the structure and the piping channels will be demolished and the building pits will be subsequently filled up with a part of the building material from structures demolition.

The site renovation will be provided by activities such as supply of the final soil layer, landscaping, grassing, remediation etc. with the objective to put the site into the final condition.
C. COMPLETE CHARACTERISTICS AND ENVIRONMENTAL IMPACT ASSESSMENT INCLUDING HEALTH IMPACTS

I. SPECIFICATION OF THE BOUNDARIES OF THE AFFECTED TERRITORY

As regards the natural conditions characteristics, the affected territory (under assessment) shall mean the circle with a radius of about 5 km, with the centre approximately at the site of placing of the proposed technology, which will be part of the nuclear installation "Interim spent fuel storage facility".

In terms of social and economic characteristics and population characteristics, the affected territory shall mean the unification of the cadastral territories of the municipalities with the residential area situated in the above-defined territory.

II. CHARACTERISTICS OF THE CURRENT STATE OF THE ENVIRONMENT IN THE AFFECTED AREA

II.1. GEOMORPHOLOGICAL CONDITIONS

In terms of geomorphology, the area under assessment is situated in the Danube Lowland land area, Danube Upland unit, Trnava Upland subunit, part Trnava Table. The eastern part of the territory belongs to the Dolný Váh Bottomland subunit, Dudváh Wetland part. On the west side, the affected territory touches the Podmalokarpatská pahorkatina upland.

From the morpho-tectonic point of view, the Trnava Table represents poorly differentiated, flat, little to moderately undulated, mildly valley relief of fluvial-aolian undulating lowland up to hilly area with the average down slope up to 2°, affected by recent fluvial, partially washouts creating erosion process, with a weak involvement of lithology.

The territory is part of the transient and tabular stage of the hilly area, with the obliterated interface running roughly in the NE-SW, along the NI area at Jaslovské Bohunice. The tabular stage is formed by minimally slant table, or its remnants, separated by the valleys of local water flows. The remnants of the table are gashed shallow by the valleys, valley depressions or enclosed depressions of polygenic origin. The area region is characterized by crossing of lengthwise and crosswise morphostructural units, separating the partial morphostructural units. The above sea level at the NI's site is within the range of 172 - 173.5 m a.s.l.

The basic drop of the terrain is in the south-east direction, namely from the height above sea level 190 m to the height above sea level 145 m. The next two prevailing directions of the terrain relief drop are NE and S and are caused by the erosion activity of the water flows, running mostly in the S direction.

The affected locality, along with the majority of the affected territory, is assigned to (Mazúr, Lukniš in the Country Atlas of the Slovak Republic, 2002):

- **System:** Alpine-Himalayan
- **Sub-system:** Pannonian Basin
- **Province:** Western Pannonian Basin
- **Subprovince:** Small Danube Basin
Area: Danube Lowland  
Unit: Danube Upland  
Subunit: Trnava Upland  
Part: Trnava Table

The affected territory marginally touches also the other part of the Trnava Upland - the Podmalokarpatská pahorkatina upland (north-west), as well as the Dolný Váh Bottomland subunit, Dudváh Wetland part.

The mildly undulated relief of the Trnava Upland creates a morphologic depression between the Small Carpathians (in the East) and Považský Inovec (in the West). The terrain is shaped also by the river Váh with its bottomland on the lower reach (the distance of the Váh river from the nuclear facility site is approximately 8 km). The hilly area relief gradually fades out in the South and transits into the Danube Lowland. The mild relief modulation is determined by the presence of aeolian origin sediments – loesses and loess clays, drifted here during the interglacial periods (middle and upper Pleistocene) reaching a thickness of up to 20 m. The loess and loess clay layers smooth down the terrain unevenness, originated by tectonic movements and erosion. Therefore, this part of the Trnava Upland is denoted as Trnava Loess Table.

The territory of the Jaslovské Bohunice nuclear installation with its surroundings (Trnava Loess Table) has the character of a flat ground up to mildly undulated terrain, with prevailing relief slant up to 7°. The most part of the affected territory and its broader surroundings, from the aspect of the sloping extent, is a plain terrain, having the relief slants between 0 – 3°. The increased inclination of the relief within the range 3 – 7° originated from water erosion in the territory and is related to the presence of water streams and erosion furrows draining the surface waters from the territory.

Fig. No. 14: Relief sloping

(prepared according to www.geology.sk)
The relief amplitude within the framework of the Jaslovské Bohunice nuclear facility area reaches approximately 10 m. The lowest situated locality is the southern part of the area, near to the place, where the regulated stream Manivier leaves the area at the 165 m height a.s.l. The highest locality is the western part of the area with the approximate height 175 m a.s.l. at the area border. Despite the relatively low vertical jaggedness of the Jaslovské Bohunice nuclear facility area relief, the affected territory is, from the aspect of the (relief) slopes orientation, rather variedly differentiated. This phenomenon has been caused mainly by the presence and erosion activity of the water flows in the territory. The drain flow direction of the surface waters in the broader affected territory is NW – SE, corresponding to the main relief orientation of the territory in the S, SW or SE direction.

The relief orientation within the Jaslovské Bohunice nuclear installation area and its surroundings, is depicted by the following picture.

**Fig. No. 15: Relief orientation**

(Prepared according to www.geology.sk)

**II.2. GEOLOGICAL CONDITIONS**

**GEOLOGICAL STRUCTURE**

From the geology aspect, the assessed territory is located in the northern projection of the Danube Basin, in the Blatné Depression. The Blatné Depression is classified as a Tertiary sedimentary basin, since it is filled predominantly by Tertiary (Cenozoic) sediments of sea origin.
The Quaternary cap is formed mainly by humic clays, loesses and loess clays (Trnava Loess Table), in the surroundings of the Váh river by alluvial clays and terraces. The humic clays feature regularly the thickness of 1.5 m, sporadically up to 5 m. The loesses and the loess clays have the maximal thickness up to 20 m, in the SW vicinity 5 – 15 m. Where the loesses cover the older buried terraces of the Váh river (in the east direction), the thickness of the Quaternary sediments may exceed even 30 m.

Fig. No. 16: Geological map sector

Explanatory notes (selected items):

Source: I. Kováč et al in J. Schwarz et al., 2004 (Set of regional maps of environmental geological factors in the region of Trnava Upland, ENVIGEO, 2004)

Note: The premises of the Jaslovské Bohunice NI marked with red colour
The Quaternary cap covers the layers of the Tertiary age sediments, namely (top down):

- mostly fluvial sediments of later Neogene (Pliocene), characterized by gravel locations (in the surroundings of Jaslovské Bohunice with the thickness more than 100 m),
- Pannonian - Pontian lacustrine and fluvial sediments, characterized by varied clays and sands, with locations of lignite (up to 300 m thickness),
- predominantly marine sediments of earlier Neogene (Miocene), namely Sarmatian shallow sea clays and sands, Badenian polymict sands and pudding stones, sands, sandstones and conglomerates of Otnang and Carpathian, as well as Egenburg. These marine sediments are mostly clastic (i.e. formed by fragments of washed away rocks – clays, sands, gravels and their strengthened equivalents), monotonous, reaching big thickness (altogether, the Blatné Depression, filled by the Tertiary sediments, features a thickness of almost 2000 m).

**Fig. No. 17: Geological cross-section of the territory 2 km to the North from the Jaslovské Bohunice N**

The tectonic faults divide the sediments' layers to individual units sinking in the direction towards the depression centre. The faults in the NE-SW direction were active during the Sarmatian and Pannonian period, the faults in NW-SE direction were active in Pliocene, whereby their activity fades away until now.

**ENGINEERING-GEOLOGICAL CONDITIONS**

The engineering-geological characteristics of the territory is determined by the geological structure of the territory at the construction level of foundations. The territorial characteristics of the NI complex in Jaslovské Bohunice is determined by a thick (10 – 15 m) layer of aeolian sediments – loesses and loess clays.

The territory of the Trnava Loess Table with the thickness of the aeolian sediments above 5 m, comprising the whole NI area of Jaslovské Bohunice, is classified in the engineering-geological district of aeolian loesses Es11.

From the hydro geological aspect, this district is formed by poorly permeable soils and the continuous horizons of the groundwater are there developed only rarely. Usually, the groundwater is
concentrated in the environment forming the bedrock of the aeolian loesses. As far as the 
**geodynamic phenomena** are concerned, the district is prone to flopping, formation of the erosion 
furrows and washouts, erosion of the banks of water streams and ponds. 
Pursuant to the classification by STN 73 1001, the district is built mostly by fine-grained earths of the 
class F6 and F5. According to STN 73 3050, the soils are mineable as the 2nd class. The earths are 
suitable for embankments and are convenient as the sealing elements for dams. 
The engineering-geological conditions of the construction work in the district are determined by 
flopping, frequent high ground freezing, predisposition of the territory to the erosion processes. The 
district is conditionally suitable for waste deposition.

**Fig. No. 18: Engineering-geological regioning map sector**

Explanatory notes:  
- **Es** – region of the aeolian loesses (Es11 – the loess thickness above 5 m)  
- **FnEs** – region of lowland flow fluvial deposits on the aeolian loesses (FnEs3 – fine-grained fluvial deposit earths up to 2 m; FnEs4 – fine-grained fluvial deposit earths 2 – 5 m; FnEs5 – gravel fluvial deposits 2 – 5 m)  
- **Fn** – region of lowland flows fluvial deposits (the numerical indexes denote the different lithology character and thickness of the fluvial deposits)  

Source: A. Ilkanič in J. Schwarz et al., 2004 (Set of regional maps of environmental geological factors in the region of Trnava Upland, ENVIGEO, 2004)

**Geodynamic phenomena**

As long as the exogenous processes are concerned, the most active processes in broader territory of 
interest are the processes of water and wind erosion. 
The plain to mildly undulated relief of the Jaslovské Bohunice NI area surroundings does not create 
the precondition for more significant scope of water erosion within the territory. The categorization
of the threat to the soils from the aspect of the potential water erosion, the territory belongs mostly to the category 1 – without erosion connected with the soil transport from the territory in the range of < 4 t/ha per year. Category 2 is along the water flows in the territory – medium erosion, representing soil transport from the territory within the range of 4 – 10 t/ha per year.

*Fig. No. 19: Potential water erosion*

Similarly to the case of potential water erosion, also the threat to the soils by potential wind erosion in the surrounding territory of the Jaslovské Bohunice NI is not hazardous. The prevalent part of the territory belongs to the category 1 - no or weak erosion, representing soil transport less than 0.7 t/ha of the soil per year. Category 2 – medium erosion, represents soil transport in the range of 0.7 – 22 t/ha per year.

*Fig. No. 20: Potential wind erosion*
From the aspect of the real status of the territory in relation to the effects of the water and wind erosion, we can conclude that the territory of the Jaslovské Bohunice NI area does not feature significant demonstrations of the aforementioned soil-destructive processes.

**SEISMICITY**

As far as the endogenous processes are concerned, the assessed territory could only be affected by seismic movements. The most significant source of the seismic threat is located in the Dobrá Voda Depression in the Small Carpathians. Less significant for the assessed territory is the southern part of the Small Carpathians (Modra, Pernek) and the southern part of the Danube Lowland (Komárno). With regard to relatively high seismic activity, the affected territory is considered to be a seismic active region. The regional seismic activity isoline runs to the east of the affected territory.

The initial seismology materials for the site of the Jaslovské Bohunice NI were elaborated in 1969 – 1970 and the seismic load on the constructions was determined to be 7º of the MCS scale (Mercalli – Cancani – Siebert). According to the initial studies, the likely strongest design earthquake at Jaslovské Bohunice could by an earthquake at the level 6 – 6.5º MCS, corresponding to the value 4.2 of the Richter scale.

**Table No. C II.2/01: Modified MCS (Mercalli – Cancani – Siebert) scale\(^1\) determining the earthquake intensity**

<table>
<thead>
<tr>
<th>Earthquake intensity</th>
<th>Earthquake</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.</td>
<td>Not felt except by a very few (under especially favourable conditions).</td>
</tr>
<tr>
<td>II.</td>
<td>Felt only by a few persons at rest; not firmly suspended subjects start to rock.</td>
</tr>
<tr>
<td>III.</td>
<td>Felt quite noticeably by persons indoors. Standing motor cars may rock slightly.</td>
</tr>
<tr>
<td>IV.</td>
<td>Felt indoors by many, at night some awakened, standing motor cars rocked noticeably, windows disturbed.</td>
</tr>
<tr>
<td>V.</td>
<td>Felt by everyone, a few instances of fallen plaster, some dishes, windows broken, pendulum clocks may stop.</td>
</tr>
<tr>
<td>VI.</td>
<td>Felt by all, many people frightened. Chimneys and plaster damaged, some furniture moved, the objects overturned.</td>
</tr>
<tr>
<td>VII.</td>
<td>All run out of the buildings. Earthquake felt also in moving cars. Slight to moderate damage in buildings.</td>
</tr>
<tr>
<td>VIII.</td>
<td>General alert. Damage great in poorly built structures, walls and furniture overturned, change of the water level in wells.</td>
</tr>
<tr>
<td>IX.</td>
<td>Panic. Poorly built structures totally destroyed, considerable damage in specially designed structures, foundations and underground plumbing, cracked and fissured ground.</td>
</tr>
<tr>
<td>X.</td>
<td>Panic. Few strongest buildings remain standing, the ground is considerably cracked, rails bent, water runs over the embankments of the rivers.</td>
</tr>
<tr>
<td>XI.</td>
<td>Panic. Only few structures remain standing, broad fissures in ground, steep slopes originate, underground pipe lines completely out of service. Rails bent greatly.</td>
</tr>
<tr>
<td>XII.</td>
<td>Panic. Damage total. Waves seen on ground surfaces. Lines of sight and level distorted. Objects thrown upward into the air.</td>
</tr>
</tbody>
</table>

Source: [http://sk.wikipedia.org/wiki/Modifikovan%C3%A9_Mercalliho_stupnica](http://sk.wikipedia.org/wiki/Modifikovan%C3%A9_Mercalliho_stupnica)

\(^1\) It is similar to MSK-64 scales (used in the former eastern block) as well as EMS-92 and EMS-98 (introduced in Europe by the European Seismological Commission)
The terrain of this region is flat, with the maximum incline of 1º, corresponding to the favourable conditions, excluding the earthquake secondary phenomena, mainly the threat of gravitational heaps.

It has been determined that within the time period of 200 years, the most likely earthquake in the locality of the Jaslovské Bohunice built-up area will reach the level 6.5º MCS. Subsequently, it was determined that an earthquake in this region is a rare phenomenon, and the analysis did not show any seismic questions preventing utilization of this region for the construction site of the nuclear power plant.

The original basis for the seismic assessment was in year 1986 and subsequently revised in several steps, in accordance with the development of the technology, data and requirements for safety. Based on the seismic risk assessment (1989), the calculation of the seismic threat was elaborated (1997) and the main seismology characteristics were determined, as follows:

- the likelihood of the earthquake occurrence 1x in 10,000 years,
- intensity 8º on the MSK-64 scale²,
- maximum horizontal acceleration 0.25 m/s² and vertical acceleration 0.13 m/s²,
- effective period of crucial movements 10s.

For the design earthquake level with the likelihood $10^{-2}$ years (100 years) there was determined the intensity 7 on the MSK-64 scale with half of the acceleration values from the earthquake.

The reaction comprised the projects of seismic reinforcement of nuclear power plant classified equipment, having been implemented since 1998 up to now.

**HYDROGEOLOGICAL CONDITIONS**

From the aspect of hydrogeological regioning, the assessed territory belongs to the groundwater district Q 050 „Quaternary of the Trnava Upland“.

In the surroundings of the Jaslovské Bohunice NI, this district is represented by a hydrogeological complex of the aeolian Quaternary sediments functioning as regional insulators (eQp) - loesses and loess clays from the Pleistocene – Holocene age.

The loesses and sandy loesses of the Pleistocene represent the dominant covering formation in the Trnava Upland. With regard to their granular character – dusty particles with admixture of sand and clay – they are very little permeable for the water and they have the character of a regional hydrogeological insulator. The loesses feature relatively thick unsaturated zone, with the groundwater level frequently at a depth bigger than 10 m; in the Jaslovské Bohunice NI area it is 16 – 20 m.

Thanks to these features, the hydrogeological complex of the aeolian Quaternary sediments fulfils the important protective function against the bedrock collectors; or it can serve as the rock environment with the least mutual interaction and circulation of the groundwater, respectively. The permeability of the watered layer (kf) moves in the range from n.10⁻⁵ to n.10⁻³ m/s. The groundwater streaming direction is from NW to SE. The groundwater level is free, locally mildly tight.

The infiltration of the atmospheric precipitation water, with regard to the thickness and permeability of the loesses, is minimal.

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2 The Medvedej (USSR) - Sponheuer (GDR) – Kárník (CSSR) scale, 12 degrees from 1964, we can consider it for the purpose of this report as equivalent to the MCS scale.
MINERAL DEPOSITS

According to the data from the Registry of the protected deposit territories, Head Mining Office (2013), the affected territory comprises the protected area Veľké Kostoľany (natural gas underground reservoir).

The PDA Boleráz (brickmaking clay mining) is located in the vicinity, in the direction to the south-west, and the PDA Dechtice I (limestone), II (dolomitic sands) and III (high percentage calcite) are located to the north-west.

The data from the Registry of the mining territories of the Head Mining Office (2013a) list the mining territory Bohunice, Bohunice I and Veľké Kostoľany (natural gas extraction). From the aspect of the natural gas amount and quality, this deposit does not belong under the balance deposit category.

The close mining area is Boleráz (brickmaking clay mining), Dechtice (limestone mining) and Dechtice I (dolomitic sands mining).

ROCK MASS CONTAMINATION STATUS

Globally the most extensive potential sources of the rock mass contamination are the consequences of the intensive use of the agrochemicals for large area management. The most significant for the rock environment contamination is the contamination of the soil, which represents the upper layer of the rock environment, thus playing the role of the contact layer between the individual geosphere components, namely the atmosphere, lithosphere and hydrosphere. Their chemical contamination is described in the corresponding chapters of this material.

From the aspect of radon radioactive contamination of the rock environment, the assessed territory belongs to the areas with low to medium radon hazards.

Radon (222Rn) represents one of the most significant natural radiation sources in the territory of interest, i.e. the radon does not originate due to the activity of the NI. Its threat is based on the fact that the radon itself is a gas, which can be inhaled, however the daughter products of its decay (polonium, bismuth and lead) are solids, which may be trapped in the organism and cause cancer following some period of exposition.

Radon originates in the considerable depths and comes in on the surface along the significant tectonic lines. In the structures built in such zones, with insufficient sealing of the basement rooms, the radon can accumulate in the cellars and basements, thus representing the health risk for the residents. That’s why several regional surveys of the radon content in the air extracted from the soil were performed. This chapter is based on the survey from 2003 (J. Hricko, F. Suchý, I. Zeman, 1993 in J. Schwarz et al., 2004), which is linked to several earlier measurements.

Generally speaking, the radon content values in the surroundings of the Jaslovské Bohunice NI area are low, in some places medium and the level of the radon risk is equal to the lowland regions of Slovakia, thus mostly low.
The closest point with a high radon risk detected is located in the town of Piešťany, which is related to the deep tectonic lines serving for ascent of the thermal springs in the Piešťany health resort.
Contamination of the rock mass by radionuclides

In the area of the NI Bohunice, the main real large area contamination source of the geological environment still remains the area of the A-1 NPP. However, the unfavourable radiation status of the area groundwater is purposively solved by implementation of the reconstruction measures (recovery pumping), removal of the contaminated groundwater from the geological environment; and the movement of the residual contamination outside of the area is inhibited. The efficiency of the recovery pumping, with regard to the limited complex source within the A-1 NPP area, at the end of the year 2013 was above 88%.

The most significant for the rock environment contamination is the contamination of the soil, which represents the upper layer of the rock environment, thus playing the role of the contact layer between the individual geosphere components, namely the atmosphere, lithosphere and hydrosphere. Their chemical contamination is described in the corresponding chapters of this material.

II.3. SOIL CONDITIONS

Basic characteristics

In accordance with Act No. 220/2004 Coll. on agricultural land protection and use as amended, there are lands with BPEJ 7 quality group (VÚPOP, 2013) in the affected territory. In the immediate vicinity of the activity, the lands in the north belong to the BPEJ 0139002, 0139202 and 0147202 category, to the west direction 0144202, southwards 0139002 and eastwards 0143002, 0138202 and 0143002.

The surroundings of the affected territory contain mainly typical medium heavy black soils and the brown soils on the loesses. The north-west and west part contain medium heavy Rego soils and eroded brown soils created on the loesses, medium heavy typical brown soils and in the east part the Rego soils and black soils eroded in the loess complexes. The soils in the affected locality are mostly clayey, deep (60 cm and more) and do not contain the soil skeleton.

According to the soil reaction map (pH) (Čurlík, Šefčík, 1998) we can characterize the soils of the affected territory as low alkaline (pH in the range 7.4 – 7.8) to neutral (pH in the range 6.6 – 7.3).

Mechanical and chemical degradation susceptibility degree

The territory of interest, with regard to the relief character, is not supposed to be a subject of more intensive water erosion manifestations. In the predominantly lowland terrain (Dudváh Bottomland and Blava stream bottomland, Trnava Table), there is no water erosion phenomenon, the other way around, on the steep land (cadastral territory Radošovce), the water erosion can manifest itself with a characteristic low intensity. There is a risk of underflooding and leaching of the soils in the lowland terrain of the Dudváh Bottomland in case of high water level in the streams.

Wind erosion can be characterized as higher up to high, since it is an open, mainly flat relief with application of the large area management, without more significant planting of the shelter belts, which could partially eliminate this undesirable phenomenon. This phenomenon is shown in extra-vegetation period.

From the aspect of the affected territory soil characteristics we conclude that the soils in the territory of interest are well resistant against the mechanical and chemical degradation. It is affected by the soil acidification due to the long distance transfer from the emission sources located in the broader surroundings, mainly from the industrial sources of the towns of Trnava, Leopoldov, Hlohovec,
Piešťany and from the traffic. The acidification is caused mainly by the pollutant fallout of SO₂, NOₓ or fluorine, respectively.

**The quality and contamination degree of soils**

The drop of the contaminants from the pesticides and industrial fertilizers was caused thanks to the significant reduction of their use, due to the worsened economic situation of the agricultural cooperatives in the territory of interest. The large capacity stock-raising terminated or was reduced, thus the primary risk of contamination and damage to the environmental elements was reduced.

Within the framework of the affected territory, there are no area-significant localities with anthropogenic activity or economic activities, which could cause the contamination of the agricultural land.

Based on the geochemical monitoring of soils in Slovakia (Čurlík, Šefčík, 1999) we can ascertain that none of the monitored heavy metals exceeded the limit values determined according to the former Regulation of the Ministry of Agriculture of the SR on maximum admissible concentrations of some hazardous substances in soils and on the appointing of the organizations authorized to determine the real levels of these substances (No. 531/1994 - 529, Note: the limits are invalid today).

**Contamination of soils by radionuclides**

Within the framework of Bohunice NI radiation monitoring, the soil activity in the surroundings is monitored, as well. The soils are sampled once a year. The collections are divided in two groups; for the grassy lands – they are performed in spring, and for the arable lands – they are performed in autumn. The determined parameter is the mass activity of the natural radionuclides (uranium decay chain – 226Ra, thorium decay chain – 232Th and the 40K isotope) and the mass activity of 137Cs or other artificial radionuclides. The field INSITU gamma spectrometry is performed twice a year, in spring and autumn. The measurement is performed in the vicinity of the dosimetry stations. The INSITU measurements also include the measurement of the absorbed dose rate at a particular place and soil sampling. The monitoring results confirm the fact that the contents of natural and artificial radionuclides in the soil are close to the average contents for the whole region, without distinguishable anomalies, caused by the Bohunice NI operation.

**II.4. CLIMATIC CONDITIONS**

The climate of the territory under assessment is a lowland, mostly warm one, the territory belongs to the A3 climatic zone (warm, moderately dry, with moderate winters).

One of the 34 automated stations for climatic data monitoring (so-called synoptic station) operated by the Slovak Hydrometeorological Institute Bratislava (SHMU) is located at Jaslovské Bohunice.

The monitored parameters include the air temperature, rainfall, wind speed and direction, air pressure and humidity and other phenomena (cloud amount, sunshine, ...).

For information, we provide several selected indicators taken from the SHMU – temperature, wind speed, wind directions, rainfall.
Table No. C.II.4./01 - Average monthly temperature values in the period 2007 – 2012 in °C (measuring station Jaslovské Bohunice)

<table>
<thead>
<tr>
<th>Year / month</th>
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Source: Yearbooks of climatological observations of meteorological stations in the territory of the Slovak Republic in 2007 – 2012, SHMU

Table No. C. II.4./02

Average wind speed for the period 2007 – 2012 in m.s⁻¹ (measuring station Jaslovské Bohunice)

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<td>4.5</td>
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<td>3.4</td>
<td>3.3</td>
<td>2.5</td>
<td>2.7</td>
</tr>
<tr>
<td>2012</td>
<td>4.3</td>
<td>4.8</td>
<td>4.4</td>
<td>4.0</td>
<td>3.7</td>
<td>2.8</td>
<td>3.2</td>
<td>2.9</td>
<td>3.3</td>
<td>3.1</td>
<td>3.7</td>
<td>2.8</td>
</tr>
</tbody>
</table>

Source: Yearbooks of climatological observations of meteorological stations in the territory of the Slovak Republic in 2009 – 2012, SHMU

Table No. C. II.4./03

Relative percentage of wind direction occurrence from the station at Jaslovské Bohunice for the period 2007 – 2012 (‰)

<table>
<thead>
<tr>
<th>Year / month</th>
<th>N</th>
<th>NE</th>
<th>E</th>
<th>SE</th>
<th>S</th>
<th>SW</th>
<th>W</th>
<th>NW</th>
<th>CALM</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>179</td>
<td>68</td>
<td>46</td>
<td>149</td>
<td>68</td>
<td>51</td>
<td>141</td>
<td>251</td>
<td>48</td>
</tr>
<tr>
<td>2008</td>
<td>186</td>
<td>55</td>
<td>66</td>
<td>189</td>
<td>60</td>
<td>46</td>
<td>125</td>
<td>226</td>
<td>48</td>
</tr>
<tr>
<td>2009</td>
<td>231</td>
<td>132</td>
<td>35</td>
<td>150</td>
<td>74</td>
<td>30</td>
<td>52</td>
<td>248</td>
<td>47</td>
</tr>
<tr>
<td>2010</td>
<td>205</td>
<td>106</td>
<td>66</td>
<td>172</td>
<td>70</td>
<td>38</td>
<td>78</td>
<td>239</td>
<td>26</td>
</tr>
<tr>
<td>2011</td>
<td>214</td>
<td>85</td>
<td>50</td>
<td>157</td>
<td>83</td>
<td>51</td>
<td>84</td>
<td>227</td>
<td>50</td>
</tr>
<tr>
<td>2012</td>
<td>173</td>
<td>87</td>
<td>57</td>
<td>157</td>
<td>67</td>
<td>48</td>
<td>112</td>
<td>266</td>
<td>33</td>
</tr>
</tbody>
</table>

Source: Yearbooks of climatological observations of meteorological stations in the territory of the Slovak Republic in 2007 – 2012, SHMU

Table No. C. II.4./04

Average monthly precipitation amounts for the period 2007 – 2012 in mm (station: Jaslovské Bohunice)

<table>
<thead>
<tr>
<th>Year / month</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>VI</th>
<th>VII</th>
<th>VIII</th>
<th>IX</th>
<th>X</th>
<th>XI</th>
<th>XII</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>54.8</td>
<td>40.5</td>
<td>59.3</td>
<td>0.3</td>
<td>58.6</td>
<td>30.4</td>
<td>36.7</td>
<td>51.4</td>
<td>128.6</td>
<td>37.8</td>
<td>42.8</td>
<td>25.1</td>
</tr>
<tr>
<td>2008</td>
<td>27.1</td>
<td>21.1</td>
<td>42.1</td>
<td>35.2</td>
<td>49.9</td>
<td>81.3</td>
<td>132.0</td>
<td>48.7</td>
<td>51.6</td>
<td>24.9</td>
<td>31.1</td>
<td>38.4</td>
</tr>
<tr>
<td>2009</td>
<td>31.0</td>
<td>60.1</td>
<td>58.9</td>
<td>7.8</td>
<td>58.1</td>
<td>121.5</td>
<td>61.0</td>
<td>49.8</td>
<td>9.5</td>
<td>52.3</td>
<td>50.2</td>
<td>69.1</td>
</tr>
<tr>
<td>2010</td>
<td>65.1</td>
<td>31.5</td>
<td>20.7</td>
<td>64.8</td>
<td>163.8</td>
<td>88.8</td>
<td>91.2</td>
<td>121.4</td>
<td>96.3</td>
<td>26.4</td>
<td>60.9</td>
<td>39.4</td>
</tr>
<tr>
<td>2011</td>
<td>32.7</td>
<td>8.0</td>
<td>35.5</td>
<td>31.7</td>
<td>62.4</td>
<td>141.9</td>
<td>81.6</td>
<td>15.6</td>
<td>23.0</td>
<td>35.2</td>
<td>1.0</td>
<td>31.3</td>
</tr>
<tr>
<td>2012</td>
<td>57.6</td>
<td>29.0</td>
<td>5.9</td>
<td>15.5</td>
<td>45.1</td>
<td>40.1</td>
<td>81.9</td>
<td>13.1</td>
<td>29.6</td>
<td>80.5</td>
<td>23.8</td>
<td>64.9</td>
</tr>
</tbody>
</table>

Source: Yearbooks of climatological observations of meteorological stations in the territory of the Slovak Republic in 2007 – 2012, SHMU

Meteorological conditions at Jaslovské Bohunice in the last 35 years:

- Average air temperature (°C): 9.4
- Maximum air temperature (°C): 36.6
- Minimum air temperature (°C): -26.1
- Average temperature of the coldest month (January) (°C): -1.5
- Average temperature of the warmest month (July) (°C): 19.5
- Average air humidity (%): 75.0
- Average annual precipitations (mm): 533.0
- Prevailing wind direction: NW
- Average wind speed (m/s): 3.9
- Average number of days with snow cover: 40.0
- Average snow height (in cm) in winter (November - March): 5.3
- Maximum snow height (in cm) in the last 35 years: 47.0
In terms of risk assessment, the data on the extreme precipitations is also important, it was determined as 65 L/s/ha (5.85 mm for 15 minutes).

II.5. AIR POLLUTION CONDITION

In relation to common pollutants it can be stated that the specified affected territory does not contain any area of controlled air quality and that as at 2012, it contained over twenty large and medium pollution sources registered in the NEIS system (National Emission Information System). Their list and summary of emission quantities from individual sources for 2012 is included in the respective Chapter C.II.15.

The immission situation for common pollutants is not monitored in the affected territory. The closest monitoring stations are situated in Trnava, on the Kollárova Street, and in this case it is a background measuring station for an urban area, which is not relevant for the territory under solution.

Thus, to express the air pollution in the territory of interest, the outputs of the environmental regionalization of the SR (2010) will be used. According to it, the average annual concentration of \( \text{SO}_2 \) in the territory of interest and in its surroundings ranges from 1.001 to 5.0 \( \mu \text{g/m}^3 \) (limit 20 \( \mu \text{g/m}^3 \)), the concentration of \( \text{PM}_{10} \) ranges from 20.01 – 30.00 \( \mu \text{g/m}^3 \) (limit 40 \( \mu \text{g/m}^3 \)), the concentration of \( \text{NO}_2 \) ranges from 5.1 – 10.0 \( \mu \text{g/m}^3 \) (limit 40 \( \mu \text{g/m}^3 \)), the concentration of \( \text{CO} \) ranges from 200.1 – 600 \( \mu \text{g/m}^3 \) (without any limit). Other monitored elements evaluated within the regionalization included \( \text{Pb} \) (the range 0.011 – 0.020 \( \mu \text{g/m}^3 \), limit 0.5 \( \mu \text{g/m}^3 \)), benzene (the range 0.8 – 1.2 \( \mu \text{g/m}^3 \), limit 5 \( \mu \text{g/m}^3 \)), average concentrations for ground ozone (the range 50.001 – 60 \( \mu \text{g/m}^3 \cdot \text{h} \), limit for human health protection 120 \( \mu \text{g/m}^3 \cdot \text{h} \)) and the number of cases of exceeding the limit ozone concentration for human health protection (the range 30,001 – 40). When coming closer to the main transport route through the Váh area, an increase in concentrations of pollutants emitted by road traffic is expected.

Based on the synthesis of the above facts as well as other knowledge such as about the presence of significant air pollution sources, summary quantity of emissions etc., the site and its surroundings were classified as areas with moderate air pollution. The affected territory can be classified as low-inverse area.

For illustration/comparison, the following table shows the average values of concentrations of monitored pollutants measured by the closest background monitoring station of the national air quality monitoring network in the municipality Topoľníky in 2010.
Table No. C. II.5./01
Evaluation of air pollution in 2010

<table>
<thead>
<tr>
<th>Station</th>
<th>Average annual concentrations of harmful substances</th>
<th>Number of cases of exceeding the limit concentration of $O_3$ for human health protection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$PM_{10}$ (in µg/m$^3$)</td>
<td>$O_3$ (in µg/m$^3$)</td>
</tr>
<tr>
<td>Topoľníky</td>
<td>23.8</td>
<td>55</td>
</tr>
</tbody>
</table>

In relation to the presence of radioactive substances in the air, their sources in the affected territory include:

- V2 Units of Slovenské elektrárne (SE EBO V2 NPP),
- V1 Units of Jadrová a vyraďovacia spoločnosť (JAVYS, a.s., V1 NPP) – under decommissioning,
- A1 Unit under decommissioning of Jadrová a vyraďovacia spoločnosť (JAVYS, a.s., A1 NPP),
- other nuclear installations of JAVYS:
  - NI RAW TCT (RAW treatment and conditioning technologies),
  - NI ISFS (Interim spent fuel storage facility at Jaslovské Bohunice).

Gaseous emissions are monitored and evaluated in all cases in relation to the determined guide values (annual limits). Information for the SE-EBO operation is (along with the evaluation of liquid radioactive discharges) published on a regular basis (once per month) at the web site: [http://www.seas.sk/sk/spolocnost/zivotne-prostredie/vplyv-prevadzok/atomove-elektrarne-bohunice](http://www.seas.sk/sk/spolocnost/zivotne-prostredie/vplyv-prevadzok/atomove-elektrarne-bohunice).

The evaluations of the gaseous discharges from the Proposer's operations (JAVYS, a.s.) along with other information (once per month, too) are published at the web site: [http://www.javys.sk/sk/informacny-servis/eko-informacie](http://www.javys.sk/sk/informacny-servis/eko-informacie)

The summary of radioactive gaseous discharges on the site for the documented year 2013 is included in Chapter C.II.15.

II.6. HYDROLOGICAL CONDITIONS

SURFACE WATER STREAMS
As regards hydrography, the axis of the territory under assessment is the river Váh flowing about 8 km to the East from the premises of the NI Jaslovské Bohunice. In the 1940s and 1950s, a system of hydroelectric plants was built on the river Váh (Váh Cascade). At present, only a part of the flow runs in the original river trough, the most part is diverted to the Biskupice channel (from Trenčianske Biskupice to Piešťany) and Drahovce channel (from Drahovce to Leopoldov).

The territory under assessment belongs to the basin of the lowland river Dudváh, which flows into Váh about 16 km to the SSE near the municipality Siladice. The territory of interest of the NI area is drained by the right-side tributary of the Horný Dudváh river, through the channel Manivier, which begins on the premises of the NI Jaslovské Bohunice and after about 4.5 km it meets the Horný Dudváh river, in the cadastre of the municipality Žlkovce.
The long-term flows of Dudváh at its mouth are in the following table.

Table No. C. H.6./01

Average monthly flows of Dudváh at Siladice [m$^3$.s$^{-1}$] (years 1931 – 1960)

<table>
<thead>
<tr>
<th>Station name</th>
<th>XI</th>
<th>XII</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>V</th>
<th>VI</th>
<th>VII</th>
<th>VIII</th>
<th>IX</th>
<th>X</th>
<th>Average annual flow [m$^3$.s$^{-1}$]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Siladice (Dudváh)</td>
<td>0.81</td>
<td>0.86</td>
<td>1.16</td>
<td>2.33</td>
<td>2.53</td>
<td>1.72</td>
<td>1.36</td>
<td>1.18</td>
<td>0.80</td>
<td>0.87</td>
<td>0.62</td>
<td>0.67</td>
<td>1.24</td>
</tr>
</tbody>
</table>

Another small river Blava flows between the premises of the NI and the municipality Jaslovské Bohunice.
The elevation difference of about 11m in the East at a distance of approximately 3 km separates the premises from the flat and in this part also sufficiently wide Váh valley.

Taking into account the distance of the rivers, the terrain and elevation of the sites we can say that the NI area cannot be directly jeopardised by floods from the nearby water course and hydroelectric dams.

**WATER RESERVOIRS**
The nearest water reservoir representing also a source of cooling water for the Jaslovské Bohunice NPP is the reservoir Slnava at Váh near Piešťany (about 10 km beeline).
Several artificial reservoirs – gravel pits are situated along the Drahovce channel near the municipality Drahovce.
At the foot of the Small Carpathians, to the east from the premises of the NI Jaslovské Bohunice, there are several water reservoirs serving as water sources for irrigation or recreation (water reservoir Dubová – 6 km far from the NPP; water reservoir Boleráz – 14 km), or fish farming ponds (Horná Krupá ponds – 10 km).

**SPRINGS AND SPRING AREAS**
In the wider surroundings of the affected territory, there is a water source at Dechtice, or Dobrá Voda (water source Dobrá Voda – Dechtice). Its yield is 60 L.s$^{-1}$. It supplies water to the Trnava group water supply system. Most settlements of the affected territory are supplied with drinking water from the water source Veľké Orvište in the Piešťany District.

**THERMAL AND MINERAL SPRINGS**
No sources of mineral or thermal waters or their protection zones are registered or recorded in the affected territory or its surroundings. The nearest mineral and thermal waters are in Piešťany.

**TERRITORIES PROTECTED BY WATER MANAGEMENT**
The territory under assessment does not include any territory protected by water management pursuant to Articles 31 – 34 of Act No. 364/2004 Coll. on waters and on the amendment to Act No. 372/1990 Coll. on offences as amended (Water Act).
Regulation of the Ministry of Environment of the Slovak Republic No. 211/2005 Coll. laying down the list of water-management-important water and water supply streams assigns the rivers Dolný and Horný Dudváh under the hydrological numbers 4-21-10-009 and 4-21-16-045 to the water streams important in terms of water management.
II.7. FAUNA AND FLORA

FAUNA
In the surroundings of the NI Jaslovské Bohunice, the character of animal communities is typical for
the agricultural and cultural residential country, with the prevalence of field monocultures, with a low
species diversity and abundance. The species bound to the accompanying vegetation of water courses
or to the line vegetation around the roads are present in broader surroundings.

FLORA
The territory under assessment belongs to the cultural country with the prevailing agricultural
production. The degree of biodiversity in the agricultural country is very low.
The potential natural vegetation of the Trnava Loess Table would be grass steppe with xerophilic
vegetation or peri-Pannonian oak and hornbeam forests (C - common oak, European hornbeam, with
broad-leaved Solomon's-seal in the undergrowth – according to Š. Maglocký, Country Atlas of the
Slovak Republic, 2002).
On the hill slopes, there would be oak forests (Qc - Turkey oak, mountain oak, Dalechampii oak,
Quercus Pedunculiflora, with mountain sedge, Lembotropis Nigricans, Kashubian Vetch, Pulmonaria
Mollis and Poa Angustifolia in the undergrowth).
In the bottomland of lowland streams, so-called hard flood-plain forests would grow – i.e. ash-elm-
oak forests (U – field elm, European white elm, English oak, with devil's wood in the bush etage and
with wild garlic and yellow anemone in the undergrowth.
The original vegetation of the affected territory was mostly converted into agriculturally intensively
used areas, also surrounding the nuclear installations. At present, the vegetable communities of the
agricultural landscape are represented by secondary vegetable communities (ruderal communities and
agricultural monocultures).
The original vegetable communities were only preserved on small islands and on safe sites, in
particular along water streams.

PROTECTED, PRECIOUS AND ENDANGERED SPECIES AND BIOTOPES
In the place of proposed technology siting, there is no evidence of occurrence of protected, precious
or endangered vegetable or animal species, however, an isolated occurrence of such individual cannot
be excluded.

SIGNIFICANT MIGRATION CORRIDORS OF ANIMALS
In general, significant migration corridors of animals are ecologically important segments of the
landscape, often the line vegetation communities. Their function consists in the interconnection of
bio centres of various levels. They were assigned the statute of biocorridors within the territorial
system of ecological stability (see Chapter III.2.2.).

II.8. LANDSCAPE STRUCTURE, LANDSCAPE, SCENERY, LANDSCAPE
STABILITY AND PROTECTION

LANDSCAPE STRUCTURE, SCENERY, LANDSCAPE
The premises of JAVYS, a.s. are situated in flat terrain and characterised by the nuclear power plant's
structures, access roads and hard surfaces. Within the broader surroundings, the area of the nuclear
power plant with the dominant cooling towers represents an element of landscape structure that is clearly identifiable with the elements of uniqueness.

Within the framework of the landscape structure of the affected municipalities, arable lands prevail followed by the areas of residential building of rural character. Within the framework of arable land, the occurrence of game refuges is not rare and occasionally self-seeded trees occur. There is bank vegetation and non-forest tree vegetation along most water courses. The typical structural elements of the landscape of the solved site also include the premises of agricultural cooperatives, private gardens and technical infrastructure elements.

II.9. PROTECTED AREAS PURSUANT TO SPECIAL REGULATIONS AND THEIR PROTECTION ZONES

The affected territory and its surroundings are situated in the territory with the first degree of landscape and nature protection in accordance with Act No. 543/2002 Coll. on landscape and nature protection (as amended), i.e. it does not interfere with any protected areas or other landscape and nature protection elements.

Out of the territorially specified sites declared by the mentioned act, there is no protected territory with an area exceeding 1000 ha in the vicinity of the affected municipalities (State Nature Protection SR, 2013). The closest large-area protected site is the Small Carpathians Protected Landscape Area. The territory is situated to the west of the affected municipalities at a distance of about 12 km (beeline). It is the only large-area protected vineyard territory with the prevalence of broadleaved forests with the occurrence of beech, ash, maple, and linden. Among the non-original trees, sweet chestnut can be found here.

In the broader surroundings of the affected territory, there are several protected areas, natural reservations and natural monuments with the degrees of protection III, IV or V. The protected areas Dedova jama, Malé vážky and the natural reservation Sedliská are situated closest to the territory solved. To the west of the affected territory there are other protected territories, at a distance of about 13 km it is the natural monument Čertov žľab, national natural reservation Hlboča, national natural monument Driny and more to the west the national natural reservation Záruby, natural reservation Čierna skala, protected area Všivavec, natural reservation Skalné okno, national reservation Lošonský háj and natural reservation Bolehlav. There are registered protected territories - the natural reservation Katarina, natural monument Ľahký kameň, natural reservation Čerenec, natural reservation Chriň, natural reservation Lančársky Dubník, natural reservation Orlie skaly, natural reservation Pod holým vrchom, natural monument Malá Pec, national monument Veľká Pec and protected area Sĺňava at a distance of 7 km to the north of the affected sites. At a distance of 13 km to the south there is the protected area Trnavské rybníky, more to the south there is the rprotected area Vlčkovský háj.
Fig. No. 23: Protected territories in the vicinity of the affected territory (prepared according to the Ministry of Environment of the Slovak Republic and Slovak Environmental Agency, Centre of Environmentalism and Informatics, 2013)

Territories with European importance:

- SKUEV0175 Sedliská with an area of 46.09 ha (about 12 km to the south-east of the NI premises)
- SKUEV0074 Dubník (about 20 km to the south of the assessed territory)
- SKUEV0278 Brezovské Karpaty (about 15 km to the north-west of the assessed territory)
- SKUEV0277 Nad vinicami (about 18 km to the west of the NI premises).

The affected territory does not interfere with protected bird areas or territories of European importance (sites NATURA 2000). The closest protected bird area is the Protected Bird Area SKCHVU054 Špačince-Nižná Fields, which was declared in order to provide the favourable state of the biotopes of a bird species with a European importance and the migratory saker falcon and to provide for the conditions of its survival and reproduction. This protected bird area interferes directly with the cadastral territories of some affected municipalities, such as the cadastral territories Jaslovce, Bohunice, Radošovce or Malženice, and the smallest distance between its boundary and the boundary of Jaslovské Bohunice NI premises is to the north of the NI - about 1 km.

Other close protected bird areas include SKCHVU014 Small Carpathians, whose boundary runs about 11 km to the north and 19 km to the west of the NI premises. Other protected bird areas situated in the broader surroundings of the affected territory include SKCHVU026 Slňava (about 12 km to the north-east of the NI premises) and SKCHVU032 Trnava Ponds (about 17 km to the south-west of the NI premises), which was in 2010 excluded from the list of NATURA 2000 sites by Government Resolution of the SR No. 345/2010 Coll.
The territories of European importance situated in the broader surroundings of the affected territory include SKUEV0267 Biele hory (about 21 km to the west of the NI premises), SKUEV0174 Lindava (about 27 km to the south-west of the NI premises), SKUEV0277 Nad vinicami (about 18 km to the west of the NI premises), SKUEV0175 Sedliská (about 12 km to the south-east of the NI premises), SKUEV0074 Dubník (about 20 km to the south of the NI premises), SKUEV0506 Orlie skaly (about 15 km to the north of the NI premises).

**Fig. No. 24: NATURA 2000 sites in the vicinity of the affected territory (prepared according to the Ministry of Environment of the Slovak Republic and Slovak Environmental Agency, Centre of Environmentalism and Informatics, 2013)**

In the affected territory, there are no trees declared protected by Act of the National Council of the Slovak Republic No. 543/2002 Coll. on nature and landscape protection as amended.

In the affected territory, there are no protected water management areas in accordance with Act No. 364/2004 Coll. as amended.

**II.10. TERRITORIAL SYSTEM OF ECOLOGICAL STABILITY**

In the prepared general building scheme of the cross-regional territorial system of ecological stability, the affected territory with the adjacent territory was evaluated as a territory with a low ecological stability. The primary reasons include the wide utilisation of the territory for agricultural purposes, a great share of arable land and built-up territory and, on the contrary, low share of forests (Aurex, 1999).

In 2002, a collective of authors prepared a new regional territorial system of ecological stability of the Trnava District, in accordance with which the regional biocorridor Blava was established representing the main skeleton of the local territorial system of ecological stability. The corridor of
the water course Blava flows from NW to SE at a distance of approximately 1700 m to the west of the premises of the NI complex.

The site of interest does not interfere with other elements of the territorial system of ecological stability defined at a local level, for example within the framework of the Land-Use Plan of the municipality Jaslovské Bohunice (Odnoga et al., 2007) or in Amendments 01/2008 to the Land-Use Plan of the municipality Veľké Kostoľany (Čuperka, Kováč et al., 2008).

II.11. POPULATION

Settlements, History and Demography

The municipalities, whose cadastral territory is directly affected by the premises of the set of nuclear installations, include Jaslovské Bohunice, Veľké Kostoľany, Pečeňady and Ratkovce. Other affected municipalities, whose built-up areas are situated in the territory specified as the affected one for the needs of this Report (a circle with a radius of 5 km with the centre at the site of the ISFS), include Radošovce, Žlkovce, Nižná, Malženice and Dolné Dubové.

The above municipalities are situated in the Trnava self-governing region in the districts of Trnava, Piešťany and Hlohovec.

Jaslovské Bohunice

Modern history of the municipality Jaslovské Bohunice started on 12 July 1958, when the municipalities Jaslovce and Bohunice united. The municipality Paderovce joined them 18 years later. The first written record mentioning Bohunice is from 1113. Paderovce were mentioned in the records for the first time only in 1333 and Jaslovce were first time documented in 1438. All the three parts of Jaslovské Bohunice – Jaslovce, Bohunice and Paderovce – have always been close to each other. It is also proved by their common patron, St. Michael Archangel, who became a dominant of historical seals.

Table No. C. II.11./01a

<table>
<thead>
<tr>
<th>Permanently living population</th>
<th>Share of women in the permanently living population (in %)</th>
<th>Labour force*</th>
<th>Share of labour force in the permanently living population (in %)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>total</td>
<td>men</td>
<td>women</td>
<td>total</td>
</tr>
<tr>
<td>1992</td>
<td>998</td>
<td>994</td>
<td>49.9</td>
</tr>
</tbody>
</table>

* data from the Census of inhabitants, houses and flats from 2001 (Statistical Office SR, 2002)

Table No. C. II.11./01b

<table>
<thead>
<tr>
<th>Permanently living population</th>
<th>0 – 14 years old</th>
<th>15-59 years old</th>
<th>women 15-54 years old</th>
<th>men 60+ years old</th>
<th>women 55+ years old</th>
<th>Age unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>331</td>
<td>686</td>
<td>607</td>
<td>368</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Veľké Kostoľany

In 1945, the municipality Kostoľany (or also Veľké Kostoľany) united with the municipality Zákostoľany, thus creating one big municipality. Zákostoľany was the second village that came into existence under the castle. It lay behind the church ("za kostolom"), and it got the name according to
it - Zákostoľany. It was mentioned in 1457 and it belonged to the Nitra Castle, later it was owned by the Andrássy family line.

The first written mention of the municipality appeared in 1209, in the document of Hungarian King Andrew II. St. Vitus Church is mentioned for the first time in 1229.

Table No. C.II.11./02a

**Basic data on the population – Veľké Kostoľany (Statistical Office SR, 2011)**

<table>
<thead>
<tr>
<th>Permanently living population</th>
<th>men</th>
<th>women</th>
<th>Share of women in permanently living population (in %)</th>
<th>Labour force*</th>
<th>Share of labour force in the permanently living population (in %)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>1386</td>
<td>1372</td>
<td>49.7</td>
<td>1262</td>
<td>705</td>
</tr>
<tr>
<td></td>
<td>705</td>
<td>557</td>
<td></td>
<td></td>
<td>45.8</td>
</tr>
</tbody>
</table>

* data from the Census of inhabitants, houses and flats from 2001 (Statistical Office SR, 2002)

**Table No. C.II.11./02b**

**Permanently living population – Veľké Kostoľany (Statistical Office SR, 2011)**

<table>
<thead>
<tr>
<th>Permanently living population</th>
<th>0 – 14 years old</th>
<th>15-59 years old</th>
<th>women 15-54 years old</th>
<th>men 60+ years old</th>
<th>women 55+ years old</th>
<th>Age unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>454</td>
<td>935</td>
<td>808</td>
<td>561</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

**Pečeňady**

In the oldest written documents, it is mentioned as villa Bissenorum (Byssenorum) -1208-1209, 1216, and villa Beseneu (1254). Translated it means the village Pečenehov. The municipality Peťová was united with Peče)ady in 1898. From 1920, there were two name versions – Pečeňady and Pečeňany. Since 1927, the name of the municipality Pečeňady has been used.

The oldest settling in the area of the municipality dates back to the Neolithic and Eneolithic Ages. Archaeological discoveries from the Bronze Age and Middle Ages come from this municipality.

**Table No. C.II.11./03a**

**Basic data on the population – Pečeňady (Statistical Office SR, 2011)**

<table>
<thead>
<tr>
<th>Permanently living population</th>
<th>living</th>
<th>Share of women in permanently living population (in %)</th>
<th>Labour force*</th>
<th>Share of labour force in the permanently living population (in %)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>total</td>
<td>men</td>
<td>women</td>
<td>total</td>
<td>men</td>
</tr>
<tr>
<td></td>
<td>248</td>
<td>261</td>
<td>509</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td>51.3</td>
<td></td>
<td>233</td>
<td>103</td>
</tr>
</tbody>
</table>

* data from the Census of inhabitants, houses and flats from 2001 (Statistical Office SR, 2002)

**Table No. C.II.11./03b**

**Permanently living population – Pečeňady (Statistical Office SR, 2011)**

<table>
<thead>
<tr>
<th>Permanently living population</th>
<th>0 – 14 years old</th>
<th>15-59 years old</th>
<th>women 15-54 years old</th>
<th>men 60+ years old</th>
<th>women 55+ years old</th>
<th>Age unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>69</td>
<td>176</td>
<td>149</td>
<td>115</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

**Ratkovce**

The municipality Ratkovce was first time mentioned in 1388 as Ratkolch, included in the property of the Čachtice Castle. It belong to the Castle's property, later the municipality became the property of the Church, Trnava parsonage and then of the chapter house. On 1 January 1974, the municipalities Ratkovce and Žlkovce united into one political municipality called Žlkovce. Later, in 1990, the municipalities were divided again, thus, today, Ratkovce is an independent municipality. Most inhabitants were employed in agriculture. The soil around the municipalities has been the best soil on the Trnava Plain.

**Table No. C. II.11./04a**

**Basic data on the population – Ratkovce (Statistical Office SR, 2011)**

<table>
<thead>
<tr>
<th>Permanently living population</th>
<th>0 – 14 years old</th>
<th>15-59 years old</th>
<th>15-54 years old</th>
<th>60+ years old</th>
<th>55+ years old</th>
<th>Age unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>total</td>
<td>288</td>
<td>39</td>
<td>105</td>
<td>86</td>
<td>58</td>
<td>-</td>
</tr>
</tbody>
</table>

*R data from the Census of inhabitants, houses and flats from 2001 (Statistical Office SR, 2002)*

**Radošovce**

In the past, the municipality belonged to the property Dobrá Voda, which was owned successively by several feudalists such as the Stibors, Országhs and Erdődys. The first written mention of the municipality can be found in the document from 1208/1209, through which Hungarian King Andrew II presented the ground Veľké Kostoľany to his Master Sebes and where, in defining the boundaries of the area, also the municipality Radichov – Radošovce is mentioned. The second document is from 1229, and it determines the boundaries of the area of the municipality Bohunice (Baguna). In this document, the municipality Radošovce is mentioned under the name Wradichov.

The population has dealt with agriculture and viticulture since ancient times. Till the end of the 18th century, the area included, in addition to the arable land, groves, meadows, pastures and vineyards. All these cultures were gradually converted into arable soil. In the past, two mills were in operation in the municipality – The Upper Mill (stone mill) and the Lower Mill (originally a wooden one). After the reconstruction of the former upper mill, the Mill (Mlyn) recreational facility at Radošovce was put into operation (1990).
Table No. C.II.11./05a
Basic data on the population – Radošovce (Statistical Office SR, 2011)

<table>
<thead>
<tr>
<th>Permanently living population</th>
<th>Share of women in the permanently living population (in %)</th>
<th>Labour force*</th>
<th>Share of labour force in the permanently living population (in %)*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>total</strong></td>
<td><strong>men</strong></td>
<td><strong>women</strong></td>
<td><strong>total</strong></td>
</tr>
<tr>
<td>416</td>
<td>202</td>
<td>214</td>
<td>51.4</td>
</tr>
</tbody>
</table>

* data from the Census of inhabitants, houses and flats from 2001 (Statistical Office SR, 2002)

Table No. C. II.11./05b
Permanently living population – Radošovce (Statistical Office SR, 2011)

<table>
<thead>
<tr>
<th>Permanently living population</th>
<th>0 – 14 years old</th>
<th>15-59 years old</th>
<th>15-54 years old</th>
<th>60+ years old</th>
<th>55+ years old</th>
<th>Age unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>total</strong></td>
<td><strong>men</strong></td>
<td><strong>women</strong></td>
<td><strong>men</strong></td>
<td><strong>women</strong></td>
<td><strong>men</strong></td>
<td><strong>women</strong></td>
</tr>
<tr>
<td>416</td>
<td>47</td>
<td>145</td>
<td>127</td>
<td>97</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Žlkovce
The actual cadastre of the municipality was populated already in the Neolithic Age, in the 5th millennium BC.
The first written mention of the municipality is from the dispute between Kosma and Peter, the sons of Hemyruch from the municipality Slažany and the Jobagyns (occupiers of the Castle Solgadyos - Solgadien) for the municipality Bohunice. In 1229, the municipality was settled by German guests and at that time, it belonged to the Nitra Castle. According to the inspection of the land area in 1258, the municipality Žuk was owned by the Johanniter Order from Malženice.
In 1974, the municipality Žlkovce united with the municipality Ratkovce into one administrative entity called Žlkovce. Thus, Ratkovce became a borough. In 1990, the joint existence of municipalities Žlkovce and Ratkovce in one administrative entity ended - on 30 August 1990, the Ratkovce part of the municipality achieved independence again.

Table No. C.II.11./06a
Basic data on the population – Žlkovce (Statistical Office SR, 2011)

<table>
<thead>
<tr>
<th>Permanently living population</th>
<th>Share of women in the permanently living population (in %)</th>
<th>Labour force*</th>
<th>Share of labour force in the permanently living population (in %)*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>total</strong></td>
<td><strong>men</strong></td>
<td><strong>women</strong></td>
<td><strong>total</strong></td>
</tr>
<tr>
<td>637</td>
<td>319</td>
<td>318</td>
<td>49.90</td>
</tr>
</tbody>
</table>

* data from the Census of inhabitants, houses and flats from 2001 (Statistical Office SR, 2002)

Table No. C. II.11./06b
Permanently living population – Žlkovce (Statistical Office SR, 2011)

<table>
<thead>
<tr>
<th>Permanently living population</th>
<th>0 – 14 years old</th>
<th>15-59 years old</th>
<th>15-54 years old</th>
<th>60+ years old</th>
<th>55+ years old</th>
<th>Age unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>total</strong></td>
<td><strong>men</strong></td>
<td><strong>women</strong></td>
<td><strong>men</strong></td>
<td><strong>women</strong></td>
<td><strong>men</strong></td>
<td><strong>women</strong></td>
</tr>
<tr>
<td>637</td>
<td>84</td>
<td>220</td>
<td>191</td>
<td>142</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>
Nižná

The land area of the municipality was largely settled already in the Neolithic and Eneolithic Ages. From the 16th century, the feudal family of Onorys had its seat in this area - a manor house and a farm. A more coherent medieval settlement right in the centre of the actual residential area of the municipality is proved by the findings of fragments from the middle of the 13th century.

Nižná is mentioned in written documents relatively late but the written record from Nižná itself is relatively old. It is a letter of Adam Onory dated 5 March 1549, written to Trnava Reeve Wolfgang Mair, in which he asks the town of Trnava to send a headsman to Nižná because he wants to punish some crime.

After frequent and destroying wars against Turkeys, at the beginning of the 17th century Nižná was almost completely destroyed. Around 1688, the family of Onorys died and Nižná was assigned to the royal chamber and in 1688, it was purchased by Christopher Erdödy for 10,000 gold coins. Thus, the village became part of the Dobrá Voda dominion for almost 250 years.

Table No. C.II.11./07a

<table>
<thead>
<tr>
<th>Permanently living population</th>
<th>Living</th>
<th>Share of women in permanently living population (in %)</th>
<th>Labour force*</th>
<th>Share of labour force in the permanently living population (in %)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>total</td>
<td>men</td>
<td>women</td>
<td>total</td>
<td>men</td>
</tr>
<tr>
<td>522</td>
<td>257</td>
<td>265</td>
<td>269</td>
<td>138</td>
</tr>
</tbody>
</table>

* data from the Census of inhabitants, houses and flats from 2001 (Statistical Office SR, 2002)

Table No. C. II.11./07b

<table>
<thead>
<tr>
<th>Permanently living population</th>
<th>0 – 14 years old</th>
<th>15-59 years old</th>
<th>15-54 years old</th>
<th>60+ years old</th>
<th>55+ years old</th>
<th>Age unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>522</td>
<td>81</td>
<td>171</td>
<td>138</td>
<td>132</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Malženice

The first signs of settlement date back to the Paleolithic Age. Although the first written record of Malženice is from 1113, it is indisputable that the municipality came into existence earlier. In 1268, King of Hungary Bela IV gave the municipality Malženice to the sons of Trnava Reeve Conch-Kunz. In the deed of donation, the municipality is called Maniga. From the 14th to the 16th century, the function and respect of the municipality rose thanks to the granted privileges that were not typical even for the municipalities with a higher number of inhabitants at that time. It was the right to establish and collect toll, the right to arrange regular markets and in particular the right to use the name oppidum for the village. At that time it was a liege village. The copy of the deed is stored at the Malženice parsonage.
Table No. C. II.11./8a
Basic data on the population – Malženice (Statistical Office SR, 2011)

<table>
<thead>
<tr>
<th>Permanently living population</th>
<th>Share of women in the permanently living population (in %)</th>
<th>Labour force*</th>
<th>Share of labour force in the permanently living population (in %)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>total</td>
<td>men</td>
<td>Women</td>
<td>total</td>
</tr>
<tr>
<td>1391</td>
<td>672</td>
<td>719</td>
<td>51.7</td>
</tr>
</tbody>
</table>

* data from the Census of inhabitants, houses and flats from 2001 (Statistical Office SR, 2002)

Table No. C. II.11./8b
Permanently living population – Malženice (Statistical Office SR, 2011)

<table>
<thead>
<tr>
<th>Permanently living population</th>
<th>0 – 14 years old</th>
<th>15-59 years old</th>
<th>15-54 years old</th>
<th>60+ years old</th>
<th>55+ years old</th>
<th>Age unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>total</td>
<td>257</td>
<td>449</td>
<td>437</td>
<td>248</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Dolné Dubové

The oldest written name of the municipality is from 1113, in the Latin language Dumba. Later, there were other names, such as Domb, Dombóc. The word domb, of Slavic origin can be found even today in the mispronunciations of the Hungarian language having the meaning "oak covered hill”. From the name Dubové, the Hungarian language still has the name Dombó or Domboc.

In the last centuries of Hungary, the municipality got the name Also Dombó. Since the establishment of the Czechoslovak republic it has been called Dolné Dubové.

Table No. C. II.11./9a
Basic data on the population – Dolné Dubové (Statistical Office SR, 2011)

<table>
<thead>
<tr>
<th>Permanently living population</th>
<th>Share of women in the permanently living population (in %)</th>
<th>Labour force*</th>
<th>Share of labour force in the permanently living population (in %)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>total</td>
<td>men</td>
<td>Women</td>
<td>total</td>
</tr>
<tr>
<td>637</td>
<td>311</td>
<td>326</td>
<td>51.2</td>
</tr>
</tbody>
</table>

* data from the Census of inhabitants, houses and flats from 2001 (Statistical Office SR, 2002)

Table No. C. II.11./9b
Permanently living population – Dolné Dubové (Statistical Office SR, 2011)

<table>
<thead>
<tr>
<th>Permanently living population</th>
<th>0 – 14 years old</th>
<th>15-59 years old</th>
<th>15-54 years old</th>
<th>60+ years old</th>
<th>55+ years old</th>
<th>Age unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>637</td>
<td>84</td>
<td>221</td>
<td>198</td>
<td>134</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>
INDUSTRY

The industrial production in the affected territory is mainly focused on the production of electric energy from nuclear fuel. The other industrial building production in the affected municipalities has only a supplementary character, larger industrial production operations in the territory include the bituminous mixture plant at Veľké Kostoľany, concrete plant at Malženice (AGS Trnava, s.r.o.), etc. Near the municipality Malženice, there is a combined cycle power plant in operation, with an installed capacity of 430 MW and annual production capacity of 3 billion kWh of electric energy, however, it has been put out of operation since 2013 and its further operation in the future is uncertain (technological equipment dismantling and sale abroad is under consideration).

AGRICULTURE

The production capability of the agricultural lands in the affected territory is very good. Thus, after the production of electric energy, the agricultural production is the second dominant production branch in the affected territory. It is focused in particular on the vegetable production (densely-sown cereals, maize, sugar beet, oil plants, technical agricultural plants, to a smaller extent root crops and vegetables). In particular the concentrated cattle and pigs breeding is characteristic for the animal production.

FOREST MANAGEMENT

Hardwood species are dominant in the territory (in particular oaks, beeches and poplars). However, forest coverage is small in the affected territory.

TRANSPORT

In the affected districts Trnava, Hlohovec and Piešťany, in which the affected territory is situated, there are three main types of transport: road, railway and air transports (Piešťany military airport). A protected airspace is declared over the premises of the NI Bohunice - LZP29 (a radius of 2000 m, a height of 1500 m).

The road network of the districts consists of Class I, II and III roads and the highway D1 Bratislava – Trnava – Piešťany – Trenčín, however, there are only Class I, II and III roads in the affected territory. The road connection of the premises of the NI Jaslovské Bohunice is provided by road No. III/504015 from two directions – a connection road through Jaslovské Bohunice to Trnava and the road to the municipality Žlkovce to the Class I road Bratislava – Trenčín (about 5.5 km).

The railway tracks in the affected district include in particular the tracks Bratislava – Trnava – Žilina, Leopoldov – Hlohovec – Nitra, Trnava – Sered’, Trnava – Jablonica – Kúty and Leopoldov – Sered’. However, the above railway tracks do not run through the affected territory. The connection with the railway track is solved as an independent siding, which was originally built for the needs of the A1 NPP and today, it serves for the whole premises. The siding 8.1 km long is connected to the railway track in the direction Piešťany – Trnava – Bratislava and is terminated in the railway station Veľké Kostoľany with a holding track for its operation.

TECHNICAL INFRASTRUCTURE

Drinking water supplies

The drinking water supplies in the affected territory are provided by the public water supply systems utilising the sources of ground waters in the area of Dobrá Voda, Dechtice and Trnava about 550 L.s\(^{-1}\) (Trnava District), the water sources Veľké Orvište and Rakovice – about 300 L.s\(^{-1}\) (Piešťany District)
and the water source near Leopoldov 100 L.s\(^{-1}\) (Hlohovec District). Additional smaller water sources are also used. The premises of the NI Jaslovské Bohunice is supplied with drinking water from a group water supply system of the Trnava water management company, which uses the water sources Veľké Orvište or Dobrá Voda.

**Electric energy supplies**
Thanks to the utilisation of the affected territory, there are dense electric overhead and cable lines. The most important ones include the VHV southern line in the direction of the NI Jaslovské Bohunice area - the western edge of the municipality Malženice. The second important branch is the eastern VHV branch in the direction SW - the northern edge of the municipality Pečeňady - Madunice. Distribution networks for individual municipalities are connected to the regionally important VHV and HV distribution systems.

**Gas supplies**
The gas supply network in the broader area consist of transit, international and domestic gas distribution networks providing natural gas supplies to the local municipalities. Within 10 km from the NI Jaslovské Bohunice, the routes of the following gas pipelines are situated:
- the transit gas line (3x DN 1 200, 1x DN 1 400) from the Russian Federation to western Europe states,
- the very high pressure gas line (1x DN 500) from the distribution node Špačince to Nové Mesto nad Váhom,
- the international gas line Bratstvo (1x DN 700) – Ukraine – Slovak Republic – Czech Republic,
- the Váh-Region gas line (1x DN 300) – Bratislava – Trnava – Trenčín.

**Waste water removal and treatment**
All the affected municipalities except Nižná have a sewerage system.

**SERVICES**
The amenities in the affected municipalities depends on the number of inhabitants in the municipality. In the affected municipalities with a smaller number of inhabitants, the services and civic amenities are governed by demand, the number of users and economic efficiency. Therefore, only a limited spectrum of services is provided (in particular grocery stores and a hospitality centre). The sports facilities include in particular football fields, the cultural ones are represented by libraries.

The municipalities with the number of inhabitants over 500 provide more complex and broader services and have more extensive civic amenities, however, their development and types also depend on the above indicators. The basic spectrum is supplemented with small non-food shops, gasoline station, automatic teller machine, post, physician's outpatient centre or pharmacy etc.

**RECREATION AND TOURISM**
With respect to the settlement character in the affected territory, the conditions for short-term – daily recreation of the inhabitants are provided by their own houses or local sports facilities (school gyms, football fields, ..). However, in general, the affected territory does not have suitable conditions for weekend recreation or holiday recreation. The closest recreation resorts for weekend and holiday recreation include the resort Slňava near Piešťany or the Protected Landscape Area Small Carpathians.
II.12. CULTURAL AND HISTORICAL MONUMENTS AND SITES

The following monumental structures are registered by the Monuments Board of the Slovak Republic as at 1 January 2010:

- Crucifixion from the 19th century (Malženice)
- Empiric cross at the cemetery from 1800 (Malženice)
- Tombstones and cross from the second half of the 18th century (Malženice cemetery)
- Three-aisled Renaissance Virgin Mary Assumption Church from the second half of the 13th century (Malženice)
- Single-aisle Gothic Virgin Mary Assumption Church from the first half of the 14th century (Dolné Dubové)
- Memorial plaque of J.I.Bajza (Dolné Dubové)
- Single-aisle Late Gothic St. Vitus Church from 1464 (Veľké Kostoľany)
- Statue of St. John the Baptist from 1728 (Pečeňady)
- Three-wing manor house and park from 1820 (Pečeňady)
- Single-aisle Renaissance St. Stephen Church from 1682 (Nižná)
- Baroque tombstone from 1788 (Nižná cemetery)
- Statue of Christ on the cross from 1805 (Ratkovce cemetery)
- Cemetery cross from the same period (Ratkovce)
- Cemetery cross on a pillar from the same period (Ratkovce)
- Statue of Blessed Virgin Mary from 1805 (Ratkovce cemetery)
- Late Baroque statue of Virgin Mary on a pillar from 1796 (Ratkovce)
- Single-aisle Late Baroque Rosary Virgin Mary Church from 1756 (Ratkovce)
- Fragments of tombstones from the second half of the 18th century (Žlkovce cemetery)

However, directly on the plots affected by the activity under assessment and in the close vicinity, there are no cultural or historical monuments.

II.13. ARCHAEOLOGICAL SITES

Directly on the plots affected by the activity under assessment and in the close vicinity, there are no known archaeological sites. However, in the cadasters of the affected municipalities there were several archaeological findings (see Chapter C.II.11.).

II.14. PALAEONTOLOGICAL AND SIGNIFICANT GEOLOGICAL SITES

There are no significant palaeontological sites and geological sites in the affected territory.

II.15. CHARACTERISTICS OF THE EXISTING SOURCES OF ENVIRONMENTAL POLLUTION AND THEIR ENVIRONMENTAL IMPACTS

AIR POLLUTION

Directly on the premises of the NI Jaslovské Bohunice, several air pollution sources are operated - JAVYS, a.s. operates one large air pollution source (the start-up and standby boiler room), medium air pollution sources (e.g. a gas boiler room, LOOS boiler, diesel generator), the radioactive waste incineration plant, a small air pollution source – a diesel generator at the ISFS.
Table No. C.II.15./01
Summary of emissions of common pollutants from certain sources directly on the premises of the 
NI Jaslovské Bohunice (2013)

<table>
<thead>
<tr>
<th>Sources</th>
<th>Fuel</th>
<th>Pollutant (kg) – year 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Natural gas (m³)</td>
<td>PM</td>
</tr>
<tr>
<td>NaRK</td>
<td>6,699</td>
<td>0.508</td>
</tr>
<tr>
<td>LOOS boiler</td>
<td>131</td>
<td>0.009</td>
</tr>
<tr>
<td>Gas boiler room</td>
<td>97,520</td>
<td>7.410</td>
</tr>
<tr>
<td>Diesel generator (structure 585d:V1)</td>
<td>0.672</td>
<td>0.954</td>
</tr>
<tr>
<td>Diesel generator of the ISFS</td>
<td>1.344</td>
<td>1.908</td>
</tr>
</tbody>
</table>

Table No. C.II.15./02
Summary of emissions of common pollutants from the BRWTC incineration plant (2012, 2013)

<table>
<thead>
<tr>
<th>Source</th>
<th>Year 2012 (kg)</th>
<th>Year 2013 (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCl</td>
<td>23.840</td>
<td>0.550</td>
</tr>
<tr>
<td>HF</td>
<td>0.820</td>
<td>0.570</td>
</tr>
<tr>
<td>Hg+Tl+Cd</td>
<td>0.054</td>
<td>0.069</td>
</tr>
<tr>
<td>As+Ni+Cr+Co</td>
<td>0.290</td>
<td>0.372</td>
</tr>
<tr>
<td>Pb+Cu+Mn</td>
<td>0.240</td>
<td>0.307</td>
</tr>
<tr>
<td>SO₂</td>
<td>1070.0</td>
<td>29.360</td>
</tr>
<tr>
<td>NOₓ</td>
<td>62.930</td>
<td>247.500</td>
</tr>
<tr>
<td>CO</td>
<td>17.170</td>
<td>35.730</td>
</tr>
<tr>
<td>PM</td>
<td>3.550</td>
<td>4.890</td>
</tr>
<tr>
<td>C орг</td>
<td>11.00</td>
<td>6.890</td>
</tr>
<tr>
<td>Operating hours</td>
<td>2671</td>
<td>3251</td>
</tr>
</tbody>
</table>

In terms of air pollution, the Trnava Region is among the areas with the lowest load in the Slovak Republic. Thanks to the wind conditions, the territory is sufficiently ventilated, which provides good dispersion of pollutants. At present, air pollution due to particulate matters (PM10) represents the biggest problem of air quality in Slovakia as well as in most European countries. The Trnava Region belongs to:

Group 1 for PM10 pollutants - a zone, in which the level of pollution by one or several pollutants is higher than the limit or the limit increased by the tolerance value, if any. For ozone, the zones and agglomerations, in which the ozone concentration is higher than the target value for ozone.

Group 3 for sulphur dioxide, nitrogen dioxide, carbon monoxide, benzene, PM2.5 – the zones, in which the level of air pollution is below the limits or target values. For ozone, the zones and
agglomerations, in which the ozone concentration is lower than the long-term target value for ozone. The immission situation of common pollutants is not monitored in the affected territory.

**Contamination of the air by radionuclides**

The sources of *gaseous discharges of isotopes* in the air in the affected territory include:

- V2 nuclear power plant of Slovenské elektrárne (SE EBO (V2 NPP)),
- nuclear installations of JAVYS, a.s.
  - V1 NPP under decommissioning,
  - A1 NPP under decommissioning.
  - RAW treatment and conditioning technologies (e.g. BRWTC (Bohunice RAW Treatment Centre, bituminisation line, active water treatment plant etc.),
  - ISFS (Interim spent fuel storage facility at Jaslovské Bohunice).

Gaseous emissions are monitored and evaluated in all cases in relation to the determined guide values (annual limits). Information for the SE-EBO operation is (along with the evaluation of liquid radioactive discharges) published on a regular basis (once per month) at the web site: [http://www.seas.sk/sk/spolocnost/zivotne-prostredie/vplyv-prevadzok/atomove-elektrarne-bohunice](http://www.seas.sk/sk/spolocnost/zivotne-prostredie/vplyv-prevadzok/atomove-elektrarne-bohunice).

The data on the discharges from the operation of the V2 NPP NI for 2013 are included in the following table:
Table No. C.II.15./03

Discharges of radioactive substances from SE EBO to the atmosphere with guide values

<table>
<thead>
<tr>
<th>Analysis/Parameter</th>
<th>Discharge from year begin</th>
<th>Guide value</th>
<th>% of guide value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alpha aerosols</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pu-238</td>
<td>3,324</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pu-239+240</td>
<td>842</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Am-241</td>
<td>867</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P_sum alpha</td>
<td>1,939</td>
<td>20000</td>
<td>0,0082</td>
</tr>
<tr>
<td>Gamma aerosols</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Co-60</td>
<td>130</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mn-54</td>
<td>145</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fe-59</td>
<td>135</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Co-57</td>
<td>443</td>
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</tr>
<tr>
<td>Co-58</td>
<td>516</td>
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<tr>
<td>Co-60</td>
<td>204</td>
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<td></td>
</tr>
<tr>
<td>Zr-65</td>
<td>143</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Se-75</td>
<td>616</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nb-95</td>
<td>312</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zr-65</td>
<td>180</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ru-103</td>
<td>772</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rh-106</td>
<td>176</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ag-110m</td>
<td>1336</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sr-124</td>
<td>224</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cs-134</td>
<td>806</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ce-137</td>
<td>881</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ce-141</td>
<td>109</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ce-144</td>
<td>340</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hf-181</td>
<td>71</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ta-181</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P_sum Gamma</td>
<td>6,194</td>
<td>80000</td>
<td>0,0077</td>
</tr>
<tr>
<td>As-75</td>
<td>944,925</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aerosols - strontium</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sr-89</td>
<td>34,023</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sr-90</td>
<td>34,412</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P_sum strontium</td>
<td>65,438</td>
<td>140000</td>
<td>0,0488</td>
</tr>
<tr>
<td>Noble gases V2</td>
<td>T8q</td>
<td>4,327</td>
<td></td>
</tr>
<tr>
<td>P_sum noble gases</td>
<td>T8q</td>
<td>4,327</td>
<td>0,0015</td>
</tr>
<tr>
<td>Iodine-131</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-131 ast.</td>
<td>0,192</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-131 rec.</td>
<td>0,210</td>
<td></td>
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</tr>
<tr>
<td>P_sum I-131</td>
<td>0,402</td>
<td>80000</td>
<td>0,0008</td>
</tr>
</tbody>
</table>

Note:
* Radionuclides included in the balances according to Item 8 of the Decision of the Public Health Authority OOZPŽ/6774/2011 (only measured values), the activities included in the calculation of doses
** Radionuclide not included in the balances according to Item 8 of the Decision of the Public Health Authority OOZPŽ/6774/2011 (short-lived radionuclide with half life shorter than 8 days, the activity included in the calculation of doses
The Proposer's sources are also monitored and evaluated, the outputs are published at the Proposer's web site in the form of "Eco-information".

**Table No. C. II.15./04: Data from measurements and evaluations of radioactive discharges from the JAVYS, a.s. sources to the atmosphere – 2013**

**Discharges of radioactive substances from JAVYS, a. s. to the atmosphere 2013**

<table>
<thead>
<tr>
<th>Discharge type</th>
<th>Obj. 46/A</th>
<th>% of annual</th>
<th>Obj. 46/B</th>
<th>% of annual</th>
<th>Obj. 808</th>
<th>% of annual</th>
<th>MISP</th>
<th>% of annual</th>
<th>V1</th>
<th>% of annual</th>
<th>JAVYS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air quantity</td>
<td>m³</td>
<td></td>
<td>i</td>
<td></td>
<td>i</td>
<td></td>
<td>i</td>
<td></td>
<td>i</td>
<td></td>
<td>i</td>
</tr>
<tr>
<td>N</td>
<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
</tr>
<tr>
<td>Cs-137</td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
</tr>
<tr>
<td>27.53</td>
<td>-</td>
<td></td>
<td>0.01E+08</td>
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<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
</tr>
<tr>
<td>Co-60</td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
</tr>
<tr>
<td>0.01E+08</td>
<td>-</td>
<td></td>
<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
</tr>
<tr>
<td>Sr-90</td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
</tr>
<tr>
<td>0.01E+08</td>
<td>-</td>
<td></td>
<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
</tr>
<tr>
<td>Zn-65</td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
</tr>
<tr>
<td>0.01E+08</td>
<td>-</td>
<td></td>
<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
</tr>
<tr>
<td>Y-90</td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
</tr>
<tr>
<td>0.01E+08</td>
<td>-</td>
<td></td>
<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
</tr>
<tr>
<td>Na-22</td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
<td></td>
<td>[Bq]</td>
</tr>
<tr>
<td>2.04E+08</td>
<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
<td></td>
<td>0.01E+08</td>
</tr>
</tbody>
</table>

Within the framework of the control of gaseous discharges impacts, the activity of aerosols is also evaluated within the monitoring programme of the NI Jaslovské Bohunice. Aerosol sampling is carried out in 24 stations situated around the premises of Jaslovské Bohunice by means of large-size sampling devices with the air flow of about 200 m³/h. The filters are analysed after a 14-day exposure.

The activity of fallouts is also monitored. These are sampled by means of large-size sampling devices at selected stations along with the samples of aerosols on water surface. Fallout samples are
processed using the method of large-volume coagulation with the following gamma spectrometry analysis. The results of monitoring of the surroundings of the Bohunice site are summarised in the material "Radiation protection at JAVYS, a.s. and the impacts of the premises of JAVYS, a.s., 2013" available to the affected municipalities.

The general evaluation along with other monitored indicators prove only a minimum impact of the SE-EBO and JAVYS, a.s. premises on the environment.

**WATER POLLUTION**

**Surface waters**

In 2010, based on the approved "Water condition monitoring programme for 2010“, the quality indicators of surface waters were monitored at 277 monitored places in Slovakia. Out of the total number of 277 monitored places, the compliance with surface water quality requirements pursuant to Annex No. 1 to Government Order No. 269/2010 Coll. could be evaluated within the range of the monitored indicators in 42 of them, the non-conformity was evaluated in most of them, i.e. in as many as 235 monitored places. The failure to meet the quality requirements was found for one or several indicators. In as many as 85% of the monitored places, the required water quality was not identified.

As regards the evaluated indicators, the surface water quality requirements specified in Annex No. 1 to Government Order No. 269/2010 Coll. were met in all monitored places in the following ones:

- **Part A** - general indicators: total organic carbon, dissolved substances (dried and annealed), magnesium, chlorides, sodium, free ammonia, organic nitrogen, phenol index, surface active substances, non-polar extractive substances, chlorobenzene, dichlorobenzenes
- **Part B** - non-synthetic substances: chromium, nickel
- **Part C** - synthetic substances: alachlorine, anthracene, benzene, brominated diphenyl ether, chloroalkanes C10-C13, chlorofenvinphos, chlorpyriphos, cyclodiene pesticides (aldrin, dieldrin, endrin, isodrin), DDT total, 1,2-dichloroethane, dichloromethane, diuron, endosulphan, hexachlorobutadiene, hexachlorocyclohexane (lindane), isoproturon, benzo(a)pyrene, ΣBenzo(b)fluoranthene+benzo(k)fluoranthene, simazine, tetrachloromethane, trichloroethylene, trifluralin, aniline, bisphenol A, clopyralid, desmedipham, dibutyl phthalate, diphenylamine, ethofumesate, phanthrene, formaldehyde, glyphosate, MCPA, pendimethalin, 1,1,2-trichloroethane, toluene, vinyl benzene, xlenes
- **Part D** - radioactivity indicators: total volume alpha and beta activity, tritium, strontium, caesium

As the affected territory belongs to the partial river-basin of Váh, we only provide information regarding this river-basin. In the partial river-basin of Váh, 98 samples were taken, of which 87 did not meet the requirements in one or more indicators. Water quality evaluation in terms of surface water contamination by specific pollutants showed that the most frequent non-conformity of annual average concentrations or highest admissible concentrations was found for mercury (in total 17 monitored places) and the majority of these cases was identified on the water courses in the partial river-basin of Váh (as many as 14 times). The second most important contaminant were cyanides analysed as total cyanides, which exceeded the environmental standards of quality in 15 monitored places, adsorbable organic halides (AOX) and DEHP in 10 places, 4-methyl-2,6-tert-butylphenol in 8 places and zinc in five places. Out of the other indicators listed in Parts B and C of Annex No. 1 to Government Order No. 269/2010 Coll., the environmental standards of quality for annual average
Concentrations or highest admissible concentrations were exceeded in maximum one to three monitored places for arsenic, atrazine, naphthalene, lead, 4-nonylphenol, tetrachloroethylene, trichloromethane, fluoranthene, cadmium, ΣBenzo(g,h,i)perylene + Indeno(1,2,3-cd)pyrene, copper. The pollution was identified most frequently in the streams of the partial river-basins of Váh, Hron and Morava.

The failure to meet the surface water requirements pursuant to Annex No. 1 to Government Order No. 269/2010 Coll. was mainly found in the monitored places that are situated under significant pollution sources, tributaries as well as in the monitored places with several adverse factors, of which the most important is the unfavourable ratio of water flow in the water body to the quantity (and pollution) of the waste waters discharged.

The monitoring places with the worst water quality in the long term include the ones with a combination of other negative factors, such as a water body with a low flow flowing through an agricultural area and the presence of a large agglomeration and point sources. The examples include a system of monitored lowland channels and smaller water courses. In the Váh Region, which belongs to the most industrially developed areas of Slovakia, there is a non-negligible impact of the considerable regulation of the main course, because it contains a system of hydroelectric dams and channels.

Contamination of waters by radionuclides
Contamination of released waters as a result of the activity in the nuclear installations of JAVYS, a.s. and SE, a.s. EBO V2 plant is strictly limited and monitored. The limits are derived from potential impacts on the environment and population and they cannot be changed for the approved activity inside the nuclear installation. For every operator, the Public Health Authority of the SR specifies the annual values of liquid discharges, the monitored indicators, the way of monitoring, reporting.

During the operation of nuclear installations, waste waters contaminated by radionuclides are produced, which are according to their character treated as liquid radioactive wastes by means of RAW treatment and conditioning technologies or they are cleaned in special facilities up to the level allowing their release to surface waters.

Multiple inspection mechanisms provide for the observance and check of the limits specified by the decision of the Public Health Authority of the SR (check of the tank before emptying, the approval process for emptying, continual monitoring of the discharged waste waters at two measuring structures).

Waste waters discharged by sewerage system at JAVYS, a.s. include:

A) rainwater
   - it is discharged into the water body Dudváh,
   - the volume activity of discharged waters for A and B branches is continuously monitored in structure 880 of the V1 NPP.

B) sink water
   - it is discharged into the structure of sink water treatment – BIOKLAR (mechanical and biological treatment plant),

C) pipeline collector - SOCOMAN
   - it is discharged into the water body Váh.

The river Váh is the water body for all service, sink (after treatment at the WWTP) and low-level waste waters produced on the premises of JAVYS, a.s., which are led through the pipeline collector Socoman through structure 368 (measuring structure for both quantity and quality of waste waters discharged). The waste waters from the premises of JAVYS, a.s. (piping capacity 354 L/s) are mixed in front of structure No. 614 with waste waters of the company SE, a.s. - EBO V2, which are discharged into the pipeline collector through the second branch (piping capacity 143 L/s) from the
premises of the V2 power plant and water of both entities are discharged together to the water body Váh. The resulting pipeline collector of dry-weather waters Socoman removes waste waters using gravity through the Drahovce channel (river km 0.4), in the cadastral territory Madunice and then to the river Váh (river km 6.4). The collector is on 10.8 km led on the right bank of the Manivier channel to the edge of the municipality Žlkovce, where it crosses to its left bank. It crosses Dudváh and continues to the right-bank termination with a tide gate at the Madunice site, the capacity of piping from structure 614 is 497 L/s.

Waters from the system from the surface run-off and clean Váh waters from the operation, which are not polluted by the technology process from the premises of JAVYS, a.s. without quantity limitation are discharged into the water body Dudváh through the open Manivier channel. It is possible to also discharge the industrial waste waters in case of planned outage of failure or unexpected event on the pipeline collector Socoman, on condition that the fact will be notified to the respective state water administration authority, Slovak Environmental Inspection and Public Health Authority of the Slovak Republic. The sampling checkpoint is structure No. 900:V1 (physical and chemical indicators) and structure No. 880 (activity monitoring).

The following tables show the data on the quantity of discharged waste waters and on the level of activity contained in the waters.

Table No. C.II.15./05
Summary of quantities of discharged waste waters to the water bodies Váh and Dudváh in 2009 – 2013 from JAVYS, a.s.

<table>
<thead>
<tr>
<th>Water bodies</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>VÁH</td>
<td>2,112,228</td>
<td>1,981,462</td>
<td>961,117</td>
<td>378,904</td>
<td>415,288</td>
</tr>
<tr>
<td>DUDVÁH</td>
<td>315,360</td>
<td>315,360</td>
<td>315,360</td>
<td>295,560</td>
<td>115,487</td>
</tr>
</tbody>
</table>

Table No. II.15./06
Váh water body - discharge of low-level waters

<table>
<thead>
<tr>
<th>Year 2013</th>
<th>Activities of radionuclides in Váh water body waste waters</th>
<th>A1 premises and RAW TCT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>V1 premises, ISFS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>CFP (MBq)</td>
<td>tritium (GBq)</td>
</tr>
<tr>
<td>Total</td>
<td>17,330</td>
<td>12,254</td>
</tr>
</tbody>
</table>

* limit of CFP (corrosion and fission products) is 13,000 MBq ; limit for tritium is 2000 GBq (since 20 July 2011)

** limit of CFP (corrosion and fission products) is 12,000 MBq ; limit for tritium is 10000 GBq

Dudváh water body - discharge of low-level waters
No low-level waters were discharged to the water body Dudváh in 2013.
Based on the analysis of discharges of radioactive substances from JAVYS, a.s. it can be stated that the quantities of the radioactive substances released into the hydrosphere in no case exceeded the authorised annual limits for the discharges of radioactive substances issued by supervisory authorities.

The company SE, a.s. - EBO 2 plant is another source of active discharges at this site and the data for 2013 are included in the following table:

**Table No. C.II.15./07**

**Discharges of radioactive substances from SE EBO to the hydrosphere, water bodies Váh, Dudváh**

<table>
<thead>
<tr>
<th>Analysis/Parameter</th>
<th>Discharge from year begin (MJ)</th>
<th>Guide value</th>
<th>% of guide value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume of discharged water</td>
<td>n3</td>
<td>21132</td>
<td></td>
</tr>
<tr>
<td>Total beta activity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sum beta</td>
<td>GBq</td>
<td>18,321</td>
<td></td>
</tr>
<tr>
<td>SUM K</td>
<td>GBq</td>
<td>18,321</td>
<td></td>
</tr>
<tr>
<td>Tritium H-3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-H-3 EBO tank</td>
<td>GBq</td>
<td>9760,732</td>
<td>48,804</td>
</tr>
<tr>
<td>H-3 JAVYS steam</td>
<td>GBq</td>
<td>0,968</td>
<td>0,006</td>
</tr>
<tr>
<td>H-3 Váh SUM</td>
<td>GBq</td>
<td>9761,718</td>
<td>200000</td>
</tr>
<tr>
<td>H-3 through structures</td>
<td>GBq</td>
<td>47,316</td>
<td>23,668</td>
</tr>
<tr>
<td>H-3 Dudváh SUM</td>
<td>GBq</td>
<td>47,316</td>
<td>280</td>
</tr>
</tbody>
</table>

**Corrosion and fission products - alpha**

<table>
<thead>
<tr>
<th>Element</th>
<th>MBq</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pu-236</td>
<td>1,359</td>
<td></td>
</tr>
<tr>
<td>Pu239+240</td>
<td>10,564</td>
<td></td>
</tr>
<tr>
<td>Am-241</td>
<td>4,105</td>
<td></td>
</tr>
<tr>
<td>K_sum alpha</td>
<td>0,016</td>
<td></td>
</tr>
</tbody>
</table>

**Corrosion and fission products - gamma**

<table>
<thead>
<tr>
<th>Element</th>
<th>MBq</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Co-51</td>
<td>3,333</td>
<td></td>
</tr>
<tr>
<td>Mn-54</td>
<td>1,345</td>
<td></td>
</tr>
<tr>
<td>Fe-59</td>
<td>0,831</td>
<td></td>
</tr>
<tr>
<td>Co-57</td>
<td>0,280</td>
<td></td>
</tr>
<tr>
<td>Co-58</td>
<td>0,973</td>
<td></td>
</tr>
<tr>
<td>Co-60</td>
<td>1,723</td>
<td></td>
</tr>
<tr>
<td>Zn-65</td>
<td>0,961</td>
<td></td>
</tr>
<tr>
<td>Se-76</td>
<td>0,539</td>
<td></td>
</tr>
<tr>
<td>Zr-95</td>
<td>0,734</td>
<td></td>
</tr>
<tr>
<td>Nb-96</td>
<td>0,681</td>
<td></td>
</tr>
<tr>
<td>Pu-103</td>
<td>0,404</td>
<td></td>
</tr>
<tr>
<td>Pb-210</td>
<td>1,249</td>
<td></td>
</tr>
<tr>
<td>Ag-110m</td>
<td>1,351</td>
<td></td>
</tr>
<tr>
<td>Sn-124</td>
<td>4,440</td>
<td></td>
</tr>
<tr>
<td>Hf-181</td>
<td>0,004</td>
<td></td>
</tr>
<tr>
<td>K_sum gamma</td>
<td>24,681</td>
<td></td>
</tr>
</tbody>
</table>

**Strontium gamma**

<table>
<thead>
<tr>
<th>Element</th>
<th>MBq</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sr-89</td>
<td>42,647</td>
<td></td>
</tr>
<tr>
<td>Sr-90</td>
<td>331,182</td>
<td></td>
</tr>
<tr>
<td>K_sum strontium</td>
<td>0,374</td>
<td></td>
</tr>
</tbody>
</table>

**Corrosion and fission products - sum**

<table>
<thead>
<tr>
<th>Element</th>
<th>MBq</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrosion and fission products</td>
<td>25,071</td>
<td>13000</td>
</tr>
</tbody>
</table>

Note: *the radionuclides included in the balances according to Item 8 of Decision of the Public Health Authority OOZPŽ/6774/2011 (only the measured values), activities included in the calculation of doses
**Ground waters**

Similarly to surface water quality, the quality of ground waters is assessed. The following map (M. Zlocha, B. Antal, 2003) shows the division of ground water to two categories – ground water suitable for drinking purposes (the limit 0) and ground water unsuitable for drinking purposes (the limit 1). For ground waters, too, the updated limits are used for the assessment of ground water suitability for drinking purposes (Government Order of the Slovak Republic No. 354/2006 Coll. laying down the requirements for water intended for human consumption and monitoring of quality of water intended for human consumption as amended). The issue of drinking waters in the affected territory and its surroundings, however, is always based on the same thing - the reason of unsuitability of ground water for drinking purposes is dominantly the contents of nitrous substances from the agricultural production.

**Fig. No. 24: Map sector showing the ground water quality according to suitability for drinking purposes**

![Map showing ground water quality](source)

The consequences of radioactive discharges in the form of activity of surface, drinking and ground waters are monitored within the framework of radiation monitoring of the surroundings of the NI Jaslovské Bohunice. The results are compared in individual reports, the general evaluation along with other monitored indicators prove only a minimum impact of the SE-EBO and JAVYS, a.s. premises on the environment.

**SOIL POLLUTION**

As the results of the regional geochemical survey of soils show (the last data from 2002 – J. Čurlík, P. Ševčík, 2002, a follow-up to the previous sampling for the preparation of the Geochemical Atlas –
Part: Soils of authors J. Čurlík, P. Ševčík, 1999), the affected territory does not show anomalous contents of contaminating substances in soil (a sampling density of about one sample per 3 km$^2$).

**Fig. No. 25: A sector of pedgeochemical association map**

The closest specified aerial anomalies are anomalies of nickel (Ni) in the soils of the Váh alluvial bottomland, to the east of the affected territory. The contents of Ni in soils depend on the Ni content in pedogenic substrata (e.g. in the mineralised zone of the Small Carpathians between Cajla and Pernek). Nickel enrichment can be also found in humus-rich alluvial soils of Váh (black earth).
Nickel gets here from certain mesozoic complexes of the klippen belt. It proves its relatively good migration ability and that the surface horizons of soils are enriched with nickel probably thanks to the bond with organic substances and secondary sesquioxides to such an extent that they exceed A-limits in many places.

Barium contents are also increased (Ba) – e.g. a sample of soil to the west of the Jaslovské Bohunice NI premises exceeding the B-limit (1000 mg/kg). The source of Ba is probably also from the pedogenic substratum, Ba is bound with feldspar-rich rock (granites of the Small Čarpathians). It is released very slowly and does not represent any relevant environmental issue. Along with land wastes, feldspars were brought by the brooks flowing from the mountains, therefore we can find its increased contents in the alluvial deposits of Váh, where detritic fragments from other crystalline rocks of the Čarpathians are brought in.

The values exceeding the B-limits (1000 mg/kg) indicate the presence of baryte (BaSO$_4$), which can come from the mineralised zones of the Small Čarpathians.

Within the framework of Jaslovské Bohunice NI radiation monitoring, the soil activity in the surroundings is monitored, as well. The soils are sampled once a year. The collections are divided in two groups; for the grassy lands – they are performed in spring, and for the arable lands – they are performed in autumn. The determined parameter is the mass activity of the natural radionuclides (uranium decay chain – $^{226}$Ra, thorium decay chain - $^{232}$Th and the $^{40}$K isotope) and the mass activity of $^{137}$Cs or other artificial radionuclides. The field INSITU gamma spectrometry is performed twice a year, in spring and autumn. The measurement is performed in the vicinity of the dosimetry stations. The INSITU measurements also include the measurement of the absorbed dose rate at a particular place and soil sampling. The monitoring results confirm the fact that the contents of natural and artificial radionuclides in the soil are close to the average contents for the whole region, without distinguishable anomalies, caused by the Jaslovské Bohunice NI operation.

**Noise and Vibrations**

In addition to the nuclear installations, there is also a combined cycle power plants near the municipality Malženice with an installed capacity of 430 MW and annual production of 3 billion kWh of electricity (it is not in operation at present). There are no other significant sources of noise and vibrations here. Noise from nuclear installation operations is in terms of broader surroundings negligible. Moreover, the closest dwelling is at a distance of about 3 km, where the level of noise from SW is virtually zero. However, the road and railway transport represents a significant source of noise and vibrations in the affected area.

**Sources of Radiation and Physical Fields**

Dose rates in the surroundings of the Jaslovské Bohunice NI premises are measured continuously on 24 stations of the teledosimetric system. The rates of spatial dose equivalent are evaluated on a regular basis and the evaluation is published at the web site: http://www.seas.sk/spolocnost/zivotne-prostredie/vplyv-prevadzok/atomove-elektrarne-bohunice. The dose rates measured at other "non-nuclear" sites are also published at the site for comparison.
For a summarising image of previous information about the exposure of individual environmental components to radioisotopes (including the food chain) generated in the environment due to the presence of the Jaslovské Bohunice NI premises, we present the radiation load on the population in the surroundings of SE-EBO and JAVYS, a.s. operations for the last 10 years (Source: the report "Radiation protection at JAVYS, a.s. and impacts of the JAVYS, a.s. premises on the surroundings, 2013"). The higher values of doses in comparison with the period before 2007 can be substantiated by using the new calculation programme ESTE AI, which uses, for dose load calculation in the surroundings, the conservative factors of inhalation, a higher consumption of water and higher speed of breathing in individual groups, based on the application of the requirements of Government Order of the Slovak Republic No. 345/2006 Coll. and Regulation of the Ministry of Health of the Slovak Republic No. 545/2007 Coll.
**Fig No. 26: Radiation load on the population in the surroundings of SE EBO and JAVYS, a.s. for the last 10 years**

The biggest annual effective doses E of a representative person from the population calculated from liquid and gaseous discharges of radioactive substances from the SE EBO and JAVYS premises (since 2011 only from JAVYS)

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**HEALTH CONDITION OF THE POPULATION**

Quality of the environment is one of the factors affecting population's health and life expectancy. Thus, its favourable development is one of the preconditions for achieving positive trends in the basic indicators of population's health condition. Health is defined as a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. Health is the result of relations between the human organism and social-economic, physical, chemical and biological factors of the environment, working environment and way of life.

The influence of the population's health condition has many determinants, the most important are: lifestyle, life conditions, genetic predisposition and level of health service.

From the actual statistically expressed characteristics of population's health condition for the affected districts Trnava, Piešťany and Hlohovec (data for smaller territorial units are not processed statistically), we chose the following data.

In 2012, the life expectancy at birth (i.e. the expected number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life) in the Slovak Republic was 72.47 in men and 79.45 years in women, which is despite the increasing trend of recent years still below the limit of the Western European average. According to the statistical data, in the period of 2009-2013, the life expectancy in the affected district Hlohovec in men was 72.01 years and in women 80.86 years, in the affected district Piešťany in women 80.44 years and in men 73.61 years, and in the affected district Trnava in women 81.21 years and in men 73.77 years, which represents in all cases, except for the men in the district Hlohovec, a higher life expectancy than the average in the Slovak Republic (72.7).
The affected districts as well as the whole affected region had in 2012 lower natality in comparison with the Slovak average. However, in general, the Trnava Region with its districts is not among the regions with the highest natality. In the long-term, the highest natality has been in the districts of Eastern Slovakia and Bratislava Region.

Table No. C.II.15./09: Natality in 2012

<table>
<thead>
<tr>
<th>Territory</th>
<th>Number of live-born babies per 1000 inhabitants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hlohovec District</td>
<td>9.5</td>
</tr>
<tr>
<td>Piešťany District</td>
<td>8.4</td>
</tr>
<tr>
<td>Trnava District</td>
<td>10.2</td>
</tr>
<tr>
<td>Trnava Region</td>
<td>9.48</td>
</tr>
<tr>
<td>Slovak Republic</td>
<td>10.27</td>
</tr>
</tbody>
</table>

In terms of another demographic indicator – abortion rate, where in spontaneous miscarriages the environmental aspect plays a role to a certain extent, for example the contents of harmful substances in the air, water, food, one (Trnava District) of the three affected districts exceeds the Slovak average of spontaneous miscarriages.

Table No. C.II.15./10

<table>
<thead>
<tr>
<th>Territory</th>
<th>Spontaneous miscarriages</th>
<th>Artificial abortion</th>
<th>Total (including ectopic pregnancies)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hlohovec District</td>
<td>3.4</td>
<td>3.4</td>
<td>10.2</td>
</tr>
<tr>
<td>Piešťany District</td>
<td>3.7</td>
<td>1.6</td>
<td>7.8</td>
</tr>
<tr>
<td>Trnava District</td>
<td>3.9</td>
<td>4.9</td>
<td>11.0</td>
</tr>
<tr>
<td>Trnava Region</td>
<td>3.8</td>
<td>5.8</td>
<td>11.8</td>
</tr>
<tr>
<td>Slovak Republic</td>
<td>3.8</td>
<td>6.2</td>
<td>12.0</td>
</tr>
</tbody>
</table>

The number of live-born children with congenital anomalies may represent another indicator of the health condition of the population, however, this indicator is affected by several other factors, such as the age of the mother, her behaviour during pregnancy etc. For the two affected districts (Hlohovec and Trnava), the indicator is well below the Slovak average. In 2012, there was no dead-born child with a congenital anomaly in the affected districts. No artificial abortion was carried out in connection with found anomaly.
Table No. C. II.15./11

Number of live-born children with congenital anomalies per 1000 live-born children in 2012

<table>
<thead>
<tr>
<th>Territory</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hlohovec District</td>
<td>27.7</td>
</tr>
<tr>
<td>Piešťany District</td>
<td>28.4</td>
</tr>
<tr>
<td>Trnava District</td>
<td>35.0</td>
</tr>
<tr>
<td>Trnava Region</td>
<td>34.5</td>
</tr>
<tr>
<td>Slovak Republic</td>
<td>34.6</td>
</tr>
</tbody>
</table>

To a certain extent, mortality can be another indicator, although in addition to the population's health condition and health care level, it is also closely related to the age structure of the population, which is also expressed to a certain extent by the average age of the population shown in the table for information.

Table No. C. II.15./12
Mortality in 2012

<table>
<thead>
<tr>
<th>Territory</th>
<th>Number of deaths per 1000 inhabitants</th>
<th>Average age (in 2012)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hlohovec District</td>
<td>8.24</td>
<td>40.2</td>
</tr>
<tr>
<td>Piešťany District</td>
<td>10.9</td>
<td>41.7</td>
</tr>
<tr>
<td>Trnava District</td>
<td>9.08</td>
<td>40.2</td>
</tr>
<tr>
<td>Trnava Region</td>
<td>9.79</td>
<td>40.16</td>
</tr>
<tr>
<td>Slovak Republic</td>
<td>9.70</td>
<td>39.32</td>
</tr>
</tbody>
</table>

Mortality caused by circulatory system diseases and cancer diseases dominate in mortality by causes in the affected districts in the respective year, identically with the situation in entire Slovakia.

Table No. C.II.15./13
The most frequent causes of mortality in 2012 (per 100,000 inhabitants)

<table>
<thead>
<tr>
<th>Cause of death</th>
<th>Hlohovec District</th>
<th>Piešťany District</th>
<th>Trnava District</th>
<th>Slovak Republic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cancer diseases</td>
<td>94</td>
<td>173</td>
<td>314</td>
<td>12,197</td>
</tr>
<tr>
<td></td>
<td>205.4</td>
<td>274.2</td>
<td>242.9</td>
<td>225.6</td>
</tr>
<tr>
<td>Circulatory system</td>
<td>191</td>
<td>383</td>
<td>612</td>
<td>27,773</td>
</tr>
</tbody>
</table>
Health condition of the inhabitants in the surroundings of nuclear power plants was specifically analysed in the paper "Health condition of the population in the surroundings of the Slovakia's nuclear power plants with the emphasis on the analysis of leukaemia mortality" (M. and H. Letkovičová, 2001).

Leukaemia morbidity\(^3\) was in this material evaluated by modern mathematical methods and the analysis of health condition covered both the surrounding of the NI Jaslovské Bohunice and the surroundings of the NI Mochovce.

Based on the performed mathematical analyses for the site Jaslovské Bohunice, the authors conclude that in all monitored time periods, all the tests confirm that leukaemia distribution in all the municipalities in the entire NI emergency zone is accidental and it is not affected by activities in the particular municipality or any external impact, thus it is not affected by the operation of the NI Jaslovské Bohunice.

Further, they concluded:
that the whole NI area is equalised in terms of:
- cancer mortality,
- total gross mortality of the population,
- the number of potentially lost life years per 100,000 inhabitants,
that there are stable indicators (no dynamics, the differences remain the same) of:
- cardiovascular disease mortality,
- premature death percentage,
- percentage of spontaneous miscarriages,
and that there is an increased difference among the sites for the indicator:
  - percentage of prematurely born babies.

---

\(^3\) leukaemia – a group of diseases (diagnoses C91 – C95) manifesting themselves by bone marrow and blood malfunction; they include acute myeloid leukaemia (AML), chronic myeloid leukaemia (CML), acute lymphoblastic leukaemia (ALL) and chronic lymphocytic leukaemia (CLL)
Even a very detailed analysis did not find any directional differences, i.e. the directional effect of NI operation on the population's health conditions in the surroundings up to a distance of 30 km. No aerial worsening of indicators was found and the state of all the monitored indicators is within the Slovak average.

II.16. COMPLETE EVALUATION OF CURRENT ENVIRONMENTAL ISSUES

Based on the data and information mentioned in the previous chapters, the environmental issues of the affected territory and its broader surroundings can be summarised as follows:

- contamination of the surface water courses due to discharging of industrial and sink waste waters,
- ground water pollution due to application of fertilisers from agricultural activities, through the infiltration of the polluted surface waters directly on site also as a consequence of leakage of barriers of the NIs under decommissioning etc.,
- air pollution by mobile sources (road transport) and stationary sources (mostly energy sources and sources connected with agricultural production) and increased dustiness caused by agricultural activities,
- an increased noise load in particular in the surroundings of important transport corridors (roads, railway),
- placing of unauthorised waste dumps,
- decreased ecological stability and insufficiently built territorial system of ecological stability.

II.17. GENERAL ENVIRONMENTAL QUALITY – SYNTHESIS OF POSITIVE AND NEGATIVE FACTORS

Quality of individual environmental components and subsequently general quality of the environment in the territory of interest can be assessed as a synthetic property based on the following characteristics:

- environment vulnerability due to perturbing influences,
- ecological importance of the territory,
- current load on the environment.

Three degrees of relative evaluation were used for vulnerability (bearing capacity):

*low vulnerability* – the component with its auto-regulation processes is able to eliminate the adverse impact of the expected influence of anthropogenic activities, the adverse impact does not have an essential impact on the auto-regulation processes

*medium vulnerability* – the component with its auto-regulation processes is able to partially eliminate the adverse impact of the expected influence of anthropogenic activities, the adverse impact has an essential impact on the auto-regulation processes
high vulnerability – the component with its auto-regulation processes is not able to eliminate the adverse impact of the expected influence of anthropogenic activities, the adverse impact paralyses the auto-regulation processes.

In evaluating the vulnerability of the territory in terms of biodiversity, gene pool and ecological stability, taking into account the identified impacts of the respective activity, we considered in general for example, the character of communities in the affected territory, the level of their quality and variety of representation, with the share of natural or semi-natural elements, etc.

Based on the fact that the affected territory is directly in the place of siting of the activity under assessment represented by a large area of nuclear installations situated in the country consisting of agriculturally managed land with a network of transport and technical infrastructure connecting small municipalities with a character of rural settlements, with a limited representation of USES elements mostly of line character around the water courses (i.e. the territory can be considered a territory with strongly disturbed auto-regulation mechanisms), the vulnerability of biodiversity, gene pool and ecological stability of the affected territory is evaluated as generally medium vulnerability.

The evaluation of sensitivity and vulnerability of the rock mass was carried out in compliance with the principles specified in the STN 44 3705 standard (Evaluation of sensitivity of rocks and vulnerability of rock environment). The vulnerability factors include the geological activities (processes) including the anthropogenic ones that cause the deterioration of quality of individual elements of the geological environment (e.g. a change of ground water level, change of rock humidity, change of rock temperature, rock mass uncovering, etc.).

During the construction of foundations of the designed structures, excavation of building pits and construction of utility networks, the building operations affected mainly the Quaternary complex of loess sediments. Loams (silts) and clays prevail in the complex.

In the sensitivity evaluation, the loess loams (silts) and clays are evaluated as very sensitive rock. According to Table 2 in the standard STN 44 3705, such rock is sensitive to the vulnerability factors connected with the uncovering of the rock mass, changes of humidity and temperature and changes of ground water level, or changes of the hydrogeological regime, changes of terrain surface morphology and seismic quakes.

In this case, the character, intensity of activities and the current available technologies classify the vulnerability of the rock mass under assessment in accordance with the mentioned STN standard as the 2nd degree of vulnerability – very vulnerable environment. In such environment, the rock is mostly sensitive to the vulnerability factors but the available technical measures can mitigate the adverse impacts on the environment. Thus, in this paper we consider them as with medium vulnerability.

Taking into account the identified impacts of the respective activity, in assessing the vulnerability of soils we considered generally, for example, the chemism of soils and the resulting ability of inactivation of pollutants, soil contamination, the ability of pollutant transport, etc. The soils of the directly affected site and its immediate surroundings, which are generally evaluated as non-contaminated or relatively clean, mostly resistant or only slightly prone to acidification, in relation to the risk of contamination of vegetable production by metals as with medium risk, with mostly high and in smaller proportion with medium resistance to intoxication by the acid group of risk metals and a weak to medium resistance to intoxication by the alkaline group of risk metals, with mostly high retention ability and medium permeability etc., are evaluated as soils with medium to low vulnerability.
In assessing the vulnerability of relief, taking into account the identified impacts of the respective activity, we considered in general, for example the surface shape, its horizontal segmentation, the acting relief processes, etc. The relief of the affected site and its surroundings, taking into account its minimum segmentation and sloping rate, as well as with respect to the intensity of exogenous processes (mostly low potential of water and wind erosion) is evaluated as a low-vulnerability relief.

The following was considered in assessing the air vulnerability:
- the current state of air pollution represented by the long-term index of air pollution,
- the existing sources of air pollution represented by the annual emissions of pollutants,
- meteorological conditions.

The air of the affected site, considering the frequency and intensity of the winds providing a good dispersion of the emitted pollutants, which are a combination of emissions in particular from the agricultural production, from the local energy sources, traffic and specific emissions from the operation of the complex of nuclear installations, operations of metal surface treatment etc., can be assessed as with medium vulnerability.

In assessing the vulnerability of ground waters, taking into account the identified impacts of the respective activity, we considered in general, for example the coefficient of permeability of the affected hydrological unit, depth of ground water level, pollution, etc. With respect to the hydrogeological characteristics of the territory showing the ability to isolate the pre-Quaternary ground waters from possible percolations, which was already considered during the selection of the site for nuclear installations siting, but with respect to the less favourable results of local monitoring of pollution of the Quaternary formations of ground waters in the affected territory resulting from the locally non-conforming condition of the protective barriers (e.g. in structure No. 41 originally intended for LRAW underground storage during the operation of the A1 NPP now under decommissioning), intensive agriculture etc., we assess the vulnerability of ground waters as medium.

In assessing the vulnerability of surface waters, taking into account the identified impacts of the respective activity, we considered their susceptibility to pollution depending on the quality and quantity indicators of the affected surface water courses, on the transport routes of pollution as well as on the types of contaminants and possibility of leakage. Their vulnerability in relation to the above mentioned as well as to the identified impacts of the respective activity is evaluated as medium.

In assessing the vulnerability of fauna and flora, taking into account the identified impacts of the respective activity, we considered in general, for example the degree of degradation and violation of their natural biotopes, etc. With respect to the characteristics of the affected territory (see above, for biodiversity vulnerability assessment) we evaluate it in this connection as medium-vulnerable.

In assessing the vulnerability of factors of human life quality and well-being, we considered the quality of individual environmental components affecting the population's health condition, with the data characterising the population's health condition, factors occurring in the territory and affecting human well-being, such as the availability of health care, education, services, job opportunities, transport load etc., as well as the presence of nuclear installations. In relation to the identified impacts of the respective activity, the factors are evaluated as medium vulnerable.
Table No. C. II.17./01
Vulnerability of individual environmental components in the affected territory

<table>
<thead>
<tr>
<th>Environmental component</th>
<th>Vulnerability level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rock mass</td>
<td>Medium vulnerability</td>
</tr>
<tr>
<td>Relief</td>
<td>Low vulnerability</td>
</tr>
<tr>
<td>Ground waters</td>
<td>Medium vulnerability</td>
</tr>
<tr>
<td>Surface waters</td>
<td>Medium vulnerability</td>
</tr>
<tr>
<td>Soils</td>
<td>Medium to low vulnerability</td>
</tr>
<tr>
<td>Air</td>
<td>Medium vulnerability</td>
</tr>
<tr>
<td>Ecological stability</td>
<td>Medium vulnerability</td>
</tr>
<tr>
<td>Fauna and flora</td>
<td>Medium vulnerability</td>
</tr>
<tr>
<td>Comfort and human life quality</td>
<td>Medium vulnerability</td>
</tr>
</tbody>
</table>

In terms of general quality of the environment as a synthetic property we can state that individual environmental components of the affected territory were summarily evaluated as the components with mostly medium vulnerability, that the affected territory consists mostly of sites with small ecological importance and in terms of territory load, it can be stated that in accordance with the environmental regionalization (year 2010) as and output of the process of spatial division of the country on the basis of the set criteria and selected sets of environmental characteristics according to the state quality and trends of changes of the affected environment that the affected territory was assigned quality degrees 3 to 4 out of a 5-point scale, which means moderately deteriorated to deteriorated quality of the environment.

II.18. ASSESSMENT OF THE EXPECTED DEVELOPMENT OF THE TERRITORY IF THE PROPOSED ACTIVITY IS NOT EXECUTED

In case that additional SF storage capacities are not built, operation of the current structure 840M – Interim Spent Fuel Storage Facility will continue until it is full, i.e. till the storage of 14,112 fuel assemblies. This condition should occur in 2022. The mentioned fact has no impact on the current territory but it has impact on the operation of the operation of nuclear power plant units, which are currently in operation at Jaslovské Bohunice and Mochovce sites. After the complete filling of the storage capacities of the storage pools at the reactor hall of the respective unit and if SF storage is not solved in other way or at other site, individual nuclear power plant units would have to be put out of operation.

If the proposed activity is not executed, the influence on the natural environment, landscape and urban complex and land use would persist within the scope of the actual impacts of ISFS operation and other nuclear installations.
II.19. COMPLIANCE OF THE PROPOSED ACTIVITY WITH THE VALID LAND-USE PLANNING DOCUMENTATION

The execution of the proposed activity is situated in the cadastral territory of the municipality Jaslovské Bohunice, which is part of the Trnava self-governing region. In accordance with the Land-Use Plan of the Higher Territorial Unit of the Trnava self-governing region, whose binding part was declared by Government Order of the Slovak Republic No. 183/1998 Coll. dated 7 April 1998 (as amended), the following is required:

- 8.9 to expand the temporary storage of high-level radioactive wastes from the Bohunice Nuclear Power Plant and spent nuclear fuel till the time of disposal to a permanent repository and to ensure safe decommissioning of nuclear energy installations at Jaslovské Bohunice.

Thus, the respective activity is in compliance with the above land-use planning documentation.

Compliance with other strategic documents

The current state of nuclear fuel storage is also discussed in the Strategy of Back-End of Nuclear Energy Peaceful Use approved by Government Resolution No. 26 dated 15 January 2014, which shows the anticipated SF production and states that the capacity of the current ISFS will not be sufficient and it is necessary to build another spent fuel storage facility around 2020. Nuclear energy back-end means the set of activities at the end of the activities connected with peaceful use of nuclear energy.

III. ASSESSMENT OF EXPECTED ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTIVITY INCLUDING THE IMPACTS ON HEALTH AND THEIR ESTIMATED SIGNIFICANCE

III.1. IMPACTS ON THE POPULATION

The directly affected population is the population of the municipality Jaslovské Bohunice because the additional building of the necessary nuclear fuel storage capacity is considered in its cadastral territory near structure 840M (the ISFS building).

For the needs of this material, the population of the municipalities situated in the circle with a radius of about 5 km, with the centre at the site of the proposed technology siting, can also be considered affected population.

Thus, inhabitants of nine municipalities become affected based on this approach:
- Jaslovské Bohunice, Malženice, Radošovce and Dolné Dubové situated in the Trnava District,
- Žlkovce and Ratkovce situated in the Hlohovec District,
- Veľké Kostoľany, Nižná and Pečeňady situated in the Piešťany District.

The nearest residential built-up area in relation to the respective premises of the Proposer is the built-up area of the municipalities Jaslovské Bohunice and Radošovce, at a distance of about 2 km.
Impacts of storage premises construction:
During construction, the surroundings will be affected by the construction activities, which include the road traffic of trucks and building mechanisms producing pollutants from fuel combustion, dust particles and noise. These impacts will be temporary and as they will be carried out mostly on the premises of JAVYS, a.s., they will not represent a significant impact on the population.

Operation impacts:
The additionally built SF storage rooms will be part of operation of the existing nuclear installation "ISFS" therefore, we can assess the impacts of new storage facilities and technological equipment only as a contribution to the actual, direct and indirect impacts on the population.

The positive, however, indirect impacts on the population include the possibility of systematic and complex approach to SF management for the SF from the nuclear power plants in operation in the Slovak Republic.

The potential impacts of the proposed activity on the affected population include its contribution to the radiation load on the territory, which is, however, currently evaluated as negligible. The contribution to liquid discharges is only possible for SF wet storage. With the wet storage technology, the air removed from the structure is filtered, monitored and released into the air. With the expansion of the existing wet storage capacities with conservative approach taking into account the currently real values of limit usage, the maximum assumption of annual limit usage is at the level of 0.2%.

During dry SF storage operation no radioactive substances will be released into the air thanks to the properties of the packaging sets and the building solution of the storage facility structure. Based on the above fact, the storage hall structure will be ventilated in the natural way. The operation of the dry storage facility will not cause liquid discharges.

For the operation of individual nuclear installations, limits of gaseous and liquid discharges are set and also the limit for the effective dose of a representative person of the population caused by the radioactive substances released to the air and surface waters. Operation of the additionally built storage facilities will not represent requirements for a change of the current limits specified by the Public Health Authority of the Slovak Republic.

The current operation of the ISFS observes the set limits with a reserve and the calculated effective dose from all nuclear installations on site for an inhabitant is of lower order than the currently specified limits.

It results from the above-mentioned that a significant increase in use of individual limits set by the decisions will not be recorded and the limit of dose rate specified by the valid decision of the Public Health Authority of the Slovak Republic cannot be exceeded.

In terms of radiation load from transportation of SF it can be stated that all the legislative requirements of radiation protection of population are met during it.
Limited quantities of produced common operating wastes (RAW produced during the activity) will be treated directly at the RAW TCT at Jaslovské Bohunice.

Based on the assessment of all potential outputs from the activity under assessment, i.e. the production of common sink and rain waters, managed and controlled removal of gaseous discharges, waste management etc., they do not represent a source of significant impacts for the affected population.
The impacts on the population in the affected territory are controlled, monitored, evaluated and published and they will also be valid for the proposed new rooms for SF storage.

**Social and economic context**
Very negative impacts on the economy would be caused by the Zero Variant, when a sufficient storage capacity for SF produced by the nuclear power plants would not be provided, which would result in the shutdown of the nuclear power plants in the Slovak Republic. The execution of the proposed variants has an important influence on the social and economic situation it will allow to keep a stable number of jobs providing for the operation of the SF storage and transport technologies as well as the nuclear power plants in operation.

**Health risk assessment**
As it results from the above-mentioned identification of impacts of the proposed activity, only the risks resulting from the connection of the proposed activity with radiation load are potentially relevant in relation to population health.

The other impacts of proposed activity performance, such as emissions of common pollutants and noise (from traffic), limited amounts of sink and rain waste waters and common operating wastes, are in relation to health risks virtually insignificant, both thanks to their intensity/rate and for the reasons proposed activity siting at a sufficient distance from the residential areas and its technical and technological solution.

The limits of radiation protection of employees as well as of the population are solved by Government Order of the Slovak Republic No. 345/2006 Coll. on basic safety requirements for health protection of workers and inhabitants against ionising radiation.

In accordance with Article 11 of the mentioned Order, the employee irradiation limit is set to an effective dose of 100 mSv during five successive calendar years, and the effective dose in any calendar year must not exceed 50 mSv. Special requirements for limits are set for specific groups of employees, such as pregnant women and nursing mothers, and trainees and students. The Order also states the limits for equivalent doses for crystalline lens, skin and upper limbs from fingers to the forearm and for lower limbs from feet to ankles, and the effective dose is the sum of equivalent doses in all organs or tissues multiplied by the respective tissue weighting factor. For the employee movement in the controlled area, personal dosimetry activities assess the irradiation, which prevents adverse impacts of the respective activity on the employee health condition caused by excessive irradiation.

Article 15 discusses the population irradiation limits in the surroundings of the workplace and sets them as follows:

a) effective dose 1 mSv in a calendar year,
b) equivalent dose in the crystalline lens 15 mSv in a calendar year,
c) equivalent dose in skin 50 mSv in a calendar year, it is determined as an average dose on an area of 1 cm² of the most irradiated skin regardless of the size of the irradiated skin area.

The above limits of irradiation relate to the average irradiation of the critical group of inhabitants, calculated for all the was of irradiation from all sources of ionising radiation and for all the activities leading to irradiation, which can be considered.
Government Order of the Slovak Republic No. 345/2006 Coll. also sets the limit of individual effective dose for the population at the site with nuclear installations to 250 μSv/year (2.50 \times 10^{-4} \text{ Sv }).

For the operation of all nuclear installations of JAVYS, a.s. at Bohunice, the decisions of the Public Health Authority of the Slovak Republic set the limits of discharges so that the effective dose of a representative person of the population caused by the radioactive substances released into the air and surface waters from the nuclear installations does not exceed 32.10^{-6} \text{ Sv/year}.

The real outputs from 2013 are shown, when jointly for all the Proposer's facilities on site, the uninhabited sector 1 to the north of the Proposer's premises was identified as a sector with the highest calculated impacts, where the potential critical group would be the age category of 2-7 years. The calculated total effective dose and load by all considered ways would be 2.20.10^{-8} \text{ Sv}. Sector 76 (Ratkovce, Žlkovce) was identified as an inhabited sector with the maximum total effective dose, where again the critical group would be the age category of 2-7 years. For this category, a total effective dose and load by all considered ways was calculated for a representative person - 1.47.10^{-8} \text{ Sv}. The calculation was made by means of the calculation programme determined in the decisions of the Public Health Authority of the Slovak Republic as a general impact from the nuclear installations operated by the Proposer at Jaslovské Bohunice (i.e. the joint impact of the RAW TCT, A1 NPP, ISFS and V1 NPP). As its is obvious from the above-mentioned, the calculated values of the total effective dose and load of all considered ways on a representative person are of a lower order than the basic limit for the RAW TCT, V1 NPP, A1 NPP and ISFS.

Thus, the operation and decommissioning of the NI during common operating conditions does not represent any risk for the health condition of the affected population. The contribution to the radiation load from the proposed SF storage capacity expansion through the gaseous discharges (for wet storage facility) is estimated as an increase in the use of the current limits within the range from 0.01 to 0.11% using the conservative approach and multi-stage filtration with an efficiency of 99.9%. In case of dry storage facility execution, no discharges of radionuclides to the atmosphere or hydrosphere are expected considering the properties of the storage packages. Even this increase in the use of limits (with wet storage) does not represent a risk of increased impacts on the population with respect to the sufficient reserve in comparison with the set valid limits specified by the current legislative framework.

Thus, based on the above-mentioned, the solved context does not represent a precondition for a health risk occurrence in the population of the affected municipalities.

Taking into account the legislative requirement to evaluate the cumulative impacts due to presence of other nuclear installations on site we state that the limitation of impacts of the nuclear installations on the population is provided by the specification of the limit of the effective dose per inhabitant for every nuclear installation.

In accordance with the above Government Order of the Slovak Republic No. 345/2006 Coll. a limit of individual effective dose for the population at the site with nuclear installations of 250 μSv/year must be observed. The Public Health Authority of the Slovak Republic issuing permits for releasing radioactive substances from under the administrative supervision by discharging them in air pollutants through ventilation stacks, by discharging in waste waters released into surface waters or by releasing solid materials, distributes the limits to individual nuclear installations so that the individual effective dose for an inhabitant of 250 μSv/year cannot be exceeded. The limits for the nuclear installations at Jaslovské Bohunice are determined as follows:
V1 NPP NI – 20 μSv/year
RAW TCT, A1 NPP, ISFS – 12 μSv/year
V2 NPP NI – 50 μSv/year (operator SE,a.s.)

The requirement is met with a sufficient reserve. It is presented by the diagram in *Fig. No. 27.*

*Figure No. 27 The use of effective dose per inhabitant*

The share of limits set for the NI Bohunice in the max. limit for discharges from NI 250 microSv/year set pursuant to Government Order of the Slovak Republic No. 345/2006 Coll.

The impact of gaseous and liquid discharges from the operations of JAVYS, a.s. for 2013 on the population is evaluated above and to assess the contribution of operation of the V2 power plant at Bohunice, we show the results from the summary report "Radiation protection at SE EBO and SE EBO environmental impacts" for 2013: "Based on the analysis of the discharges of radioactive substances from SE-EBO in 2013, it can be stated that the discharges into the atmosphere and water bodies Váh and Dudváh in the mentioned year did not exceed the authorised basic radiological limit of 50 μSv for the limitation of population irradiation in the surroundings of the nuclear installation SE EBO for a calendar year (Decision of Public Health Authority of the Slovak Republic OOZPŽ/6774/2011). Based on the balances of real discharges from SE EBO and real meteorological situation in 2013, the programme ESTE AI calculated:

- the highest values of the individual effective dose in inhabited zone 75 Pečľady – to the south-east of SE EBO – reached, for the critical group of 12-17-year old individuals, the value $2.07 \times 10^{-7}$Sv (0.44 of the annual radiological limit)

- the highest value of the individual effective dose in uninhabited zone 73 (to the south-east of EBO) is $3.12 \times 10^{-7}$ Sv (0.62 % of the annual radiological limit).
In 2013, none of the SE EBO discharges into the atmosphere and hydrosphere exceeded the annual guide value. The measured results of the SE EBO environmental monitoring document that in terms of radiation safety, SE EBO operation in 2013 was stable and reliable with a very low impact on the surroundings."

The non-exceeding of the basic limits guarantees that the contribution of irradiation of inhabitants from all nuclear sources on site (summarily max. 82 μSv/year) is insignificant to the natural background (2000-3000 μSv/year) and does not represent a health risk for the environment.

For other pollutants released into the air, there is not assumption of cumulative effect taking into account the sufficient heights of ventilation stacks and goods dispersion conditions of the site.

Acceptability of the activity for the affected population
The municipalities delivered their approving opinions on the Notice of Change, they emphasise in the opinions the observance of basic safety requirements in accordance with the valid legislation of the Slovak Republic.

To improve communication with the affected municipalities, communication activities were executed beyond the ambit of Act No. 24/2006 Coll. Information about the proposed activity was provided in articles in the magazine “JAVYS U nás”, at the website and in the presentations during meetings with the mayors of the affected municipalities.

III.2. IMPACTS ON THE ROCK MASS, MINERAL RESOURCES, GEODYNAMIC PHENOMENA AND GEOMORPHOLOGICAL CONDITIONS

The direct impact on the rock mass or the indirect impact in the form of contamination is with respect to the character of the respective activity irrelevant for routine operation. Any potential risk of contamination as a consequence of non-standard operating states is excluded thanks to the technical execution of the storage and transport means and building barriers of the structures. Any risk of contamination of the rock mass connected with the related traffic is eliminated by applying the legislative requirements for nuclear and radiation safety and observance of transport conditions in compliance with the RID.

Mineral deposits are not affected by the respective activity.

The area of interest is not situated in a territory with active exogenous geodynamic phenomena (slides, increased water ro wind erosion etc.) nor the respective activity causes them by its character. The outputs of assessment of seismic threat to the affected site were taken into account in the project of "Seismic retrofitting and expansion of the ISFS storage capacity at Bohunice“ and the requirements for the additional construction of further capacities will be taken into account in the safety and project documentation.

The siting and character of the proposed activity does not have any impact on the local geomorphological conditions, either.
III.3. IMPACTS ON CLIMATIC CONDITIONS

Neither the current operation nor the additional building of further storage capacities represent a source of pollutants which could affect the climatic conditions of the territory.

The respective activity would be part of the ISFS nuclear installation situated in the existing NI complex at the Jaslovské Bohunice site, which implies the assumption that it has not impact on the local micro climate in connection, for example, with the change of built-up territory etc.

III.4. IMPACTS ON THE AIR

During the construction of new storage rooms, low-importance impacts on the air will occur (negligible quantity of emissions produced during transportation of building materials and operation of building mechanisms, dust during construction.

No air pollution by pollutants will occur during both wet and dry SF storage technology operation. In case of wet storage, the air from the structure will be filtered, monitored and released into the air. In case of dry storage, the hall structure will be ventilated in the natural way. No radioactive substances will be released into the air from the operation of dry storage thanks to the technical securing and design of the transport and storage packaging sets. The gaseous fluid from the wet SF storage operation is removed by the air-conditioning system through the filtration stations with the efficiency of radionuclide catching of at least 99.9%. During SF transports, polluting emissions are produced due to fuel combustion in the transportation means. Taking into account the transportation intensity, this impact on the air is negligible.

The comparison of gaseous discharges to the atmosphere from the current operation of the actual ISFS and the limits for the discharges shows that the activity released into the environment represents only fragments of the set limits. The operation of the additionally built storage rooms will not demand a change of the currently valid limits of gaseous discharges set for the NI of JAVYS, a.s.. No other impacts on the population are expected.

III.5. IMPACTS ON WATER CONDITIONS

During the construction of the storage rooms, sink waste waters will be produced due to the use of hygienic facilities by the workers carrying out the building operations. Drinking water consumption will depend on the number of the workers executing the construction. Neither drinking water consumption nor waste water production during the construction will represent an impact on water conditions.

The operation of SF storage will be connected with the production of common sink and rain waste waters, in the volumes adequate to the area of the civil structure (an insignificant increase in comparison with the current state) and to the number of employees (without a change of the number of employees). Waste waters from the surface run-off (rainwater) are led to retention tanks and discharged to the river Dudváh, the sink waters are treated at the mechanical and biological waste water treatment plant and removed through the piping collector Socoman to the river Váh. Waters are discharged to water bodies based on the decision issued by the District Office Trnava.
waters are monitored at both water bodies according to the conditions set in the decisions of the respective supervisory bodies. No other types of waste waters will be produced by the dry SF storage technology, except for the case of needed decontamination of rooms during emergency events, where the used decontamination solutions would be treated as liquid radioactive wastes by the existing NI RAW TCT. At the proposed SF storage methods, wet or dry, no chemical substances or preparations are used which could affect surface or ground waters when leaking.

Taking into account the character and quantities of waste waters (an insignificant change of surface run-off water quantity, the same production of sink water), the operation of the additionally built storage spaces will not represent a measurable contribution to the currently released pollution from JAVYS, a.s. operations. The building of additional pools (Variant No. 1) would increase the quantity of released waste waters depending on the production of low-level waters produced during the pool water treatment approximately twice in comparison with the current quantity produced with the Zero Variant.

III.6. IMPACTS ON SOIL

Taking into account the proposed location on the existing premises of JAVYS, a.s. by interconnecting with structure No. 840M, no impacts on soil will occur, the proposed siting of the storage rooms is registered as built-up areas and courtyards.

In terms of a potential impact caused by the contamination through the discharges into the air, in relation to common pollutants we can only expect the impacts of SF transport means, which are negligible taking into account the frequency of transportation, and the impacts of the transport of building materials during a short period of construction of storage rooms. Neither the period of construction nor the period of operation of the SF storage facility represent a source of increase in the quantity of pollutants representing a risk of soil contamination, change of their chemistry (acidification) etc.

The impact of the emitted radioactive substances on soils, for example through fallout, washing out by rain etc., is monitored within the framework of an extensive system of monitoring of the environmental impacts of the Jaslovské Bohunice nuclear installations, and based on the monitoring it is evaluated as minimal in the long term.

Any non-standard situations of common character, for example, during transport (e.g. oil, diesel oil, petrol leakage from a transport vehicle) on soil can be solved by usual emergency procedures.

III.7. IMPACTS ON FAUNA, FLORA AND THEIR BIOTOPES

Neither the construction stage nor operation of the additional storage areas will have impacts on fauna, flora and their biotopes.

The contribution of the proposed activity to the radiation load on the territory is virtually negligible, so we can assume that it will not represent a source of significant impact on fauna, flora and their biotopes. The above assessment also relates to the indirect impact on the health condition of fauna and flora in the environment of the site (including their biotopes), all that in consideration of the
conclusions of regular evaluations of monitoring of the activity of soil, grass, aerosols, fallouts, waters, sediments, precipitations, samples of agricultural production and rates of the spatial dose equivalent, which evaluate the radiological impact of operation of the complex of nuclear installations as minimal (the Slovak legislation does not set any standards for exposure of non-anthropoid biotopes).

For common pollutants, in accordance with Regulation of the Ministry of Agriculture, Environment and Regional Development of the Slovak Republic No. 360/2010 Coll. on air quality, the average annual limits are known, which have been set for the protection of ecosystems for SO$_2$ 20 μg.m$^{-3}$ and for NO$_2$ 30 μg.m$^{-3}$. In the affected territory and its close vicinity, the immission concentrations of SO$_2$ range from 1.001 to 5.0 μg.m$^{-3}$ and the concentrations of NO$_2$ range from 5.1 to 10.00 μg.m$^{-3}$ (in accordance with the regionalization of the Slovak Republic for 2010). The activity under assessment can be a relevant source of emissions of common pollutants virtually only from fuel combustion during SF transportation and during construction at the transportation of building materials. In terms of the number of SF transportations per year, the contribution to the emissions into the air will not change and for a limited period of construction, the contribution from fuel combustion to the current immission situation will be minimal.

III.8. IMPACTS ON THE LANDSCAPE

Neither the period of construction nor the operation of the additional SF storage facilities will affect the country and its ecological stability.

The existing interim spent fuel storage facility is, and the proposed expansion of further storage areas for SF will be situated in a fenced area of the nuclear facilities of JAVYS, a.s. The purpose and architecture of the complex of NI at Jaslovské Bohunice is solved as a standard industrial built-up area. The direct impact of the proposed expansion of SF storage capacities, which will be a supplementation of the current NI ISFS with the siting at structure 840M, on the landscape scenery, its image or structure is virtually irrelevant.

III.9. IMPACTS ON THE PROTECTED AREAS AND THEIR PROTECTION ZONES

The proposed activity will be situated in the territory with the first lowest degree of territorial protection in accordance with Act No. 543/2002 Coll. on nature and landscape protection as amended. Thus, its execution will not directly affect any of the small-area or large-area protected territories or their protection zones.

The nearest protected areas include:

- large-size protected area
  - Protected Landscape Area Small Carpathians (about 12 km to the west of the NI premises)
- small-size protected area
  - Protected Area Dedova jama (about 6 km to the east of the NI premises)
    - it is declared to protect the rest of the original flood-plain forest important as a refugium of animals, an important landscape forming
element and the site of rare occurrence of a population of summer snowflake and other protected plant species
 ✓ Protected Area Malé vážky (about 7 km to the south-east of the NI premises)
   – declared to protect the water biocenose important in terms of science research, education and culture.
➢ sites of NATURA 2000
 ✓ Protected Bird Area SKCHVU054 Špačince-Nižná Fields (the closest boundary about 1 km to the north of the NI premises)
 ✓ Protected Bird Area SKCHVU014 Small Carpathians (about 11 km to the north of the NI premises)
 ✓ territory of European importance SKUEV0267 Biele hory (about 21 km to the west of the NI premises)

No protected tree or wetlands of national or regional importance have been declared in the affected territory. Wetlands of local importance situated in the cadastre of the affected municipalities are not in direct contact with the siting of the proposed activity.

Based on the above distances and character of the activity under assessment the direct impact on the mentioned objects of protection is excluded.

In relation to the indirect impacts of the proposed activity, which are relevant with the mentioned position and distances of the protected areas from the ISFS structure potentially only in case of the respective activity’s contribution to radiation load, it can be stated on the basis of regular evaluation of the impacts of presence of all nuclear installations in the affected territory that this (cumulative) impact is minimal.

Regular and long-term monitoring of the surroundings in connection with nuclear installation operations proves through its measured activity values in individual samples of environment elements that their cumulative radiological impacts is minimal. The emissions of common pollutants from traffic, taking into account the average annual concentrations to which the limit for protection of ecosystems applies, will neither represent a risk of adverse impact on the health condition of the object of protection of individual territories. The SF storage rooms expansion will neither affect the Protected Bird Territory "Špačince-Nižná Fields", which is closest to the NI premises because it does not interfere with its territory, nor it will affect the landscape elements providing breeding places and food sources of saker falcon.

III.10.IMPACTS ON THE TERRITORIAL SYSTEM OF ECOLOGICAL STABILITY

The territorial system of ecological stability (USES) can be understood as a structural skeleton of the landscape representing the important elements of the landscape structure – i.e. the biocentres, biocorridors, interaction elements, gene-pool-important sites, such as large forests, woods, game refuges, non-forest tree and bush vegetation, permanent grass and herb growths of various character and species composition, wetlands and other positive elements of the landscape structure.

The impacts on the territorial system of ecological stability can be understood, for example, as a direct intervention into the areas of USES elements connected with the occupation of a part of their areas or liquidation of the whole affected structure, or their interruption, such as a violation of biocorridor integrity which causes a loss of its function (however, it can also include the violation of functional links acting among individual elements) or as an indirect impact through immissions, for example, whose consequence is the deterioration of its health condition and limitation or loss of its stabilising function.
The activity under assessment is located out of the areas of individual USES elements, which excludes a direct intervention into any of the elements of the skeleton of the territorial system of ecological stability and subsequent impacts on its function. With respect to its character and rate of impacts caused by its operation, there is no anticipation of links' function violation or influencing of the actual health condition of individual USES elements.

**III.11. IMPACTS ON THE URBANISED AREA AND LAND USE**

Neither the stage of construction nor the operation of the new SF storage facilities will affect the urbanised area and land use.

The operation of the existing ISFS even with the building of additional storage capacities will not affect the structure of the residential units concerned.

The agricultural and forest management use of the territory is, with respect to the siting of the SF storage facilities, affected potentially only indirectly, through their contribution to the radiation load on the territory. However, this contribution is non-significant, which is also confirmed by regular systematic monitoring, which also includes the monitoring of activity of selected agricultural commodities (milk, grass, meat, ..) and does not represent for the surroundings a risk of threat to health or property even during non-standard operating states.

The industrial use of the territory at the site is affected significantly by the operation of the existing ISFS because it represents for the nuclear power plants in operation in the Slovak Republic, the possibility to manage SF safely and comprehensively. The additional building of sufficient SF storage capacity would significantly contribute to an increase in the security and stabilisation of the power system of the Slovak Republic ensured by the operation of the nuclear power plants.

The share of use of freight transport in constructing the activity under assessment will not change significantly, the frequency of SF transportations to the storage facilities will not change at the current state of SF operation, in case of EMO NPP Units 3 and 4 commissioning, the frequency of SF transportations would rise by one transportation per year.

No other impacts on the urbanised area and land use are known.

**III.12. IMPACTS ON CULTURAL AND HISTORICAL MONUMENTS**

In the immediate surroundings of the siting of ISFS storage technologies (the additional rooms will be architecturally interconnected with the existing building), there are no monuments of cultural or historical value, which would be the target of interest of the inhabitants from the close surroundings or visitors of the affected region.

In the broader affected territory there are several structures of cultural and historical value, however, they will not be affected by the operation of the proposed activity considering its character a proposed siting.
III.13. IMPACTS ON ARCHAEOLOGICAL SITES

There are no archaeological sites in the close surroundings of the site of the existing ISFS structure (part of the NI Jaslovské Bohunice).
The character of the activity under assessment excludes impacts on more distant archaeological sites.

III.14. IMPACTS ON PALEONTOLOGICAL AND SIGNIFICANT GEOLOGICAL SITES

In the close surroundings of the site of the proposed activity, there are no significant geological sites or known paleontological sites, which could be affected by its operation.
The character of the activity under assessment excludes impacts on more distant paleontological or geological sites.

III.15. IMPACTS ON IMMATERIAL CULTURAL VALUES

As it has been already mentioned, in the territory of interest immediately affected by the presence of the current activities, which should be supplemented with new SF storage rooms, there are no cultural values of material or immaterial nature. The character of the proposed activity also excludes the impact on the local customs and traditions.

III.16. OTHER IMPACTS

III.16.1 Impact on transport

Neither of the three variants will have higher demands for traffic load because the number of SF transportations to the storage facilities will not change with the current operation of NPPs in the Slovak Republic. If additional two Units of EMO are commissioned, an increase by one SF transportation per year is considered. Neither the production of secondary RAW from the operation of additionally built storage facilities will represent increased demands for the frequency of transportation within the premises to the RAW treatment and conditioning facilities or for the frequency of conditioned RAW transportations to the fibre-concrete containers determined for disposal in the Mochovice NRWR with respect to non-significant quantities of solid RAW produced, the liquid RAW is transported by piping systems.

During the operation of the proposed activity in the affected territory, no other, different from the above-mentioned, impacts were identified, which could affect well-being and quality of life of the inhabitants of the affected municipalities or inhabitants of more distant surroundings, natural environment or the affected landscape.
III.17. SPATIAL SYNTHESIS OF ACTIVITY’S IMPACTS IN THE TERRITORY

Synthesis of negative impacts

The negative impacts of the operation of the activity under assessment include in particular a negligible contribution to the radiation load in the affected region.

In terms of the spatial synthesis of impacts it can be stated that at present the affected territory is loaded by ionising radiation and emissions of radioactive substances released from the nuclear installations SE-EBO (V2 NPP), V1 NPP and A1 NPP under decommissioning, operation of the RAW treatment and conditioning technologies (RAW TCT) and the interim spent fuel storage facility (hereinafter the "ISFS"). Contribution to the radiation load from V2 NPP operation amounts to 95.7%, contribution from the nuclear installations of JAVYS, a.s. amounts to 4.3%. At present, the construction of an Integral RAW Storage Facility (hereinafter "IRAWS") is under preparation at the site.

Radiation load from the mentioned nuclear installations at the site Jaslovské Bohunice and in its surroundings is monitored together in compliance with the monitoring plan of SE-EBO. The monitoring outputs for the documented year 2013 are mentioned for individual environmental components in the respective chapters of this report.

The level of "admissible" radiation load at the nuclear site such as the surroundings of the nuclear installations at Jaslovské Bohunice is based on the limit value of the individual effective dose for an inhabitant of the critical group 250 μSv/year (set by Government Order of the Slovak Republic No. 345/2006 Coll. on basic safety requirements for health protection of workers and inhabitants against ionising radiation), which is specified together for all the ways of irradiation from all the nuclear installations on site. This value represents ¼ of the general limit for the effective dose for the population from the artificial sources of radioactivity set by the Order to 1 mSv/year.

At present, the limits of the individual effective dose for an inhabitant of the critical group are distributed among individual nuclear installations by the respective decisions of the Public Health Authority of the Slovak Republic as follows:

<table>
<thead>
<tr>
<th>Nuclear installation</th>
<th>Operator</th>
<th>IED limit</th>
<th>Share in the IED limit value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE-EBO (V2 NPP)</td>
<td>SE, a.s.</td>
<td>50 μSv/year</td>
<td>20%</td>
</tr>
<tr>
<td>V1 NPP</td>
<td>JAVYS, a.s.</td>
<td>20 μSv/year</td>
<td>8%</td>
</tr>
<tr>
<td>A1 NPP+ RAW TCT + ISFS</td>
<td>JAVYS, a.s.</td>
<td>12 μSv/year</td>
<td>4.8%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>82 μSv/year</td>
<td>32.8%</td>
</tr>
</tbody>
</table>

Note: No separate IED limit is considered for the IRAWS

As it is obvious from the above mentioned, the Public Health Authority of the SR permitted to all the nuclear installations on site to use only about one third of the limit value of the individual effective dose for an inhabitant of the critical group specified by Government Order of the Slovak Republic No. 345/2006 Coll. on basic safety requirements for health protection of workers and inhabitants against ionising radiation (250 μSv/year).

The real discharges of the nuclear installations are a source of IED of a lower order than the permitted limits.
### Table No. C.III.17./02
Maximum annual individual effective doses of a representative person from the population calculated from liquid and gaseous discharges of radioactive substances from SE-EBO and JAVYS, a.s. operations

<table>
<thead>
<tr>
<th>Year</th>
<th>IED (nSv/year)</th>
<th>Site</th>
<th>Critical group</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>41.4 (JAVYS, a.s.) 176.0 (SE-EBO)</td>
<td>Ratkovce, Žlkovce (JAVYS, a.s.) Pečeňady (SE-EBO)</td>
<td>Children 2-12 years (JAVYS, a.s.) Children 12-17 years (SE-EBO)</td>
</tr>
<tr>
<td>2012</td>
<td>39.8 (JAVYS, a.s.) 185.0 (SE-EBO)</td>
<td>Ratkovce, Žlkovce (JAVYS, a.s.) Pečeňady (SE-EBO)</td>
<td>Children 2-7 years (JAVYS, a.s.) Children 12-17 years (SE-EBO)</td>
</tr>
<tr>
<td>2013</td>
<td>14.7 (JAVYS, a.s.) 207 (SE-EBO)</td>
<td>Ratkovce, Žlkovce (JAVYS, a.s.) Pečeňady (SE-EBO)</td>
<td>Children 2-7 years (JAVYS, a.s.) Children 12-17 years (SE-EBO)</td>
</tr>
</tbody>
</table>

(Source: Radiation Reports of the operators)

Thus, based on the above data it is unambiguous that in the area of interest (even as a consequence of cumulation of impacts from several nuclear installations) the limits of individual effective dose for an inhabitant of the critical group specified by Government Order of the Slovak Republic No. 345/2006 Coll. are not reached, i.e. in this connection there is no reasonable expectation of a significant negative impact of the activity under assessment even in connection with the other existing loading of similar character.

To a certain extent, there will be a synthesis of impacts of the activity under assessment with the impacts in the affected territory also in connection with the emissions of noise, common waste waters and air pollutants, and traffic load, however, in all cases, the contribution of the respective activity to the other existing environmental load is acceptable (i.e. it does not represent a risk of exceeding the degree recommended or set for the protection of environmental components or population's health. See details in the previous chapters.).

**Anthropogenic load and spatial distribution of expected overloaded sites**

**The anthropogenic load** connected with the activity under assessment will be represented in particular by the contribution to radiation load on the air of the affected site.

**Overloaded site** shall mean a site with significant concentration of anthropogenic activities with adverse effects on population's health or environmental components.

**The affected site**, in which the activity under assessment should be located, is with respect to the character of the activities performed there (operation of nuclear installations), placed at a distance of several kilometres from the built-up areas of the surrounding municipalities (i.e. from the territories with a naturally higher cumulation of various anthropogenic activities), as well as out of the main transport routes in the affected territory. Exactly because of the character of current usage, no other anthropogenic activities are accumulated on site, which means activities with more or less significant adverse impacts on individual environmental components or population's health. However, directly in connection with the operation of the nuclear installations on site, there are several environmental pollution sources, such as mostly energy-character operating sources of air pollution, and the
performed activities represent a source of common sink and industrial waste waters, noise etc. So the site can be considered a common industrial zone with standard administrative background.

Based on the results of the current environmental condition monitoring we suppose that the site of interest cannot be considered an overloaded site.

In the specified affected territory there are, in terms of anthropogenic load, in addition to line air pollution sources, also several mostly medium stationary sources of air pollution related in particular to energy and agricultural activities, and the domestic hearths in the surrounding rural settlements also represent a non-negligible air pollution source. Water pollution sources in the affected municipalities are connected in particular with the level of connection of the population to the public sewerage system, with the performance of agricultural activities etc. so in general, it is a common rural country in the Western Slovakia region with developed agriculture, small industry proportional to the settlement importance (e.g. concrete paving production, metal surface treatment, ..), and services.

Thus, the cumulated anthropogenic load of the affected territory caused that during the environmental regionalization of the Slovak Republic, the affected territory received a quality degree of 3 to 4 out of the 5-degree evaluation scale, which means a moderately deteriorated to deteriorated environmental quality, however, no other site within it can be considered an overloaded site.

**Synthesis of positive impacts**

The most important positive impact of the activity under assessment is undoubtedly the functionality and safety of management of the SF produced during the operation of nuclear power reactors at Jaslovské Bohunice and Mochovce. The positive contribution of storage capacity expansion at Jaslovské Bohunice is a combination of use of wet and dry storage. The stock would be relocated from the wet storage facility to the dry storage facility and subsequently the SF assemblies produced at that time from the units' operation, after partial cooling in the spent fuel storage pool, would be placed in the wet storage facility. In terms of strategy and security it is more convenient to concentrate the fuel at one site before it is finally disposed, for example, in a deep repository or by transporting for reworking. Relevant factors for the site of Jaslovské Bohunice also include the planned construction of a new nuclear source.

The advantage of the siting of the proposed expansion of SF storage facilities is the mutual interconnection with other operations (RAW treatment and conditioning), the use of the existing infrastructure and the existence of an extensive and complex monitoring system for individual impacts caused by radioactive materials management, including the outputs of the monitoring from the time before starting the activity of this character at the affected site.

**III.18 COMPREHENSIVE ASSESSMENT OF THE EXPECTED IMPACTS IN TERMS OF THEIR SIGNIFICANCE AND THEIR COMPARISON WITH THE VALID LEGAL REGULATIONS**

Based on the evaluation of all the necessary inputs and outputs of the activity and taking into account the condition of the environment, to which the outputs are released, it can be stated that they are in compliance with the valid legal regulations of the Slovak Republic and all of them respect the limits in the respective area set by the legal regulations.

During operation of the storage technologies, no adverse impacts on biotopes, landscape scenery, soil, rock mass, territorial system of ecological stability elements, protected territories, cultural...
monuments and discovery sites are expected because the proposed operation of these elements does not affect the elements and is not situated in their territory or in the close vicinity of them. As regards the long-term direct and indirect influences, it is a long-term positive impact on energy security and stability of the power system of the Slovak Republic. The contribution of the storage technologies to the adverse impacts on the population (gaseous discharges into the air) and impacts on the personnel (radiation) will be eliminated by the building solution itself and by observing the technological measures.

**Impacts in terms of significance for individual environmental aspects**

**Air**
The impact of the activity under assessment on the municipal air quality is assessed as negligible with the following substantiation:
- the activity does not represent a source of emissions of basic pollutants, pollutants are produced only during transportation, whose intensity is insignificant
- air vulnerability is relatively low – the limits specified for air protection are not exceeded, the affected territory does not fall under the territory with special air protection
- the gaseous discharges will be released into the environment only up to the level of the set limits
- the actual air quality will not change significantly in any of the parameters

**Soil and rock mass**
The impact on soil and rock mass is assessed as insignificant for the following reasons:
- there will be no land occupation
- the hygienic condition of soil cannot be deteriorated by the planned activity
- taking into account all the technical and technological measures, the outputs from the proposed activity will not affect the actual condition of soil and rock mass
- the activity does not produce emissions, which would contribute to acidification or intoxication of soil

**Fauna and flora**
We anticipate insignificant impacts taking into account:
- the negligible outputs from the proposed activity, which will practically not change the actual environmental condition
- there will be no land occupation, felling of trees, destruction of biotopes
- the planned activity will not result in emissions of conventional pollutants significant to flora (in particular SO₂)

**Surface and ground water**
Neither surface nor ground waters will be affected because no waste waters are produced with the proposed dry storage technology, which is the recommended variant. During wet storage operation,
waste water quantities produced are treated in the existing facilities and waste water treatment outputs are not significant for water quality in water bodies. The consumption of service water for pool water cooling with wet storage will not affect surface water sources. The influence on waters is assessed as insignificant.

**Wastes**
The proposed activity will produce only a minimum quantity of secondary RAW produced during the operation of equipment, which, based on their character, can be treated by the RAW TCT NI's treatment and conditioning technologies. During construction, no significant quantity of inactive wastes will be produced, the wastes will be managed in compliance with the requirements of legal regulations and waste management hierarchy.

The environmental impact of wastes is assessed as insignificant with the following substantiation:

- production of a small quantity of secondary RAW managed within the framework of RAW treatment and conditioning technologies directly on site
- the conditioned RAW represent only a small volume of RAW disposed at the National RAW Repository
- for the wastes produced during construction, waste recycling or disposal facilities are available

**Landscape**
The impacts on landscape are assessed as insignificant because the landscape structure and use, scenery or the territorial system of ecological stability will not change; the activity under assessment will not affect the cultural and historical monuments, the structure of settlements, architecture, local traditions or the existing economic activities.

Landscape protection will be affected neither in the national or in the European context of interest.

**Population**
The adverse impacts on the population are assessed as low-significant with the following substantiation:

- in comparison with the actual condition, for the execution of Variant No.1, a slight increase in the radiation outputs to the atmosphere is expected, however, it is within the framework of fulfilment of the set limits and there is no assumption of a threat to health of the affected population as a consequence of exposure to ionising radiation effects, even during non-standard states of performance of the proposed activity
- the proposed activity cannot affect significantly the total radiation load on the population because it is not a dominant source of radioactive contamination of the environment in the affected territory, the dominant source is the operation of the V2 nuclear power plant
- max. values of the effective dose of a representative person caused by radioactive substances released into the air and surface waters in discharges (with wet storage) from the proposed activity are considerably lower than 32 µSv/year (the actual limit – annual limit of irradiation for a representative person from the population from discharges of nuclear installations of JAVYS, a.s. at J. Bohunice).
Positive impacts

The purpose of the proposed activity is to provide a sufficient storage capacity and safe storage of SF from the operation of the nuclear power plants in the Slovak Republic. The proposed activity represents a long-term positive influence on the energy security and stability of the power system of the Slovak Republic. The execution of the proposed variants has an important influence on the social and economic situation by allowing to keep a stable number of jobs providing for the operation of the SF storage and transport technologies as well as the nuclear power plants in operation.

Time path of impacts of the proposed activity

At the site Jaslovské Bohunice, JAVYS, a.s. operates four nuclear installations (A1 NPP, V1 NPP, ISFS and RAW TCT). Construction of additional SF storage rooms is expected in 2018-2021. The operation of the proposed expansion of storage facilities will be probably since 2021 part of the ISFS NI and its activity is expected in parallel with the existing technologies for RAW treatment and conditioning (e.g. BRWTC, bituminisation lines, fragmentation and decontamination line etc.), A1 NPP NI decommissioning (Stages III and IV), V1 NI (Stage II), later with the operation of the Integral RAW Storage Facility. The ISFS will provide storage of the SF produced by the nuclear power plants of the Slovak Republic till 2121.

Taking into account the expected outputs, the operation of the additionally built storage facilities will represent an insignificant change of impacts on the environment and it will not be necessary to change the currently valid limits determined by the Public Health Authority of the Slovak Republic.

The comparison of the impacts of the activity under assessment with certain relevant valid legal regulations is included in the following table:

Table No. C. III.18./01

<table>
<thead>
<tr>
<th>Area</th>
<th>Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>Act No. 137/2010 Coll. on air as amended</td>
<td>the activity under assessment does not represent an air pollution source, this only applies to the operation of a standby source of electric energy (diesel generator)</td>
</tr>
<tr>
<td>Regulation of the Ministry of Agriculture, Environment and. Regional Development of the Slovak Republic No. 360/2010 Coll. on air quality as amended</td>
<td></td>
</tr>
<tr>
<td>Regulation of the Ministry of Environment of the Slovak Republic No. 410/2012 Coll. implementing certain provisions of the Act on Air as amended</td>
<td></td>
</tr>
<tr>
<td>Noise and vibrations</td>
<td>the activity under assessment respects the mentioned legal regulations in the</td>
</tr>
<tr>
<td>Regulation of the Ministry of Health of the Slovak Republic No. 549/2007 Coll. laying down the details on the admissible values of noise, infra-sound and vibrations and on the requirements for objectification of noise, infra-sound and vibrations in the environment as amended</td>
<td></td>
</tr>
<tr>
<td>Government Order No. 115/2006 Coll. on minimum health and safety requirements for</td>
<td></td>
</tr>
</tbody>
</table>
employee protection against the risks related to exposure to noise as amended

<table>
<thead>
<tr>
<th>Stage of Construction</th>
<th>Waters</th>
</tr>
</thead>
<tbody>
<tr>
<td>stage of construction; in the stage of operation the activity does not produce noise or vibrations</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Waters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Act of the National Council of the Slovak Republic No.364/2004 Coll. on waters and on the amendment to Act of the Slovak National Council No.372/1990 Coll. on offences as amended (Water Act) as amended</td>
</tr>
<tr>
<td>Regulation of the Ministry of Environment of the Slovak Republic No. 100/2005 Coll. on details of hazardous substances treatment, on emergency plan requirements and on the procedure in solving an extraordinary deterioration of waters as amended</td>
</tr>
<tr>
<td>Government Order of the Slovak Republic No. 269/2010 Coll. laying down the requirements for achieving the good condition of waters as amended</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Soils</th>
</tr>
</thead>
<tbody>
<tr>
<td>Act of the National Council of the Slovak Republic No. 220/2004 on agricultural land protection and use and on the amendment to Act No. 245/2003 Coll. on integrated environmental pollution prevention and control and on the amendment to certain acts as amended</td>
</tr>
<tr>
<td>the activity under assessment respects the above legal regulations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nature protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Act of the National Council of the Slovak Republic No. 543/2002 Coll. on nature and landscape protection as amended</td>
</tr>
<tr>
<td>Regulation of the Ministry of Environment of the Slovak Republic No. 24/2003 Coll. implementing the Act on Nature and Landscape Protection as amended</td>
</tr>
<tr>
<td>the activity under assessment respects the above legal regulations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Wastes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Act of the National Council of the Slovak Republic No. 223/2001 Coll. on wastes and on the amendment to certain acts as amended</td>
</tr>
<tr>
<td>Regulation of the Ministry of Environment of the Slovak Republic No. 310/2013 Coll. implementing certain provisions of the Act on Wastes as amended</td>
</tr>
<tr>
<td>the activity under assessment respects the above legal regulations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Care of historical monuments</th>
</tr>
</thead>
<tbody>
<tr>
<td>the activity under assessment respects the above legal regulations</td>
</tr>
<tr>
<td>Legal Regulation</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Act No. 49/2002 Coll. on protection of monuments and historic sites as amended</td>
</tr>
<tr>
<td><strong>Nuclear safety</strong></td>
</tr>
<tr>
<td>Act of the National Council of the Slovak Republic No. 541/2004 Coll. on peaceful use of nuclear energy (Atomic Act) and on the amendment to certain acts as amended</td>
</tr>
<tr>
<td>Regulation of the Nuclear Regulatory Authority of the Slovak Republic No. 30/2012 Coll. laying down details on the requirements for nuclear materials, radioactive waste and spent nuclear fuel management</td>
</tr>
<tr>
<td>Regulation of the Nuclear Regulatory Authority of the Slovak Republic No. 430/2011 Coll. on nuclear safety requirements as amended</td>
</tr>
<tr>
<td><strong>Radiation protection</strong></td>
</tr>
<tr>
<td>Act of the National Council of the Slovak Republic No. 355/2007 Coll. on public health protection, support and development and on the amendment to certain acts as amended</td>
</tr>
<tr>
<td>Regulation of the Ministry of Health of the Slovak Republic No. 524/2007 Coll. laying down details on the radiation monitoring network as amended</td>
</tr>
<tr>
<td>Regulation of the Ministry of Health of the Slovak Republic No. 545/2007 Coll. laying down details on the requirements for radiation protection provision during the activities leading to irradiation and the activities important in terms of radiation protection as amended</td>
</tr>
<tr>
<td>Government Order of the Slovak Republic No. 345/2006 Coll. on basic safety requirements for health protection of workers and inhabitants against ionising radiation as amended</td>
</tr>
<tr>
<td>Government Order of the Slovak Republic No. 346/2006 Coll. on requirements for the protection of external workers exposed to ionising radiation risk during the activity in the controlled area as amended</td>
</tr>
<tr>
<td><strong>Occupational safety</strong></td>
</tr>
<tr>
<td>Act No. 124/2006 Coll. on occupational health and safety and on the amendment to certain acts as amended</td>
</tr>
<tr>
<td>Government Order of the Slovak Republic No. 391/2006 Coll. on minimum safety and health requirements for workplaces as amended</td>
</tr>
</tbody>
</table>
III.19. OPERATING RISKS AND THEIR POSSIBLE IMPACT ON THE TERRITORY

Description of the proposed variants

In compliance with the adopted SF management strategy in the Slovak Republic approved on 15 January 2014, the concept of long-term SF storage is considered. For that purpose, the existing wet interim storage facility should be expanded with further storage capacity for wet and dry SF storage. With wet storage (Variant No.1), fuel assemblies will be stored in compact casks for 48 pieces of spent fuel used currently in the existing ISFS. They will be placed underwater in the storage pools. For dry storage, the use of two-purpose or single-purpose packaging sets is considered. The two-purpose packaging sets mean massive steel containers with the currently standard system of double lid and double sealing, intended for transport and storage (Variant No.2). The packaging provides both mechanical and biological protection. They are hermetic and heat removal is ensured by free air flow on the external surface of the container, which is usually ribbed. The single-purpose containers are thin-walled steel vessels (canisters) intended for SF storage (Variant No.3), and for their transportation, special handling packages with the design similar to the two-purpose containers are used. Subsequently, they are placed into ferro-concrete storage modules. The ferro-concrete modules serve as both mechanical and biological protection against ionising radiation and their structure ensures passive heat removal by directed air flow inside the module around the metal canister's surface.

This chapter does not assess the activities of SF management connected with their transportation from the Units and placing into the existing ISFS at Jaslovské Bohunice because these activities are solved and described in the safety documentation of the existing ISFS.

Legislative requirements, defence-in-depth, technical solutions

Much like during the operation of any other industrial facility and for human activities, during the operation of a nuclear installation, the possibility of occurrence of a failure, incident or accident cannot be completely excluded. As during accidents in nuclear installations, radioactive substances can leak into the environment, various specific requirements are imposed on them. The basic requirements for the design of a nuclear installation intended for SF management taking into account the accident situations in postulating the initiating events (extreme natural conditions including earthquake, plane crash and human activity and industrial activity impacts including explosion) include:

- keeping the subcriticality,
- provision of residual heat removal,
- minimising the effects of ionising radiation on the service staff, population and environment in compliance with the international criteria and standards,
- taking into account the features affecting nuclear safety,
- taking into account the features affecting conventional safety, such as toxicity, inflammability, explosiveness and other dangerous properties including the consideration of mutual dependence of various SF management steps.

The storage basket for dry storage packaging sets or the cask for wet storage ensure the position (layout geometry) of individual assemblies in the container and SF subcriticality by absorbing the
neutrons. Absorption is ensured by the material of the absorption box which is made of boron alloyed stainless steel, aluminium or a composite material.

Residual heat removal for wet storage is provided by means of active cooling system. In accordance with defence in depth, this system is backed up and designed for all emergency conditions.

For dry storage, heat removal is provided exclusively in a passive way and it is designed with a sufficient reserve in order to provide sufficient heat removal also during emergency situations.

Biological protection and minimisation of ionising radiation effects is provided by a sufficient shielding layer surrounding the fuel assemblies. In the wet storage facility, it is a sufficient water level in vertical direction and also a massive wall of pools in horizontal direction. In dry storage in two-purpose metal containers, sufficient shielding is provided by the steel jacket including the neutron absorber, in single-purpose metal containers, the shielding ability is ensured by the ferro-concrete storage module (the storage structure).

The materials used for packaging sets must provide chemical and radiological stability and adequate resistance against mechanical and thermal effects and must be designed for the whole proposed period of storage facility operation. All the building structures and technological equipment important for NI nuclear safety must be designed, produced, assembled and tested in order to ensure their reliable function.

Risk assessment is based on the assumption that a packaging set corresponding to the current condition of technical level knowledge and practice will be used for SF storage. The basic technical parameters necessary to elaborate the analysis of operating risks were specified in the feasibility study both on the basis of documentation of compact casks (KZ-48) and transport containers (TK C-30) used for wet transportation and storage of SF and on the basis of the available data on the dry SF storage packaging sets executed and used throughout the world, taking into account the current level of technical knowledge and international practice (e.g. CASTOR®, CONSTOR®, MVDS®, MPC®, HI-STORM®, MAGNASTOR).

Within the feasibility study, preliminary balance calculations were made for all the proposed technical variants in order to verify the absorption, cooling as well as shielding ability of the wet and dry storage packaging sets under consideration.

The particular (detailed) technical parameters of the selected packaging sets (boron content in the absorption boxes, shielding thickness and type, shape, design and material of the heat transfer surface) will be known only during the selection of the suitable supplier, based on the calculations for the defined fuel parameters.

To meet all the legislative requirements, the activity of the interim SF storage facility will be contained in the following elementary systems:

- Transport technological facilities including the transport and storage containers
- Inspection and maintenance
- Decontamination
- Contaminated water management (variant No. 1)
- Air conditioning
- Operating fluid distribution systems
- Heavy-current distribution systems
- Technological process control and management systems
- CCTV
- Special monitoring
- Radiation and dosimetry monitoring
Consideration of accidents and postulated initiating events

To prevent the occurrence of events and accidents important in terms of safety, the "defence-in-depth strategy" principles, which are generally used in the world in designing and operating nuclear installations, are accordingly applied. In assessing NI safety, the NRA SR assesses the ability of the installations to fulfil the safety functions in accordance with the design in order to provide for the required level of defence in depth.

Nuclear installations must be designed so that even during the postulated initiating events, nuclear safety and radiation protection of the population is provided. Postulated initiating events mean unintentional, however, considered events that endanger the safety functions of the NI directly or indirectly. For preparation of safety analyses, these events are specified by the valid Atomic Act and its implementing regulations prepared on the basis of IAEA safety guides and regulations.

The events are categorised as follows:

- **expected events** (mean frequency of occurrence $> 10^{-2}$/year) are defined as relatively frequent deviations from normal operating conditions of the NI caused by malfunction of systems or by NI operators' errors. These events do not have any serious safety consequences that would prevent the continued NI operation after the elimination of the event causes.

- **design basis accidents** are defined as rare deviations from normal operating conditions of the NI, whose occurrence is possible but low probably and they are considered in the NI design (mean frequency of occurrence $10^{-4}$ to $10^{-2}$/year). During these events, the NI damage can be such that it cannot be quickly put into operation only by eliminating the initial event cause. The damage of the NI and release of radioactive substances into the environment does not exceed the set limits.

- **selected beyond design basis accidents** are caused by a multiple failure (of the equipment, operators, safety systems) that was not considered by the design. The occurrence of the selected beyond design basis accidents is improbable (mean frequency of occurrence $10^{-6}$ to $10^{-4}$/year) and their radiological consequences in the emergency planning zone have to be kept within the set limits, however, in certain cases, they can require application of measures mitigating the radiological consequences in the emergency planning zone.

- **severe accidents** with an extremely low frequency of occurrence (mean frequency of occurrence $< 10^{-6}$/year). They are caused by a multiple failure (of the equipment, operators, safety systems). Nuclear fuel damage and the radiological impacts on the population (in the emergency planning zone or even beyond the boundary of the emergency planning zone depending on the particular situation) require the application of measures mitigating the radiological consequences.

- The initiating events with the frequency of occurrence $< 10^{-7}$/year can be neglected in the safety analyses and severe accidents.

The consequences of possible failures and accidents are generally divided into accidents and failures caused by external or internal factors. The external factors include the most serious natural phenomena (natural disasters and extreme natural conditions), such as earthquake, windstorm, floods, extreme external temperatures, extreme cooling water temperatures, precipitations in any form,
humidity, frost cover, and also explosion, fire and plane crash. The internal factors include operator's error and malfunctions or failures of equipment.

The project of the SF storage facility must be prepared so that any consequences of the postulated initiating events are minimised and the event will not cause any serious effect and the NI will remain in safe condition through the passive safety characteristics (heat removal reserve for dry storage) or thanks to the operation of the active safety systems that are continuously serviceable (a backup of the cooling system with wet storage with a standby electric power source).

The set of selected events for the analyses of operating failures and accidents is defined on the basis of the operating experience of the operator of the wet interim SF storage facility at Jaslovské Bohunice, as well as on the basis of the experience of several operators of dry storage facilities (ISFS Dukovany, RHK Paks).

For both SF storage methods, the following external initiating events are considered:
1. Fire
2. Explosion
3. Earthquake
4. Flood caused by intensive rain
5. Extreme heat
6. Frost cover and extreme cold
7. Plane crash

For the wet SF storage method, the following internal initiating events are considered:
1. Power supply failure
2. Loss in the system of demineralised water and cooling water make-up
3. Failure of cooling system pump and cooler
4. Air-conditioning failure
5. Fuel assembly fall or collision in handling in the relocation pool

For the dry SF storage method, the following internal initiating events are considered:
1. Power supply failure
2. Technological equipment failure during the conversion of wet to dry storage
3. Monitoring system failure
4. Leakage of the primary or secondary lid
5. Container fall or collision during manipulation
6. Air supply prevention

Interim SF storage facility operation and operating risks

Operation of the interim SF storage facility means the operation of the structure and technological units and in case of expansion of the interim storage facility's capacity with dry interim storage facility, also the activities connected with relocation of the SF assemblies from the wet to dry interim storage facility. The expansion of the interim storage facility with another wet interim storage facility (storage pools) represents the performance of routine activities well managed today.

The relocation of SF assemblies is a technologically demanding activity during which highly radioactive material is handled and all the operations are carried out underwater. The use of the
existing ISFS technological equipment is considered for that purpose. Thus, this activity also is considered common, well managed activity with a low probability of operating staff failure. The internal transport of the packaging sets to the part of dry interim SF storage includes activities related to SF relocation to the handling area in the ISFS, where the container is closed, decontaminated and stabilised to a level allowing its safe manipulation to the dry interim storage facility part by means of the proposed handling means. However, the use of single-purpose containers represents another risk because this type of packaging sets requires a larger number of operations during the final disposal in the dry storage ferro-concrete module. All the deliveries of the technological equipment representing the obligatory part for reliable and safe operation of the whole storage complex represent the source of potential risk and their damage and malfunction.

Influence of initiating events and their consequences for operation

External initiating events (natural disasters and extreme natural conditions)

Taking into account that on the basis of valid legislative regulations, the packaging sets for both dry and wet SF storage must be designed so that the consequences of initiating events do not cause a significant loss of parameters, which can affect their integrity and function, in the following text all the external factors are assessed jointly for both SF storage methods.

Fire

The storage facility project must be designed so that fires are prevented by using non-flammable substances, fire retardant materials and structures with a sufficient fire resistance. Therefore, the risk of fire is very low and environmental impact is negligible. The packaging sets are designed so that they will resist to fire both according to the requirements for transport and storage. The fires out of the storage place do not represent any threat to safety. The use of flammable substance in the operation of the ISFS will be minimised. Therefore, only local and very limited fires can occur, which with respect to the duration and achieved temperatures will never exceed the conditions, under which the packaging sets are tested (maximum temperature 800°C for a period of 30 minutes).

Explosion

The scope of potential external sources and possible consequences of their explosions are analysed in the safety documentation of the existing ISFS NI. The conclusions of the analyses show that in the surroundings of the site, there are no sources of initiating events causing explosions, which could at present or at any time in the future endanger the operation and safety of this NI. It results from the evaluation of potential sources of external explosions that no potential source of external explosions is located at a distance smaller than its safe distance. Therefore, it is not necessary to carry out further detailed analyses of sources and it is not necessary to protect the ISFS structure against effects of external explosions.
Earthquake

The civil structures and packaging sets are also dimensioned for the case of earthquake. The level is defined for the site and for this degree of seismicity the packaging set will be tested (intensity 8° of the MSK scale in free field). For that reason, during an earthquake, no radioactive materials will be released from the storage system.

If we take into account the proposed wet SF storage system in the expanded wet interim SF storage facility on the premises of JAVYS, a.s., for the purposes of this document we can use the conclusions stated in the safety documentation after the seismic retrofitting and storage capacity increase for the ISFS Jaslovské Bohunice. It results from the analyses that with wet storage using the existing compact casks, the critical state in fact cannot occur. Of course, to update individual statements it will be necessary to make corresponding calculations and analyses for the new parameters.

The packaging sets for SF dry storage are also resistant to earthquake effects, subcriticality is also provided by the passive system (boron alloyed absorption boxes of the fuel basket and geometry of fuel assembly placing).

It results from the above statements that during an earthquake, no radioactive materials will be released from any proposed storage system.

Flood

Both dry and wet SF storage system will be designed in a way as to resist to flood effects. The packaging sets for dry storage are waterproof. Based on the analyses carried out after the event in Fukushima it was proved that the site of Jaslovské Bohunice is not endangered in an essential way (the surface water sources, ground waters, extreme precipitations) because the comparison of elevation data show that the premises are situated sufficiently above the maximum levels of main water courses, even in case of historically extreme flows. Possible risks are eliminated by the measures providing the function of the sewerage system on the premises and by the design of the structures.

Extreme heat

The maximum cooling capacity of the reconstructed cooling system of the ISFS NI is 2148 kW and it is higher with a sufficient reserve than the maximum residual output of the stored fuel with the full condition for a conservative variant of storage. On condition that in the new (expanded) wet interim storage facility, fuel with enrichment up to 5% $^{235}$U and maximum burn-up as much as 70 MWd/kgU will be stored, new calculations will have to be made. In the calculations of the parameters of facilities for spent fuel storage or transport, when determining the limit conditions of the calculation, the solver can consider the real isotopic composition of spent nuclear fuel, structural materials of the storage or transportation equipment and cooling medium.

The design of the packaging set for dry storage as well as the use of inert gas must ensure that the cooling parameters will not drop below the safe limit even during extreme temperature conditions.

Plane crash

It is the most significant impact produced by human activity or natural elements, when an object thanks to its huge kinetic energy can seriously endanger a NI. For that reason the site is protected...
against any type of air traffic by the published prohibited space LZ P29 (a cylinder with a radius of 2000 m and a height of 1500 m).

The risk of plane crash on the existing structure of the ISFS was assessed according to the recommendations of the IAEA in the safety documentation of the existing NI, which evaluated all the potential sources of air traffic. The found probability of plane crash on the ISFS structure is lower than the limit recommended value $1.10^{-7}$ year$^{-1}$, although the calculations used conservative procedures and parameter values. Moreover, there is a published prohibited air traffic space, which can sufficiently reduce the above values. The influence of this administrative measure, however, can be evaluated only with difficulties, thus, it was not taken into account in the mentioned analysis.

In terms of the effects of flying objects, in addition to plane crash, a projectile hit in case of a terrorist attack can also be considered. To limit the consequences of such an event, the ISFS NI project contains the system of physical protection in compliance with the Vienna Convention on the Physical Protection of Nuclear Materials and respective IAEA regulations.

The system of physical protection of the expanded interim spent fuel storage facility will be provided by a set of technical, regime and organisational measures preventing from and detecting unauthorised activities and by selected units of security service. Standby protection of the storage facility will be in compliance with the respective legal standards provided by selected units of security service. This technical system will be fully integrated into the technical system of physical protection of the JAVYS premises - AKOBOJE.

In terms of physical protection of the storage facility, on the premises of the storage facility, the following zones will be preserved and secured by the technical means of the physical protection technical system:

- Guarded area – is an area, whose circumference is fenced by mechanical barriers as it is stated in the plan of physical protection, and by the electronic security system
- Protected area – is an area inside the guarded area, whose circumference is bounded by mechanical barriers equipped with an electronic security system;
- Internal area – is an area in the building or room situated inside the protected area, whose walls are mechanical barriers equipped with security technology.

**Internal initiating events (considered for wet SF storage – Zero Variant, Variant No.1)**

**Power supply failure**

In the valid safety documentation of the existing ISFS, this type of accident is analysed conservatively for the full capacity of the ISFS. The most serious impact of the failure in terms of nuclear safety is the interruption of pool water cooling and failure of the air-conditioning systems in the ISFS.

Taking into account the technical and legislative requirements, the existing NI is equipped for the operation of important ISFS systems with a backup power supply with diesel generator.

**Loss in the system of demi water and cooling water make-up**

The level of pool water is maintained by the demineralised water make-up system. Demineralised water replenishment is to replace the losses due to evaporation through the air-conditioning systems.
When water make-up supply is interrupted, the level will drop. It is obvious from the analyses for the existing ISFS that even with such conservative pre-conditions, no significant level drop will occur in eight hours. The level drop to a limit value in terms of shielding will occur only in 6.25 days, which is a time sufficient to remove the cause of interruption of pool make-up water supplies. For the period of the failure, the radiation situation in the building and surroundings will remain unchanged.

**Failure of cooling system pump and cooler**

The variant with an anticipated complete failure of cooling, make-up and ventilation in the maximum-loaded ISFS pool was analysed. The calculations proved that the increase of temperature in the interim storage facility pool volume situated above the output from the hottest assembly will not increase the value 53 °C in 100 hours and temperature of the covering surface in a hot assembly on a hot fuel element will reach the value 57 °C. The coolant will not reach the boiling point, nor locally. Based on the results of the analysis it can be stated that within the stated time limits, neither temperature (in terms of material) nor radiation limits will be exceeded. (Source: Safety Report)

**Air-conditioning failure**

Air-conditioning failures include failures fans or of the power supply of electric motors. With wet storage, the air-conditioning system provides air removal from the space above the pool water level. The analysis of air-conditioning failures of the existing ISFS NI states that in case of an air-conditioning failure occurrence, the principles of radiation protection in the ISFS will not be violated. It results from further analysis that in terms of hydrogen creation, the exhaustion failure can last as long as 70 hours and the principles of radiation protection will not be violated. This period can be considered sufficient for any repair because no irreparable failure is expected for air-conditioning systems.

The leaks of gaseous substances from the ISFS NI after the storage capacity expansion by building additional pools (Variant No.1) will not represent any significant increase in normal leaks from operation of the existing NI. The gaseous leaks on the premises of the nuclear installations at the site Jaslovské Bohunice are below limits in the long term.

**Fuel assembly fall or collision in handling in the relocation pool**

As regards the activities related to SF transport and handling, we can apply the approaches used in case of reconstructed ISFS. A maximum (in terms of potential RAS leakage) possible accident was conservatively selected - a fall of a full cask in the relocation pool from a height of 4.55 m to the bottom, i.e. after it has been lifted to the transport position, and damage to the cladding of all transported fuel elements is anticipated. The calculation analyses show that during this emergency event, the limit set by Government Order of the Slovak Republic No. 345/2006, i.e. an effective dose of 1 mSv per inhabitant in a calendar year, will not be exceeded.
Internal initiating events (considered for dry SF storage – Variants No.2 and No.3)

Power supply failure

All the safety functions of the considered packaging sets are provided for only on the basis of the passive approach. Therefore, no electric energy supplies or active systems are needed to meet the requirements of nuclear safety and radiation protection.

Technological equipment failure during the conversion of wet to dry storage

The technological equipment intended for drainage and drying of the internal fuel basket space may cause a time delay in relocating the SF assemblies to the packaging set for dry storage. However, in technical terms it has no significant influence on personnel's dose rate increase or personnel's contamination.

In the worst case, the failure elimination can cause contamination of the tools which are part of the storage facility's technological equipment. The event has no impact on nuclear safety or radiation protection.

Monitoring system failure

In case of a failure of the pressure sensor in the interspace, the defect can be identified quickly. If the failure is confirmed and the pressure drop is not caused be leakage, the sensor will be replaced. During this event, the primary lid remains tight, thus nuclear safety and radiation protection will not be jeopardised.

Leakage of the primary or secondary lid

The current packaging sets for dry storage are equipped as standard with a system of double lid with pressure monitoring in the interspace. The internal space of the container closed by the primary lid is filled with inert gas with a small underpressure and the interspace between the lids with an overpressure of about 6 bar. The tightness of the metal container is monitored by a pressure sensor or manostat. In the container body, there is underpressure, and there is an overpressure in the interspace between the primary and secondary lids. As the container body has a volume many times bigger than the interspace, when the primary lid leaks, the pressure will drop, however, to a value higher than the atmospheric pressure. If the pressure dropped to atmospheric pressure, the secondary lid would leak. In case of primary lid leakage the container is still tight because it has two barriers. If leakage of one of the barriers is detected tightness with two barriers will again be provided by installing a tertiary lid. Taking into account that tightness is still ensured during a failure of tightness of the primary or secondary lid, it can be stated that the event has no negative impact on nuclear safety or radiation protection. The co-occurrence of leakage of both lids is virtually excluded.

Container fall or collision during manipulation

The IAEA Guide (introduced into the legislation of the Slovak Republic – Regulation of the NRA SR No. 57/2006 Coll.) specifies the requirements for transport and storage containers.
After the test has been carried out, container's tightness is evaluated. Only an approved certified transport package for transportation or safe spent fuel handling to the storage facility can be used.

Air supply prevention
In the design of an interim SF storage facility, all the events which can cause cooling loss or drop (clogging of building air vents, for example, due to snow cover, fire or container burying by building wrecks during an earthquake) must be analysed and it must be proved that cooling parameters will not drop below the safe limit.

Individual packaging sets are dimensioned for extreme temperature conditions, where it must be proved that with a temporary cooling loss, the critical temperatures on the fuel element cladding will not be exceeded with both dry and wet storage.

Common occupational injuries
Due to careless behaviour, occupational injuries can occur, such as falls, contusions, surface wounds etc. The worker will be provided with first aid and medical treatment in the healthcare facility at Jaslovské Bohunice.

Conclusion
Taking into account the design of the building and technological equipment, personnel qualification and training, the operating events caused by internal factors will have a considerably limited extent and the integrity of the building or packaging set will not be violated during any event. Liquidation of possible consequences in the structure itself will have no environmental impacts.

Considering the fact that one of the main tasks of the packaging sets and interim SF storage facility is to isolate radionuclides in the stored fuel from the surrounding environment during the considered initiating events, it can be stated that no initiating event was identified, which would lead to inadmissible RAS leakage into the environment during the storage or operations related to SF management. The admissible short-term increase in dose rate or RAS release in case of selected beyond design basis (severe) accidents caused by external factors has only a short-term character and will not considerably contribute to an increase in the adverse environmental impacts of the existing ISFS. Such accidents are improbable and their radiological consequences will be kept within the set limits. However, for emergency planning, they can require application of measures for mitigating the radiological consequences.

The threat of intentional (terrorist) attacks will be solved and eliminated using the standard means and procedures of physical protection of nuclear installations used in the current practice in compliance with the international and national legislative regulations.

Obligations of the Slovak Republic in the area of physical protection of nuclear materials result from international conventions, and in accordance with the Act on the Armed Forces of the Slovak Republic also the area of prevention and emergency situation occurrence due to an air attack is solved. It includes a variety of military preventive measures and active protection procedures.

The analyses of resistance of the packaging sets for SF dry storage carried out in the USA, Germany and other IAEA member countries confirm the resistance of the considered single-purpose and two-
purpose packaging sets against plane crash, including a large transport aircraft, where their integrity is maintained.

The safety documentation of the existing ISFS contains calculations for the case that SF assemblies with enrichment exceeding 4.4% $^{235}$U are delivered to the interim storage facility. However, the results of calculations for such an emergency situation proved that for the most conservative case (infinite lattice of assemblies), a critical state would occur in the interim storage facility when all the assemblies have the enrichment 5.5% $^{235}$U and higher. The critical state for the real arrangement of assemblies in the cask would not come into existence even with the enrichment 8.5% $^{235}$U, which is not expected at present at all, i.e. the calculated values of fuel enrichment endangering ISFS safety are considerably higher than those used today and planned to be used for VVER-440 reactors. Thus, the occurrence of conditions for the critical state as a consequence of assemblies interchange before the interim storage facility capacity is exhausted is virtually excluded.

The activity and its environmental impacts are prepared in a way as to prevent adverse impacts in compliance with the Atomic Act and its implementing regulations. From this view, no potential considerably adverse impacts, which should be solved beyond the ambit of generally valid legislative or other regulations, have been identified. The found impacts well below the limits are fully acceptable without requirements for additional measures (compensating, technical, other) in the affected territory.

In this connection we state once again that all the included requirements and demands for the assessment of safety of the solved activities are not the subject of the assessment of impacts on the environment and population but of further steps of the permitting procedure.

IV. MEASURES PROPOSED FOR THE PREVENTION, ELIMINATION, MINIMISING AND COMPENSATION OF THE PROPOSED ACTIVITY’S IMPACTS ON THE ENVIRONMENT AND HEALTH

In connection with the expected impacts and other possible risks of construction and operation of the proposed activity, it is necessary to adopt several measures minimising and preventing the adverse impacts and their consequences.

IV. 1. LAND-USE PLANNING MEASURES

All the three proposed variants are situated on the premises of JAVYS a.s at the site Jaslovské Bohunice and fall under the cadastral territory Bohunice near Trnava. Within the town planning scheme of the municipality Jaslovské Bohunice, whose obligatory part was declared by Generally Binding Order No. 49 dated 20 March 2008, the affected site is categorised as a nuclear power plant area. Thus, the siting itself of the construction on the premises of the existing nuclear installations can be considered a land-use planning measure.

In preparing the project documentation for the land-use decision and building permit, the following measures will be adopted:
in designing the newly built civil structures, including their foundations, the outputs of the engineering geological and hydrogeological survey of the affected site and the outputs of assessment of the seismic threat to the site of interest will be respected
• a programme of regular monitoring of selected technical elements of the building and technological equipment serving to check and provide safety of the elements with a long service life (as many as 100 years), such as building settlement, crane track settlement and span, will be prepared
• respecting all the existing protection zones on the site of interest
• a plan of fire protection will be prepared
• safety analyses and radiation load calculation will be carried out
• a monitoring system for the check of efficiency of the measures and signalling of the situations, in which the limits of impacts in the operating and storage rooms could be exceeded, will be prepared and submitted for approval
• requirements for the provision of occupational health and safety during construction and during operation pursuant to Article 4 (1) and (2) of Act No. 124/2006 Coll. will be taken into account in the construction organisation part of the project documentation.

IV. 2. TECHNICAL MEASURES

TECHNICAL MEASURES

In the sector of soil and water
• to take all the available measures to prevent a leak of hazardous substances from the building and transport mechanisms used during construction
• to provide the building site and subsequently individual operation workplace with a sufficient quantity of absorbents of hazardous substances
• to prefer the minimising of hazardous substances storage and handling on the premises of the building site. If the activity is necessary, to perform it in compliance with the valid regulations.
• to ensure accident-free operation of the building and transport mechanisms through their good technical condition
• to execute the transportation in compliance with the respective legislative regulations
• in case of soil contamination by hazardous substances or radioactive substances, to immediately dispose the soil in compliance with the principles of hazardous waste management or radioactive waste management
• to execute the emergency protection of operation in compliance with the requirements of the safety analysis and respective valid legislation

In the sector of air
• to minimise the gaseous emissions from combustion engines by maintaining the building mechanisms, vehicles and other devices in good technical condition and by means of proper organisation of transport and building work in order to exclude unnecessary drives of transport vehicles and engine idle run
to consistently observe the operating regulations of the installed filtration equipment and air-conditioning, with the emphasis on regular check and maintenance (it applies to wet storage)

In the sector of waste management
- to store and dispose all the wastes produced during construction, operation and decommissioning in compliance with law, on the contract basis through entities with respective authorisations
- during operation, to prevent waste production, to separate and recycle the produced waste to a maximum possible extent
- to store and manage the hazardous wastes produced in accordance with the valid legislation

In the sector of health protection
- in the interest of reducing the radiation load on the population and employees, to evaluate the environment and impacts of discharges on a regular basis
- to check the full function and efficiency of the installed filtration device in regular intervals
- in the interest of occupational health and safety provision in performing the proposed activity, to ensure that the project, design of machines or other technical equipment and working procedures include the evaluation of persistent hazards and risks resulting from the proposed solutions in specified operating and user conditions, and also the risk assessment for their usage and the proposal of protective measures against such hazards and risks pursuant to Article 4 of Act No. 124/2006 Coll.

IV. 3. TECHNOLOGICAL MEASURES

- In the sector of soil and water
  - at the time of execution, to take all the available measures to prevent leakage of oil substances from the building and transport mechanisms used and to equip the building site with a sufficient quantity of absorbents of oil substances,
  - at the time of operation, to execute all the available measures to prevent uncontrollable leakage of hazardous substances, i.e. to execute the emergency protection of operation and to perform inspection and maintenance activities of the equipment used on a regular basis, and to equip individual workplaces with sufficient quantity of absorbents,
  - in case of leakage of hazardous substances during transportation of wastes or raw materials necessary for operation, to proceed in compliance with the respective emergency plan and to dispose any contaminated soil in compliance with the principles of hazardous waste management.

- In the sector of radiation protection and health protection
  - to be solved on the basis of a safety analysis of the proposed operation
IV. 4. ORGANISATIONAL AND OPERATING MEASURES

The organisational measures during construction will consist in:

1. Work organisation:
   - Performance of assembly work according to the approved Work Programme,
   - Observance of the valid directives of JAVYS, a.s. (Process documentation) for occupational health and safety,
   - Observance of the valid directives of JAVYS, a.s. (Process documentation) for work performance in the controlled area.

2. Preparation of material for assembly:
   - The material for construction will be gradually transported to the structure 840M according to the Work Programme.

The organisational measures during operation will consist in work organisation:

- Work performance according to the PP (Operating Regulation),
- Observance of internal directives (Process documentation) for occupational health and safety,
- Observance of internal directives (Process documentation) for work performance in the controlled area.

TECHNICAL SAFETY AND OCCUPATIONAL HEALTH AND SAFETY

For identification of hazard and risk assessment, the PAZ programme is used – OHS module (BOZ). The module creates a configuration of the working position in terms of influence of risk factors and performed risky activities. All relevant information is made accessible to all employees in the internal computer network. The employees are provably familiarised with risks in individual workplaces within the framework of the induction training in the workplace and within the periodical training in accordance with LZ/VP/ZSM "Employee education and training“ and the related documentation.

Based on the risk assessment and evaluation of hazards resulting from the working process and working environment, the list of provided personal protective equipment is prepared – BZ/KB/SM-01 "Provision of personal protective equipment and hygienic articles".

The internal directive specifies the rules of provision of personal protective equipment (PPE). In cooperation with the Provider, the occupational health service has prepared written documents in accordance with the evaluation of hazards resulting from the work character and working environment factors (noise, vibrations, chemical substances, carcinogens and mutagens) and non-removable hazards, which can affect employee health.

Health surveillance including the medical preventive examinations in relation to work in regular intervals taking into account the character of work and working conditions in the workplaces is provided in accordance with LZ/SS/ZSM "Social care" and related documentation.

The employees are assigned to jobs and workplaces by the Proposer, considering their abilities and health condition and according to the rate of health threat, and for specific professions it provides preventive periodical medical examinations, psychological, neurological, ophthalmologic, orthopaedic examinations and the examinations required by special regulations.

The activities connected with identified hazards are carried out under specific conditions as follows:

- by creating and observing the documented procedures for the situations, where their absence would lead to a deviation from the OHS policy and objectives – risk assessment and operating rules issued as operating documentation;
in accordance with Article 4 of Act No. 124/2006 Coll., the designers, design engineers and authors of working procedures are obliged to prepare the projects, machine designs and working procedures in compliance with the OHS regulations. They must include persistent risk and hazard assessment, draft protective measures, emergency plan, rules for waste disposal etc. The observance of the provision is checked within the process of commenting.

The organisational measures for safe work securing are provided by:

- **Z-Order** - an order for safe work securing on technological equipment,
- **B-Order** - an order for safe work securing on electrical equipment and networks,
- **R-Order** - an order for safe work securing in the rooms with an increased radiation risk,
- **PO-Order** - an order for the securing of safe work with an increased risk of fire occurrence.

The organisational measures for safe work performance are provided by:

- **M-Order** - a document authorising to perform manipulations on the operated equipment,
- **HZ (defect report)** - a document authorising to perform operative maintenance on the equipment,
- **PPr (Work Order)** - a document authorising to perform work on the equipment,
- **PRG, PPS** - programmes and working procedures of operation are the documents authorising to perform the planned non-standard activities according to the previous approval.

For the operation of the existing ISFS, approved operating regulations are in place for the purpose of employee protection and they will be updated for the additionally built facilities. Technical safety of the proposed SF technology will be assessed during the permitting process. To ensure technical safety, certain equipment will be included among classified equipment in accordance with Regulation of NRA SR No. 430/2011 Coll. on nuclear safety requirements. Classified equipment is defined in Act of the National Council of the Slovak Republic No. 541/2004 Coll. as: "systems, structures and components or parts thereof, including their software, important for nuclear safety of the nuclear installation, classified into safety classes according to their importance for nuclear safety, as well as according to the safety function of the system they are part of, and according to the significance of their potential failure".

The project documentation will be submitted to the professionally competent person issuing the professional opinion, which will represent the background document for the permitting body. The professional opinion contains: verification of fulfilment of occupational health and safety requirements by assessing the construction documentation, as well as the professional opinion for the building permit in accordance with Article 14 (1) (d) of Act of the National Council of the Slovak Republic No. 541/2004 Coll. as: "systems, structures and components or parts thereof, including their software, important for nuclear safety of the nuclear installation, classified into safety classes according to their importance for nuclear safety, as well as according to the safety function of the system they are part of, and according to the significance of their potential failure".
Republic No. 124/2006 Coll. and Article 13 of STN EN ISO/IEC 17020:2005. Only on the basis of this opinion and other statements of the affected bodies, subsequently a permit will be issued for the execution of storage capacity expansion.

In compliance with the provisions of Regulation of the NRA SR No. 430/2011 Coll., operation safety evaluations through the operating indicators of safety will be carried out on the nuclear installation on a quarterly and annual basis. The operating indicators of safety are specified as follows:
- condition of classified equipment,
- operating events and causes of their occurrence,
- radiation protection,
- human factor,
- observance of regulations,
- OHS and fire protection,
- emergency planning,
- safety culture and other.

The residual risks and threats in terms of occupational health and safety (OHS) resulting from the proposed technical solutions pursuant to Article 4 of Act No. 124/2006 Coll. will also be assessed in the project preparation, and for the use of electrical hand tools, it will be necessary to introduce record-keeping of regular checks and reviews pursuant to Article 9 of Regulation No. 508/2009 Coll. and STN 331600. Record-keeping of selected technical equipment pursuant to Article 8 of Regulation No. 508/2009 Coll. will also be introduced.

MINIMISING THE EXTERNAL EXPOSURE

Minimising the external exposure of workers

Parameters of the packaging sets will be incorporated into the project documentation after detailed safety analyses in order to achieve necessary limitation of ionising radiation impact on workers below the set legislative limits.

Equipment care programmes

- Classified equipment – CE will be included in the lists and plans of CE quality, inspections will be carried out pursuant to the approved quality assurance individual plans.
- Selected technical equipment will be included in the lists and plans of selected technical equipment, inspections will be carried out pursuant to Regulation No. 508/2009 Coll.
- Equipment inspections and maintenance will be carried out according to the technological documentation of the equipment manufacturer.
- Equipment diagnostics will be carried out according to the annual schedule of vibro-acoustic measurements.
IV. 5. OTHER MEASURES
None

IV. 6. STATEMENT ON THE TECHNICAL AND ECONOMIC FEASIBILITY OF THE MEASURES
The proposed measures are organisationally, technically and economically feasible

V. COMPARISON OF PROPOSED ACTIVITY’S VARIANTS AND PROPOSAL OF THE OPTIMAL VARIANT (INCLUDING THE COMPARISON WITH THE ZERO VARIANT)

V.1. CREATION OF THE SET OF CRITERIA AND DETERMINATION OF THEIR IMPORTANCE FOR OPTIMAL VARIANT SELECTION

The assessment criteria were set on the basis of the prediction that every activity in the territory can affect the state of any component of the environment as well as on the landscape-ecological and social-economic characteristics of the affected territory.

Thus, the preliminary assessment of the respective activity was carried out not only within the scope of the sets of environmental criteria, expressing the impacts on individual components of the environment and within the scope of the set of technical and technological criteria, where the evaluation of such criteria expressed the degree and level of the technical and technological solution of the activity, but also within the scope of the last group of assessed criteria, i.e. the impacts on the affected population including the evaluation of the activity's impacts on the population well-being and health condition as well as on their social and economic situation.

Taking into account the character of the respective activity, the impacts caused by spent fuel presence and management including its transportation can be considered generally the most important criteria of assessment. The significance of the activity for SF management safety and complexity, thus the assurance of operation of nuclear power plants in the Slovak Republic is also an important criterion for the evaluation of the respective activity.

V.2. SELECTION OF AN OPTIMAL VARIANT OR SPECIFICATION OF SUITABILITY ORDER FOR THE VARIANTS UNDER ASSESSMENT

COMPARISON OF THE OPTIMAL VARIANT

Impact assessment scale:

+ 3 Very significant favourable impact, long-term, mostly with a regional or cross-regional reach
+ 2 Medium-significant favourable impact, mostly with a local importance
Low-significant favourable impact, or with a small-area operation

No impact or irrelevant impact

Low-significant adverse impact, or with a small-area operation

Medium-significant adverse impact, mostly with a local importance

Very significant adverse impact, long-term, mostly with a regional or cross-regional reach

### Table No. C. V.2./01
Preliminary comparison of suitability of individual variants of the activity

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Environmental aspect</th>
<th>Variant 0</th>
<th>Variant 1 (wet storage facility)</th>
<th>Variant 2 (container on the surface)</th>
<th>Variant 3 (vault system)</th>
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<tbody>
<tr>
<td>Impact on population health and influence of population life quality</td>
<td>total radiation load on the population</td>
<td>-2</td>
<td>-2</td>
<td>-1</td>
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<tr>
<td></td>
<td>noise</td>
<td>-1</td>
<td>-1</td>
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<tr>
<td></td>
<td>smell</td>
<td>0</td>
<td>0</td>
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<td>0</td>
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<td>air pollution by pollutants</td>
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<td>traffic situation</td>
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<td>-1</td>
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<td>risk of extraordinary events</td>
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<td>Impacts on soil and rock mass</td>
<td>possibility of occupation of PPF or LPF</td>
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<td>radioactive contamination of soil and rock mass</td>
<td>-2</td>
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<td></td>
<td>pollution of soil and rock mass</td>
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<td>Impacts on surface and ground waters</td>
<td>discharge of waste waters to water bodies/pollution</td>
<td>-1</td>
<td>-2</td>
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<td>thermal pollution of surface waters</td>
<td>-1</td>
<td>-2</td>
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<tr>
<td></td>
<td>radioactive contamination of surface waters</td>
<td>-1</td>
<td>-1</td>
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<tr>
<td></td>
<td>radioactive contamination of ground waters</td>
<td>-1</td>
<td>-1</td>
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<td>ground water pollution by pollutants</td>
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<td>threat to water sources</td>
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<td></td>
<td>contamination of the air by radionuclides</td>
<td>-1</td>
<td>-1</td>
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<tr>
<td></td>
<td>thermal air pollution</td>
<td>-1</td>
<td>-2</td>
<td>-2</td>
<td>-1</td>
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<tr>
<td>Impacts on waste management</td>
<td>quantity of produced other and hazardous wastes</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>-----------------------------</td>
<td>------------------------------------------------</td>
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<tr>
<td>Radioactive wastes (RAW)</td>
<td>quantity of produced secondary radioactive wastes</td>
<td>-2</td>
<td>-3</td>
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<td>Impact on the transport infrastructure</td>
<td>road traffic</td>
<td>0</td>
<td>-1</td>
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<td>railway transport</td>
<td>0</td>
<td>-1</td>
<td>-1</td>
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<tr>
<td></td>
<td>suitability of the existing transport infrastructure</td>
<td>0</td>
<td>1</td>
<td>-2</td>
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<td>Impacts on biota</td>
<td>permanent occupation of territory</td>
<td>0</td>
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<td>felling of trees</td>
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<td>presence of protected or endangered species</td>
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<td>Impacts on the landscape</td>
<td>utilisation of the territory</td>
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<td>landscape stability</td>
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<td>Material and energy inputs</td>
<td>consumption of raw materials</td>
<td>-2</td>
<td>-3</td>
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<td>-1</td>
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<tr>
<td></td>
<td>consumption of chemical substances and chemical preparations</td>
<td>-2</td>
<td>-3</td>
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<td>fuel consumption</td>
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<tr>
<td></td>
<td>service water consumption</td>
<td>-2</td>
<td>-3</td>
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<td>drinking water consumption</td>
<td>-1</td>
<td>-1</td>
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<tr>
<td>Employment</td>
<td>stabilisation of job positions</td>
<td>-3</td>
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<tr>
<td>Energy security</td>
<td>Provision of operation of the NPPs in the SR</td>
<td>-3</td>
<td>3</td>
<td>3</td>
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<tr>
<td></td>
<td>stability of the power system of the SR</td>
<td>-3</td>
<td>3</td>
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<tr>
<td>Compliance with legal requirements</td>
<td>observance of Act No. 541/2004 Coll.</td>
<td>-3</td>
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<tr>
<td>Total costs</td>
<td>investment costs</td>
<td>0</td>
<td>-2</td>
<td>-3</td>
<td>-1</td>
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<tr>
<td></td>
<td>operating costs</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
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<tr>
<td>Total impact:</td>
<td>-36</td>
<td>-24</td>
<td>-1</td>
<td>8</td>
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The results:
Variant No. 1 - 24 points
Variant No. 2  - 1 point
Variant No. 3  - 8 points
Zero Variant  - 36 points

Sequence of suitability of the respective activity's variants:

  Variant No. 3
  Variant No. 2
  Variant No. 1
  Zero Variant

After a preliminary comparison of the variants of the respective activity under assessment, with
general summarising evaluation of individual impacts, the most optimal variant seems to be Variant
No. 3.

V.3. SUBSTANTIATION OF OPTIMAL VARIANT PROPOSAL

The zero variant is defined as the condition resulting from non-execution of the activity. In case that
SF storage capacity expansion is not executed,
it will not be possible to provide for the long-term storage of SF from the nuclear power plants in
operation once the existing ISFS structure has been fully filled. It has a capacity of 14,112 fuel
assemblies and at present 80% are full (the free storage capacity will be sufficient until about 2022).
It will be possible to store SF only at individual nuclear power plants in the pools near the reactors.
After they have been filled and if SF is not removed in any other way, the reactors will have to be
shut down, which would represent a loss of electric energy production in the Slovak Republic and
destabilisation of the power system of the Slovak Republic.
The activity under assessment ensures the fulfilment of the task of JAVYS, a.s. company imposed by
Act No. 541/2004 Coll. (Article 10 (3)).
Taking into account the experience in wet storage and the possibility to use relocation of fuel
assemblies from the wet storage facility to the dry storage facility, it was proposed to build new
rooms using an architectural interconnection with the existing ISFS building. This way also reduces
the investment and operating costs by the costs of construction of the access to the control area with
the radiation protection instruments provision. The possibility of using the existing infrastructure,
monitoring systems of the site and the use of the technological and transport equipment of the wet
storage facility represents a favourable aspect.
The evaluation of the proposed variants shows that the wet storage method is less suitable, taking into
account a higher production of secondary RAW, which, however, can be treated on site by means of
the existing RAW treatment and conditioning technologies, and a higher consumption of raw
materials and energies in particular for the operation of the auxiliary systems (e.g. water treatment,
air-conditioning systems).
Storage capacity expansion with the dry method is evaluated as an optimal variant, taking into
account all the evaluation criteria. The significant disadvantages of Variant No. 2 include the
necessary technical modifications of the storage pools at the reactor halls of the NPPs, modifications
of the transport and technological means used during transportation, provision of transport vehicles
(new railway carriages) and a destruction carriage. The comparison of the two technological ways
of dry storage shows that Variant No. 3 is the more suitable one not only in terms of economic
aspects, it does not require any technological modifications in the storage pools at the reactor halls of the NPPs in operation, it does not require railway siding expansion, but also as regards the building solution because it minimises the impacts on the service personnel and the environment (SF storage below the terrain level, the service personnel is not present in the area of SF storage).

Thus, it can be generally stated that the selection of Variant No. 3 in terms of all aspects under assessment, i.e. environmental, technical and technological as well as social and economic, respecting the set limits and conditions of operation, seems to be an optimal solution for the provision of a sufficient storage capacity for the SF from the nuclear power plants in operation in the Slovak Republic.

VI. PROPOSAL OF MONITORING AND POST-DESIGN ANALYSIS

VI.1. PROPOSAL OF MONITORING FROM THE BEGINNING OF CONSTRUCTION, DURING THE CONSTRUCTION, DURING OPERATION AND AFTER THE END OF OPERATION OF THE PROPOSED ACTIVITY

The project of "SF storage capacity expansion" means the construction of additional SF storage rooms, which will be architecturally interconnected with the existing NI "ISFS" (structure No. 840M).

The activities especially important in terms of radiation protection are monitored pursuant to Government Order No. 345/2006 Coll. on basic safety requirements for the protection of health of workers and inhabitants against ionising radiation, Act No. 355/2007 Coll. on public health protection, support and development and on the amendment to certain acts and Regulation of the Ministry of Health of the Slovak Republic No. 545/2007 Coll. laying down details on requirements for radiation protection provision during the activities leading to irradiation and activities important in terms of radiation protection.

The expansion of storage rooms will be part of the controlled area, and to monitor the radiation situation, the existing specialised monitoring systems will be used or they will be adapted to the selected variant of SF storage. The requirements for monitoring are unambiguously specified by the permits and decisions of state supervision bodies, in particular of the Public Health Authority of the Slovak Republic and Nuclear Regulatory Authority of the Slovak Republic. JAVYS, a.s. performs monitoring of operation of all installations in accordance with the requirements, permits and decisions of the state supervision bodies, and this will also apply to the new storage rooms of SF.

Monitoring the discharges of RA substances through the ventilation stack

The monitoring of discharges of RA substances through the ventilation stack is ensured by the monitoring system, in accordance with the operating instruction approved by the supervisory bodies.

The check of discharges from the ventilation stack, structure 840M room No. 306 in the part, in which the air-conditioning systems of the whole interim spent fuel storage facility are terminated, consists of:

a) the check of investigation level of aerosol volume activities by means of a continual monitor
b) the check of weekly, monthly and quarterly discharges.

Aerosol discharges are checked by means of:

- isokinetic equipment with a large-size filter
- continual monitor for tritium (H3) measurement in gaseous fluid
- equipment for tritium sampling
- equipment for carbon sampling

The monitoring system continually monitors the volume activity of alpha and beta aerosols in the ventilation stack and for balancing needs it catches aerosols by means of a balance filter with a diameter of 200 mm, which is subsequently evaluated in accordance with the approved methodologies for balancing in radiochemical laboratories. The volume activity of aerosols, immediate flows through the moving filtration tape as well as through the balance filter are displayed by the evaluation unit. Tritium samples are taken by the equipment working on the principle of condensation. The sampling is evaluated in the laboratory. Carbon activity is determined in the laboratory, if necessary.

The equipment meets the requirements for "legally controlled measuring instruments" in accordance with Act on Metrology No. 142/2000 Coll. and implementing Regulation No. 210/2000 Coll.

Monitoring the liquid discharges

No waste waters are released into the environment from the ISFS structure. All the liquid wastes are led through piping to structure 800:V1. Liquid discharge monitoring is carried out in structure 800:V1 and at the border of JAVYS, a.s. to the Socoman piping collector. After the measurement in the tank, the waste waters are led to the water collector Socoman, where they are measured using the continual measurement of summary activity.

The equipment meets the requirements for "legally controlled measuring instruments" in accordance with Act on Metrology No. 142/2000 Coll. and implementing Regulation No. 210/2000 Coll.

Radiation characteristics monitoring for both wet and dry variants:

The existing system of measurement of equivalent dose rates will be supplemented with an adequate number of probes for the measurement of the value. Their number depends on the particular ground plan because the detection abilities of the probes depend on the distance from ionising radiation sources and the objective is to have information about the size of equivalent dose rates in order to protect the personnel entering these premises. The new probes will be connected to the existing system in order to provide the radiation safety technician with immediate information.

Aerosols monitoring in the hall of storage for dry storage is not considered because this value is indirectly detected by other technological measurement.

Aerosols monitoring in the hall of storage for wet storage would be identical with the existing monitoring, which is included in the approved and valid operating documentation.

Environmental monitoring in the surroundings of JAVYS, a.s.

The teledosimetric system is the most important part of environmental monitoring in the surroundings of JAVYS, a.s.

AEROSOL SAMPLES OBTAINED FROM CONTINUAL SAMPLING

Aerosol sampling is carried out continually in 24 stations of the teledosimetric systems situated around the premises of Jaslovské Bohunice by means of large-size sampling devices with the air flow
of about 200 m$^3$.h$^{-1}$. After 14-day exposure, the filters are pressed into a kind of tablet and measured on the HPGe detector.

**Radioactivity of Fallouts**

Fallouts are taken by means of large-size sampling equipment installed in selected stations.

**Milk Radioactivity**

Milk samples with a volume of two litres are taken in weekly intervals from two dairy works and two agricultural enterprises (Dolné Dubové – cow-house, Drahovce – cow-house, Nižná – cow-house, Trnava – cow-house). A gamma spectrometry analysis determining the presence of artificial radionuclides is carried out on the samples. A monthly sample is cumulated from the weekly samples and it is radiochemically treated, then a gamma spectrometry analysis is carried out.

**Radioactivity of Drinking and Surface Waters**

Samples of drinking waters are taken on a quarterly basis in ten sampling places of drinking water (Hlohovec, Kátlovce, Malženice, Siladice, Trakovice I and II, Veľké Kostoľany, Zelenice, Žlkovce I and II) in a quantity of 10 L. The samples are radiochemically treated and the total activity and tritium volume (3H) is determined by means of liquid scintillation spectrometry.

Samples of surface waters are taken on a monthly basis in a quantity of 50 L (Dudváh – Bučany and Veľké Kostoľany, Váh – Várov Šúr, Madunice, Žlkovce – channel). The samples are radiochemically treated and the total activity and tritium volume (3H) is determined by means of liquid scintillation spectrometry.

**Radiation Monitoring Wells**

Water samples are taken from radiation monitoring wells twice a year with a volume of 10 L – in spring and in autumn. The samples are radiochemically treated and the total activity and tritium volume (3H) is determined by means of liquid scintillation spectrometry.

**Radioactivity of Agricultural Products**

**Grasses, clovers and other**

Grass samples are taken twice a year, in spring and in autumn, in the vicinity of the teledosimetric stations (grass samples from 15 places, clover samples from three places). The samples are dried and pressed into a cylindrical shape in the laboratories. A gamma spectrometry analysis is carried out on the treated samples.

**Radioactivity of soils**

Soil samples are taken once a year in ten places at two depths - 0 to 2 cm and 2 to 5 cm. Sampling is carried out in two groups – grassy surfaces, from which samples are taken in spring, and arable lands – the samples are taken in autumn. The samples are dried, homogenised and evaluated by means of gamma spectrometry in the laboratories.

**On-site measurement in the field**

On-site gamma spectrometry is carried out twice a year, in spring and in autumn, in the vicinity of the teledosimetric stations.
Dose measurement
The rate of gamma radiation dose equivalent is measured by means of the TLD dosimeters situated in the teledosimetric stations. The TLD dosimeters from the stations are evaluated after a monthly exposure.

Dose rate measurement
Dose rates are measured continually in all 24 stations of the teledosimetric system.

Evaluation of the environmental monitoring in the surroundings of JAVYS, a.s.
Every year, analyses of about 2000 samples of the environment from the surroundings of the SE-EBO and JAVYS, a.s. premises are carried out. The results of the analyses prove that the environmental impact of SE-EBO and JAVYS, a.s. is minimal or even negligible.

Monitoring the discharges of non-radiation harmful substances from the controlled area to the environment
Waste waters are discharged from the controlled area discontinuously. Prior to the discharge, a chemical and radiochemical analysis of the water to be discharged is carried out. If the water does not meet the conditions for discharging set by the state supervision bodies, the process of treatment is repeated. Detailed records are kept about discharged waters.

VI.2. PROPOSAL OF CONTROL OF SET CONDITIONS OBSERVANCE

It is not necessary to propose the control of set conditions observance because at JAVYS, a.s. it is unambiguously set by decisions of the Public Health Authority of the Slovak Republic and NRA SR, which are based on the requirements of the legislation of the Slovak Republic.

VII. METHODS USED IN THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS FOR THE PROPOSED ACTIVITY AND THE WAY AND SOURCES OF ACQUISITION OF THE DATA ON THE CURRENT STATE OF THE ENVIRONMENT, WHERE THE PROPOSED ACTIVITY IS TO BE EXECUTED

- Proposer's documentation review
- Permits and decisions of state supervision bodies
- Proposer's operating regulations
- Investment plan
- Feasibility study
- Proposer's technical documentation
- Personal negotiations, visits in similar workplaces and correspondence
- Negotiations with VUJE workers
- Review of information available on the internet
VIII. KNOWLEDGE SHORTCOMINGS AND EQUIVOCATIONS OCCURRED DURING THE ASSESSMENT REPORT PREPARATION

In terms of the results of the environmental assessment of complete impacts of the activity we state that in the process of report preparation there were no essential issues, for which there is no necessary information and draft solutions.

IX. ANNEXES TO THE ASSESSMENT REPORT (GRAPHIC, MAP, TABULAR AND PHOTO DOCUMENTATION)

- Annex No. 1: Nuclear installations at Jaslovské Bohunice
- Annex No. 2: Map of the affected territory
- Annex No. 3: Illustration of sectors according to the ESTE AI programme
- Annex No. 4: Summary of technological solutions of SF storage used abroad
- Annex No. 5: Evaluation of incorporation of specific requirements regarding the notice
- Annex No. 6: Assessment scope and evaluation of fulfilment of assessment scope specific requirements
X. GENERAL COMPREHENSIBLE FINAL SUMMARY

1. Basic data on the Proposer
Jadrová a vyradovacia spoločnost’, a.s.
Tomášikova 22
821 02 Bratislava
Comp. ID No.: 35 946 024

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The Proposer of the activity “Expansion of storage capacity of the interim spent fuel storage facility at Jaslovské Bohunice” – Jadrová a vyradovacia spoločnost’, a.s. with its registered office in Bratislava is an organisation established and authorised by the Ministry of Economy of the Slovak Republic in accordance with Article 3 (9) of Act No. 541/2004 Coll. on peaceful use of nuclear energy (Atomic Act) and on the amendment to certain acts as amended, which provides for safe RAW and spent fuel management pursuant to Article 10 (3) of the above Act.
At the site Jaslovské Bohunice, it operates the nuclear installations "RAW treatment and conditioning technologies" and the Interim spent fuel storage facility" and decommissions the nuclear installations "A1 NPP" and "V1 NPP".

2. Basic data on the proposed activity

2.1 Name
Expansion of storage capacity of the interim spent fuel storage facility at Jaslovské Bohunice

2.2 Purpose of the facility
The purpose of the activity under assessment is to expand the existing storage capacity of spent nuclear fuel for at least 18,600 fuel assemblies. Two stages of storage capacity expansion are planned; during the first stage, the storage capacity will be expanded by at least 10,100 pieces of SF, during the second one, by at least 8,500 pieces of SF.
At present, SF is stored in structure 840M "Interim spent fuel storage facility“, which provides "wet storage".

The expansion of spent fuel storage capacity will serve for long-term storage of the SF produced by
all nuclear power plants in the Slovak Republic taking into account that pursuant to Article 3 (9) of Act No. 541/2004 Coll. the company JA VYS, a.s. is a legal entity established and authorised by the Ministry of Economy of the Slovak Republic and provides for SF storage pursuant to Article 10 (3) of Act No. 541/2004 Coll., which states: "In the interest of provision of nuclear safety and prevention of ungrounded accumulation of radioactive wastes and spent nuclear fuel, the licence holder is obliged, during nuclear installation commissioning and operation, to hand over the radioactive wastes, no later than within 12 months from their production, and spent fuel, immediately after the fulfilment of requirements for its safe transport and storage, to the legal entity established in Article 3 (9) for further management."

Spent fuel assemblies can be stored in several ways, which implies the three submitted technological variants:

1. Wet SF storage capacity expansion by expanding the storage capacity of SF storage pools and enlarging the current building of ISFS using the current storage casks KZ-48 for 48 pieces of SF.

2. SF storage capacity expansion using dry storage with the architectural interconnection with the current ISFS building using the transport and storage containers for maximum 84 pieces of SF placed on the hard surface in the storage hall of the SF storage facility.

3. SF storage capacity expansion using dry storage with the architectural interconnection with the current ISFS building using the storage containers (canisters) for maximum 85 pieces of SF placed in the ferro-concrete storage modules of the SF storage facility.

2.3 Facility siting

Spent nuclear fuel storage capacity expansion for all the assumed variants is proposed at the site Jaslovské Bohunice with the interconnection with the existing ISFS building as part of the nuclear installation "Interim spent fuel storage facility".

The existing ISFS is situated in the cadastral territory Bohunice, parcel No.: 701/50, 701/51. The proposed variants would be situated on parcels No.: 701/46, 701/87, 701/9. The mentioned parcels are owned by the Proposer, registered as built-up areas and courtyards, out of the built-up territory of the municipality.

2.4 The reason for siting at the proposed site

In compliance with the Atomic Act in force, JAVYS, a.s. holds the licence for the transport and storage of the SF produced in the Slovak Republic. It operates a wet interim SF storage facility with a capacity of 14,112 fuel assemblies. At present, about 80% of the storage facility are full. The free storage capacity will be sufficient approximately till 2022.

JAVYS, a.s. is responsible not only for the storage of fuel assemblies from the shut down units of the V1 NPP (5143 fuel assemblies), it also provides for the storage of the SF owned by the company SE, a.s. operating the nuclear units in the Slovak Republic. To ensure the operation of all nuclear units in the Slovak Republic and taking into account the construction of a new nuclear source that is under preparation at Jaslovské Bohunice, the ISFS storage capacity needs to be expanded.
In addition to the above mentioned, the reason for the siting of the proposed variants is the possibility of using the infrastructure, utility networks and services (e.g. the source of electric energy, water, inputs etc.) available at the site. Moreover, the advantages of the site solution at Jaslovske Bohunice include the utilisation of the synergistic effect of stock relocation from the wet to the dry interim storage facility and the subsequent wet storage of the SF produced by units' operation after partial heat removal in the SFSP. Till the end of operation of the wet interim storage facility, the fuel from the storage pools will be gradually relocated to the dry interim SF storage facility. In terms of strategy and security, the fuel would be concentrated at one site before it is finally disposed, for example, in a deep repository or by transporting for reworking. Relevant factors for the site of Jaslovske Bohunice also include the planned construction of a new nuclear source with a planned power of max. 2400 MW of electric energy.

2.5 Proposed technological solution

The SF storage capacity can be expanded in three ways, which implies the three submitted technological variants:

Variant No. 1: Expansion of SF wet storage capacity by building four additional pools with the use of storage casks KZ-48.

Variant No. 2: SF storage capacity expansion using dry storage with the architectural interconnection with the current ISFS building using the transport and storage containers for maximum 84 pieces of SF placed on the hard surface in the storage hall of the SF storage facility.

Variant No. 3: SF storage capacity expansion using dry storage with the architectural interconnection with the current ISFS building using the storage containers (canisters) for maximum 85 pieces of SF placed in the ferro-concrete storage modules of the SF storage facility.

Description of individual variants:

Variant No. 1: Expansion of SF wet storage capacity by building four additional pools with the use of storage casks KZ-48

The technical solution consists in the expansion of the storage capacity of the existing wet storage facility in the ISFS at Jaslovske Bohunice operated by JAVYS, a.s. by building four new pools. The expansion of the storage capacity using this variant cannot be solved in two stages (in the first stage, the storage of 10,100 fuel assemblies is requested, and in the second stage, the storage capacity should be expanded by additional 8,500 fuel assemblies). In case of wet expansion of the interim SF storage facility, both stages would have to be executed in one building step so that no division to further dilatation units would occur. It would be very complicated to seal the units and ensure uniform settlement. Therefore, it would be necessary to execute one unit for the storage of 18,600 fuel assemblies. To ensure the system's synergy with the original solution, it is expected that the fuel will be stored in the pools in the KZ-48 compact casks with 48 fuel assemblies each. Therefore, there is a need to build four new pools for 388 pieces of KZ-48 casks. This variant would require an increase in the cooling capacity of the water cooling station, a modification of the existing
technological systems (crane track, ventilation system, collection of leaks from interspace lining etc.).

The advantages of this variant include in particular a smaller storage area, easier accessibility and check of the state of the fuel assemblies. The disadvantages include in particular considerable demands of the building expansion of the pools (maintaining the tightness, resistance and uniform settlement of the structures) and the expansion of the technological systems and transport technology.

**Fig. No. 1: Diagram of the container and storage part of the ISFS (floor +7.2 m) with four additional pools**

Variant No. 2: SF storage capacity expansion using dry storage with the architectural interconnection with the current ISFS building using the transport and storage containers for maximum 84 pieces of SF placed on the hard surface in the storage hall of the SF storage facility.

The technical solution consists in the expansion of the storage capacity by building a module of dry storage facility in the ISFS at Jaslovské Bohunice operated by JAVYS, a.s.

The expansion of the storage capacity for SF in the Slovak Republic is requested in two stages. In the first stage, the storage of 10,100 fuel assemblies is requested, and in the second stage, the storage capacity should be expanded by additional 8,500 fuel assemblies.

This variant considers the direct insertion of spent fuel at the reactor unit to a dry type transport and storage packaging set. The fuel assemblies are stored in the dry inert atmosphere. This concept of SF storage solution requires a modification of the affected technology at all units in operation at nuclear power plants in the Slovak Republic. To provide for SF handling, transport and storage in the Slovak Republic, a suitable transport and storage container must be approved according to the valid Atomic Act for the currently used VVER-440 type fuel with a perspective of its approval also for the fuel enriched in $^{235}$U (up to 5%).
The fuel will be inserted into the containers:

- in the main reactor building in the container shaft near the spent fuel storage pool in the reactor building of the respective unit of the nuclear power plant. The containers will be decontaminated in the main reactor building in the decontamination shaft. The containers will be transported from the reactor building to the storage facility by a railway carriage.

- in the wet part of the ISFS in the receiving pool. The containers will be decontaminated in the decontamination shaft of the ISFS. The containers will be transported from the area of the wet part of the ISFS to the dry part of the ISFS through a building interconnection.

Before SF receiving in the dry storage facility, the required checks will be carried out and afterwards, the container will be transported to its storage position in the storage area and connected to the system monitoring the gas pressure in the container (check of container’s tightness).

The containers with SF will be stored in the building, whose primary function will be to protect the containers against weather impacts. The building’s design must also enable passive heat removal from the surface of the transport containers by means of natural ventilation.

The building of the interim storage facility will consist of the technical zone, receiving area and storage area. The fuel will be placed in the fuel basket made of premium boron steel providing for the fuel subcriticality. The container will be protected against the leakage of radioactive substances by a double sealing system. The structural material of the container will provide for the shielding of ionising radiation. The container will consist of the following components:

- storage basket (cask);
- the vessel of the container;
- shielding against gamma radiation and neutron radiation;
- surface treatment of the container against weather impacts;
- connection lines for the monitoring systems;
- the system of pins and clips for packaging set handling.

The advantages of using the transport and storage containers include lower initial investment costs taking into account lower demands of the civil structure of the interim storage facility. However, the gradual purchase of packaging sets according to the requirements resulting from SF production represents higher financial demands.

The main disadvantages include the price and requirements of the currently valid Atomic Act for periodical approval of the transport equipment type.
Fig. No. 2: Transport and storage container for VVER-440 type SF

Fig. No. 3: Hall of storage of transport and storage containers
Variant No. 3: SF storage capacity expansion using dry storage with the architectural interconnection with the current ISFS building using the storage containers (canisters) for maximum 85 pieces of SF placed in the ferro-concrete storage modules of the SF storage facility

The technical solution consists in the expansion of the storage capacity by building a module of dry storage facility (in two stages) using a building interconnection with the existing ISFS at Jaslovské Bohunice operated by JAVYS, a.s.

The structure of the dry interim storage facility will be interconnected with the existing ISFS by a connecting corridor leading to the operating part and it will create one closed structure. The architecture of the storage part of the wet storage facility will not be affected. By modifying the existing and supplementing the new transport corridor, another technical zone will be added, i.e. the receiving area and the storage area of the dry storage facility. In the technical zone, a zone with a storage space for packaging sets for the purpose of check and maintenance will be created.

The receiving area is intended for the handling equipment, which is designed for packaging sets handling in the transport corridor. The crane parking position is situated in this area.

*Fig. No. 4: Storage capacity expansion for VVER-440 SF type*

The SF produced by NPP operation should be transported in compliance with the transport conditions for TK C-30 and stored using the wet method in the ISFS at Jaslovské Bohunice. SF storage in the ISFS storage pools will ensure active cooling needed for the fuel with high burn-up and initial
enrichment. After a sufficient cooling period, it will be possible to provide for effectively its longterm storage using the dry method and passive cooling system. The storage capacity of the wet interim storage facility will be gradually vacated by relocating the oldest stored SF from the stock of the existing ISFS after the fulfilment of the limit parameters for the canisters for dry fuel storage. All manipulations and activities related to fuel relocation to dry storage will be carried out in the structure of the existing wet storage facility. The necessary technology will be delivered for that purpose. It will be designed in a way as to not affect the activities of wet storage carried out at the same time. For that reason, only the technical solutions conforming to the dimensions, design and layout of the receiving and relocating pool of the ISFS, as well as to the parameters of the handling and transport devices, are considered.

The dry storage system in civil structures (the "vault" system) is considered as an underground ferro-concrete cell-type structure. Heat will be removed by means of natural air circulation through the input and output inner walls of the cells and the ventilation stack. Shielding will be provided by the design of the storage cell itself. Each storage cell will contain several metal canisters containing the stored SF. The vertical metal canisters will be placed in concrete modules on beds adapted for cooling air circulation preventing the cumulation of precipitated water, if any. The upper part of the canisters will be equipped with a massive plug embedded in the upper vault structure, which will be designed in a way as to be resistant to the load during the insertion of the canister into the cell as well as in case of a heavy object fall into the storage space. The canister will be a cylindrical steel vessel with the internals consisting of absorption boxes of the same design as for the compact casks with a defined number of fuel assemblies. The absorption boxes will provide for both the fixation of fuel assemblies and subcriticality of the stored fuel. The fuel assemblies will be stored in the dry inert atmosphere and the canister must provide for the following main functions:

- safe retention of radioactive substances;
- provision of subcriticality of the stored fuel;
- provision of fuel cooling and residual heat removal;

Main advantages of this solution include in particular the utilisation of the existing operated systems of the ISFS and experienced service personnel, relatively low demands for the size of the storage area, which consist in particular in the utilisation of the self-shielding ability, when fuel is stored in a vault chamber. Equally with all solutions on the basis of canisters, in this case too, only a minimum number of transport packagings to be approved pursuant to the valid Atomic Act is necessary.

As regards architecture, the advantages include the building interconnection of the wet and dry parts of storage allowing different settlement of the buildings; in terms of seismic resistance, the advantages include the fact that the hall for dry storage has a simple structure, partially embedded into the terrain, and it contains no complex technological devices. The disadvantages include more demanding canister handling, placing the canisters into the shielding cylinder and placing the canisters into the underground cell.
Fig. No. 5: Section of the SF storage structure in civil structures (the "vault" system)

Fig. No. 6: Placement of the canisters with SF in a ferro-concrete storage module
Zero Variant

It is defined as the condition resulting from non-execution of the activity. At present, the nuclear installation "Interim spent fuel storage facility“ is operated at the site Jaslovské Bohunice. It was commissioned in 1988 as a "wet storage facility” of spent nuclear fuel. In 1997-2000, the project of "Seismic retrofitting and expansion of the ISFS storage capacity“ was implemented. These days, the activity is operated on the basis of permit issued by the NRA SR No. 444/2010 dated 9 December 2010, which is valid until 31 December 2020. It is storage of the spent fuel assemblies in the casks in the water pools with a relatively low volume utilisation of the pools where water as a storage medium provides for the residual heat removal and also acts as shielding against radioactive radiation.

The main advantage of wet storage systems is the fact that the stored fuel is easily accessible and controllable. A relatively large quantity of fuel can be stored in storage pools at the same time. The water environment allows better heat removal in view of a higher heat conductivity of water in comparison with the air.

The ISFS is a detached building on the premises of JAVYS, a.s. at the site Bohunice. The building is entered and exited through the access to the controlled area, the ISFS rooms have a character of controlled area. According to the degree of radiation situation, they are divided into service, periodic-service and non-service areas.

As regards technology, the ISFS building is divided to two parts: the container and the storage part. The container part consists of the container hall serving for container handling, decontamination and tests and of the siding corridor for container unloading and loading to transport railway carriages.

The storage part consists of four storage pools with the dimensions 23.4 x 8.4 x 7.2m. One pool is a spare one in case that it is necessary to remove the fuel from the permanently filled pools. The technical solution of SF storage is executed so that the spent fuel assemblies are stored under the water surface in the storage pools in vertical position in the storage cask T-12, KZ-48 (the intact fuel assemblies) or T-13 (the untight fuel assemblies placed in hermetic boxes). The storage casks are designed in a way as to ensure the subcriticality of the stored fuel and integrity of the fuel assemblies in case of an earthquake. The spent fuel is shielded by the water surrounding the fuel assemblies and the concrete walls of the pools. Water ensures residual heat removal from the spent fuel and along with the concrete walls, it also provides a sufficient biological protection against radioactive radiation. In each storage pool, 98 KZ-48 type compact casks can be stored (in 14 rows with seven casks in each of them), each cask can contain 48 fuel assemblies. The maximum designed ISFS storage capacity after the reconstruction and seismic retrofitting is 14,112 fuel assemblies. At present about 80% of the wet ISFS are full, the free storage capacity will be sufficient approximately till 2022.

The ISFS structure has its own cooling and treatment station. The radiation monitoring system ensures radiation situation monitoring inside the ISFS and in its surroundings and the monitoring of personnel's individual doses. The air-conditioning systems provide for the ventilation and air-conditioning of the ISFS rooms in order to fulfil the conditions for operators in terms of radiation safety as well as in terms of suitable working conditions for the personnel. The ventilation stack of the ISFS is 35 m high. Four filtration stations are available for the filtration of the air exhausted by the ventilation systems from Ra - aerosols, the stations are connected as needed to form a route for various air flows.

In handling the spent fuel, the task of exhaust ventilation systems is to prevent activity leakage in other way than through the aerosol filters. The monitoring of released activity in the ventilation stack takes place continuously.
The Zero Variant represents the preservation of the actual state, i.e. the necessary storage capacity for SF produced by the nuclear power plants will not be provided, which, after the filling of the pool storage storage capacity at individual reactors, could lead to the shutdown of units of the Slovakia's nuclear power plants in operation.
3. The brief environmental impact assessment (impacts on the population, impact on the abiotic and biotic environment, impacts on the landscape, its structure, protected areas and their protection zones, other impacts)

The SF storage activity has no significant requirements for inputs (drinking water, cooling water (only for the wet variant), electric energy, compressed air and oxygen); only the quantities and types of packaging sets necessary for the storage of fuel assemblies represent an important input. The relevant outputs include only the gaseous discharges with wet storage and liquid discharges (indirectly from pool water treatment), insignificant quantities of wastes from equipment maintenance and usage of personal protective equipment.

**Environmental impact assessment**

The following table shows summary information about the identification and assessment of the proposed activity's environmental impacts.

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Identification yes/no</th>
<th>Note/explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impacts on the population - health risks</td>
<td>yes</td>
<td>For the activity under assessment, along with other nuclear facilities on site, the compulsory evaluation of radiation load is carried out on a regular basis. It shows that the achieved highest values of individual effective dose have lower order values in comparison with the specified limits (specified by the Public Health Authority of the Slovak Republic). The contribution of the additionally built storage capacity to total discharges is expected to represent an increase in the use of the current limits within the range of 0.01-0.11% (using the conservative approach and multi-stage filtration with an efficiency of 99.9%), which will not cause any significant changes in the dose load on the population, and it only applies to Variant No. 1 (wet storage). With dry storage variants, no discharges are released to the air or waters. Based on the above-mentioned, the impacts on the population can be assessed as minimum and acceptable.</td>
</tr>
<tr>
<td>Social and economic consequences and relations - employment</td>
<td>yes</td>
<td>During the ISFS operation, employment will be kept in JAVYS, a.s. and indirectly also in the operated nuclear power plants because the risk of NPP Units shutdown will be eliminated.</td>
</tr>
<tr>
<td>Activities of the inhabitants</td>
<td>no</td>
<td>In terms of the development of the affected municipalities and activities of their population, there is no expected separate impact of the activity under assessment thanks to its location out of the built-up territory of the municipalities within the premises of the company JAVYS, a.s.</td>
</tr>
<tr>
<td>Impacts</td>
<td>Identification yes/no</td>
<td>Note/explanation</td>
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<tr>
<td>Impacts on the rock mass, mineral resources, geodynamic phenomena and geomorphological conditions</td>
<td>no</td>
<td>The impact is irrelevant taking into account the character and siting of the respective activity.</td>
</tr>
<tr>
<td>Impact on rock mass pollution</td>
<td>no</td>
<td>The impact is excluded taking into account the character and siting of the respective activity.</td>
</tr>
<tr>
<td>Impacts on climatic conditions</td>
<td>no</td>
<td>The activity is not relevant for significant changes in greenhouse gas production.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No pollutant emissions are produced during the SF storage facility operation. Only during transportation, emissions are produced due to fuel combustion by the transport vehicles. Taking into account the number of transportations per year, the production of pollutants is negligible.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>During wet storage facility operation, the gaseous fluid is exhausted from the controlled area, filtered on the highly efficient aerosol HEPA filters. After the completion of wet storage capacity expansion, only the quantity of radionuclides released into the air through the ventilation stack (structure 840M) would change. The contribution can be expressed as an increase in the level of the use of the current limits within the range of 0.01-0.11% while providing the multi-stage filtration of the gaseous fluid. In case of the dry variants, no discharges are released into the air, thanks to the properties and securing of the packaging sets. In all the variants, the activity is without a request for changes of the current limits for gaseous discharges from the facilities of the company JAVYS, a.s.. Based on the above-mentioned, the impacts on the air can be assessed as minimum and for the given territory bearable and acceptable.</td>
</tr>
<tr>
<td>Impacts on water conditions (e.g. quality, regimes, run-off conditions, reserves)</td>
<td>yes</td>
<td>The operation of the respective activity is connected with the production of common sink and rain waste waters, in the volumes adequate to the area of the civil structure and to the number of employees (without an increase). The storage technology produces low-level waste waters only with wet storage, from pool water treatment. The water is removed through pipelines to the treatment plant in structure 801, they are not discharged into surface waters.</td>
</tr>
<tr>
<td>Impacts</td>
<td>Identification yes/no</td>
<td>Note/explanation</td>
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<tr>
<td>------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Impacts on soils (e.g. the way of use, soil erosion)</td>
<td>no</td>
<td>With dry variants, no active waste waters are produced. During storage, no chemical substances or preparations are used which could affect surface or ground waters when leaking. Taking into account the character and quantities of waste waters (an insignificant increase in surface run-off waters, no changes of sink water quantities), the operation of the additionally built storage spaces will not represent a measurable contribution to the currently released pollution from JAVYS, a.s. operations.</td>
</tr>
<tr>
<td>Impacts on soil pollution</td>
<td>no</td>
<td>The activity under assessment will be situated within the existing premises of JAVYS, a.s., thus there will be no new occupation of open spaces. The way of utilisation of the surrounding agricultural lands as well as the actual soil erosion will not be affected.</td>
</tr>
<tr>
<td>Impacts on fauna, flora and their biotopes</td>
<td>no</td>
<td>Taking into account the proposed siting within the bounded premises and minimum discharges only with wet storage, there will be no impacts on soils, the impact of storage capacity expansion is not relevant in connection with new land occupation. Taking into account the level of pollution of the released waste gaseous fluid (for the wet variant), the potential of impacts on soils is minimal, which is proved for example by systematic monitoring of influence of operation of the nuclear installations in the surroundings of the nuclear site Jaslovské Bohunice on individual environmental components.</td>
</tr>
<tr>
<td>Impacts on the landscape - structure and utilisation of the landscape</td>
<td>no</td>
<td>The activity is concentrated in the existing industrial area, the inputs and outputs from the activity cannot change the current state of the surrounding fauna, flora and biotopes. Based on the above-mentioned, the impacts on the biota can be assessed as minimum and for the given territory bearable and acceptable.</td>
</tr>
<tr>
<td>The impact on the protected areas and their protection zones</td>
<td>no</td>
<td>The expansion of the storage capacities is proposed as a building interconnection with the ISFS structure on the premises of JAVYS, a.s., which has the character of a standard industrial built-up area. The direct impact of the proposed new storage areas on the landscape scenery, its image or structure is virtually irrelevant.</td>
</tr>
<tr>
<td>The premises of the NI do not interfere with any protected areas, the first degree of landscape and nature protection applies here.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impacts</td>
<td>Identification yes/no</td>
<td>Note/explanation</td>
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</tr>
<tr>
<td>[e.g. the proposed protected bird areas, areas of European importance, the European system of protected territories (Natura 2000), national parks, protected landscape areas, protected water management areas]</td>
<td></td>
<td>Although, there is the territory of Natura 2000 nearby, the Protected Bird Area Špačince - Nižná Fields, the proposed activity will not affect the conditions of securing the favourable state of the biotope of a bird species with a European importance and the migratory saker falcon, which has lived here also during the operation of the NI Bohunice.</td>
</tr>
<tr>
<td>Impacts on the territorial system of ecological stability</td>
<td>no</td>
<td>The proposed activity does not represent a significant change. The influence on the landscape can be assessed as insignificant.</td>
</tr>
<tr>
<td>Impacts on the urbanised area and land use</td>
<td>no</td>
<td>The operation of the existing ISFS even with the building of further storage capacities will not affect the structure of the residential units concerned.</td>
</tr>
<tr>
<td>Impacts on cultural and historical monuments</td>
<td>no</td>
<td>The proposed activity does not represent a significant change.</td>
</tr>
<tr>
<td>Impacts on archaeological sites</td>
<td>no</td>
<td>There are none in the territory.</td>
</tr>
<tr>
<td>Impacts on palaeontological and significant geological sites</td>
<td>no</td>
<td>There are none in the territory.</td>
</tr>
<tr>
<td>Impacts on the immaterial cultural values (e.g. local traditions).</td>
<td>no</td>
<td>The proposed activity does not represent a significant change.</td>
</tr>
<tr>
<td>Other impacts</td>
<td>Impacts on transport</td>
<td></td>
</tr>
<tr>
<td></td>
<td>no</td>
<td>The intensity of SF transportation depends on its production by the operated nuclear power plants in the Slovak Republic. With all the three variants, the frequency of transportation will not change in comparison with the actual state. Only in case of Mochovce NPP Units 3 and 4 commissioning, the number of transportations would be increased by one transportation per year.</td>
</tr>
<tr>
<td></td>
<td>Impacts on waste management (WM)</td>
<td>During the maintenance and operation of the facilities, small amounts of inactive wastes or secondary RAW will be produced (PPE, filters), which do not mean a change of the current waste management. Based on</td>
</tr>
</tbody>
</table>
Impacts | Identification yes/no | Note/explanation
--- | --- | ---
 |  | the above-mentioned, the impacts on the waste management and related impacts can be generally assessed as minimum and for the given territory bearable and acceptable.

The operation of the proposed expansion of the storage areas will not cause any significant change of outputs in comparison with the actual state. **The proposed wet and dry storage technologies will not require a change of the currently set limits of gaseous and liquid discharges** specified by the decision of the Public Health Authority of the Slovak Republic. Taking into account the siting, character of the SF storage technology and the outputs from the proposed activity, there is no reason to expect any negative cross-border impact.

**The variant selection** was carried out on the basis of the following criteria:
production of secondary RAW, influence on the radiation load, demands for energies and raw materials, environmental impact, investment costs, energy security and stability. **The evaluation proved the selection of Variant No. 3 "SF storage capacity expansion using dry storage with the architectural interconnection with the current ISFS building using the storage containers (canisters) for maximum 85 pieces of SF placed in the ferro-concrete storage modules of the SF storage facility“ as an optimal variant.

4. Conclusion

The technological solution of SF storage capacity expansion for long-term storage of spent fuel from the NPPs in the Slovak Republic can be executed by three basic variants.

The first variant under assessment is the expansion of the existing wet SF storage type and the use of KZ-48 compact casks. The main advantage of the variant is the smallest requirement for the storage area and better removal of residual heat produced by SF taking into account a higher thermal capacity of water in comparison with air. Taking into account the state of current knowledge and development, wet storage is considered inconvenient especially as regards the need of active systems affecting safety and reliability (the case of energy and cooling medium supply failure) and the operating costs.

The second variant under assessment is the architectural interconnection of the dry storage hall with the wet interim storage facility. For SF storage, the technology of transport and storage containers placed in the storage hall is considered. Their main advantage is that they can be filled right in the reactor hall and then transported to the dry storage part. However, such technical solution requires a modification of the NPP units in operation.

The third variant under assessment and at the same time, the recommended one is the architectural interconnection of the dry storage hall with the wet interim storage facility, where for SF storage the technology of storage using single-purpose (storage) metal canisters placed in ferro-concrete vault-type modules is considered. This storage system with the storage area situated under the terrain level with natural air circulation provides sufficient physical protection against external impacts and also the biological protection against adverse ionising radiation. The design provides a high mechanical resistance and also sufficient residual heat removal even during adverse climatic conditions. With the
recommended variant, SF from the NPP units in operation to the ISFS will be transported by means of the existing C-30 transport containers and KZ-48 compact casks in a wet way and subsequently, they will be placed into storage pools. The oldest spent fuel will be relocated from the storage pools (after a storage period of about 30 years) to the canisters in the dry part of the storage facility.

**XI. LIST OF SOLVERS AND ORGANISATIONS THAT TOOK PART IN THE ASSESSMENT REPORT PREPARATION**

- Jadrová a vyraďovacia spoločnosť, a.s., Bratislava,
- ZŤS VVÚ Košice

**XII. LIST OF SUPPLEMENTARY ANALYTICAL REPORTS AND STUDIES AVAILABLE AT THE PROPOSER'S PLACE THAT WERE USED AS SUPPORTING DOCUMENTS FOR THE ASSESSMENT REPORT PREPARATION**

**LITERATURE USED:**


Michal Katuša, Zuzana Podmanická, Monika Procházková, Neonila Foltánová, Andrea Galvánková, Zuzana Štukovská, Klára Smutná: "Development of population in the Slovak Republic and regions in 2012
VÚJE a.s., 2014: Dry interim SF storage facility – feasibility study

**WEB SITES USED:**
- [http://www.enviroportal.sk](http://www.enviroportal.sk)
- [http://www.sazp.sk](http://www.sazp.sk)
- [http://www.statistics.sk](http://www.statistics.sk)
- [www.infostat.sk](http://www.infostat.sk)
- [http://www.environment.sk](http://www.environment.sk)
- [http://sk.wikipedia.org](http://sk.wikipedia.org)
- [http://www.pamiatky.sk](http://www.pamiatky.sk)
- [http://www.e-obce.sk](http://www.e-obce.sk)
- [http://www.obce.info](http://www.obce.info)
- [http://www.uzis.sk](http://www.uzis.sk)
- [http://www.shmu.sk](http://www.shmu.sk)
- [http://www.sopsr.sk](http://www.sopsr.sk)
- [http://http://www.vupu.sk](http://www.vupu.sk)
- [http://www.enviro.gov.sk](http://www.enviro.gov.sk)
- [http://www.ssc.sk](http://www.ssc.sk)
- [http://www.sopsr.sk](http://www.sopsr.sk)

**BRIEF LIST OF THE BASIC LEGISLATION REGARDING THE AFFECTED TOPIC:**

Act of the National Council of the Slovak Republic No. 541/2004 Coll. on peaceful use of nuclear energy (Atomic Act) as amended
Act of the National Council of the Slovak Republic No. 238/2006 Coll. on the National Nuclear Fund for decommissioning of nuclear installations and spent fuel and radioactive wastes management (Nuclear Fund Act) as amended
Act of the National Council of the Slovak Republic No. 355/2007 Coll. on public health protection, support and development and on the amendment to certain acts
Regulation of the Ministry of Health of the Slovak Republic No. 524/2007 Coll. laying down details on the radiation monitoring network
Regulation of the Ministry of Health of the Slovak Republic No. 545/2007 Coll. laying down details on the requirements for radiation protection provision during the activities leading to irradiation and the activities important in terms of radiation protection
Regulation of the Nuclear Regulatory Authority of the Slovak Republic No. 30/2012 Coll. laying down details on the requirements for nuclear materials, radioactive waste and spent nuclear fuel management
Government Order of the Slovak Republic No. 345/2006 Coll. on basic safety requirements for health protection of workers and inhabitants against ionising radiation
XIII. DATE AND CONFIRMATION OF CORRECTNESS AND COMPLETENESS OF DATA BY THE SIGNATURE (STAMP) OF THE ASSESSMENT REPORT AUTHOR'S AUTHORISED REPRESENTATIVE AND PROPOSER

PLACE AND DATE OF REPORT PREPARATION: Bratislava, 20 January 2015

REPORT AUTHOR:

JAVYS, a.s.
Tomášikova 22
821 02 Bratislava

Responsible solver: ......................................................

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Head of Radiation Protection,
Environment and Chemistry Section

Cooperated: Ing. Milan Bárdy, Ing. Daniel Vašína,
Ing. Viliam Mrva, Ing. Lubomír Král,
Ing. Branislav Birčák, Martin Skaličan,
Ing. Luboš Vráblik, MVDr. Zuzana Kollárová,
Ing. Milan Lörinc

Proposer's authorised representative:

......................................................

JAVYS, a.s.
Ing. Peter Čižnár
Chairman of the Board of Directors
and Chief Executive Officer

......................................................

......................................................

JAVYS, a.s.
Ing. Ján Horváth
Member of the Board of Directors and
Safety Division Director

JAVYS, a.s.
Ing. Miroslav Bočík, PhD.
Member of the Board of Directors and A1 Decommissioning
and RAW and SF Management Division Director