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I. GENERAL DATA ON PROPONENT

1. Name

Jadrová a vyraďovacia spoločnosť, a.s.

2. Company Identification Number

Company Identification Number: 35 946 024

3. Registered Office

Tomášikova 22
821 02 Bratislava

4. Authorised Representative of Proponent

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II. General Data on Proposed Activity

1. Name

Integral Nuclear Waste Repository

2. Purpose

The purpose of the proposed activity is exclusively the storage of solid nuclear waste modified by various technologies produced from the decommissioning of nuclear facilities on the site until the time of their transportation to a permanent deposition site. Another purpose is to enable to concentrate the named materials on a single site for environmental protection reasons, their central registration and control.

The integral RAW repository is exclusively a storage facility for storing of packaging units containing solid or solidified radioactive waste with equivalent dose rate of 10 mSv/hour at the unit surface, or its shielding.

3. User

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

4. Proposed Activity Character

This is a new activity – establishment of a facility for RAW storage classified pursuant to Annex No. 8 of Act No. 24/2006 Coll. on Environmental Impacts Assessment and on the change and amendment of certain acts as follows:

Chapter 2
Energy Industry
Item No. 9
Facilities for storage (planned for 10 plus years) of spent nuclear fuel or radioactive waste in a place other than the production site.

Pursuant to the relevant annex, the proposed activity is subject to statutory assessment without limitations.

5. Location of the Proposed Activity

Option 1
Region: Trnava
District: Trnava
Municipality: Jaslovské Bohunice
Cadastral Area: Bohunice

Option 2
Region: Trnava
District: Piešťany
Municipality: Veľké Kostoľany

Cadastral Area: Veľké Kostoľany

Option 3
Region: Nitra
District: Levice
Municipality: Kalná nad Hronom
Cadastral Area: Mochovce

6. Situational Drawing of the Location of the Proposed Activity

The general setting of sites for Options 1 and 2 and for Option 3 is provided in Annex No. 1 and No. 2, respectively.

7. Commencement and Completion Dates of Proposed Activity Construction and Operation

Assumed construction commencement date: 03/2013
Assumed construction completion date: 10/2015
Assumed operation commencement date: 2015
Assumed operation end date: 2085

8. General Description of Technical and Technological Solution

This preliminary environmental study is submitted for assessment in three options and the zero option:

- Option 0: zero option
- Option 1: RAW IR location within JAVYS, a.s. complex in Jaslovské Bohunice
- Option 2: RAW IR location in immediate proximity of JAVYS, a.s. complex in Jaslovské Bohunice
- Option 3: Location within the RAW National Depository in Mochovce

8.1. Technical Solution of RAW IR as Independent Nuclear Facility

The integral repository of radioactive waste is planned as a free standing structure of hall type and modular structure enabling extension and simple connection to road infrastructure. Its concept represents a system of single-aisle single-floor halls with a bridge crane and common annex. The partially double storied annex contains controlled (CZ) and uncontrolled (UCZ) zone premises. The entrance is formed by a storm lobby and personal decontamination room preceded by office space in the UCZ. The remaining sections include support technology rooms related to the operation, such as RAW storage control room, ventilation machine room, electric distribution point, decontamination space and decontamination solutions storage space.
The storage space forms four modules with the possibility of gradual extension depending on the RAW needs. The following packing units will be used to store solid and fixated (solidified) RAW in the respective modules of the RAW IR:

- FCC
- MEVA 200 l barrels
- MEVA 200 l barrel pallets
- 2 EM-01 containers
- ISO containers with large sized components
- Free deposited (uncontaminated) components, segments or ingots
- Big bags for very low activity waste

- Metal containers for very low activity waste
- Highly shielded containers

Liquid RAW storage is not permitted in RAW IR.

Packing units have the following characteristic features and parameters:

- FCC: Made of fibre reinforced concrete.
    - Proportions: 1.7 x 1.7 x 1.7 m
    - Container weight: 4,200 kg
    - Maximum loaded container weight: 12,500 kg
- MEVA 200 l barrel: Made of zinc coated sheets.
    - Proportions: Ø600x800 mm
    - Weight with waste: 450 kg
- 2 EM-01 container:
    - Proportions: 1.1 x 1.1 x 1.7 m
    - Weight with waste: 1,500 kg
- ISO container: ISO 20´ series 1, see STN 26 9341, STN 26 9343 and ISO 1496-1+Amdl
    - Made of steel.
    - Outside proportions: 2,438 x 2,438 x 6,058 mm
    - Container weight: 24,000 kg
    - The container may contain: Max. 50 MEVA barrels (200 l) loaded on pallets, max. 18 pallets with a bearing capacity of 1,500 kg
- Free deposited/ components, segments or ingots: Materials without surface contamination that are only activated, refused or contaminated on inaccessible surfaces (inside); may be shielded
- Big bags: Solid plastic packaging with a volume of about 1m3 for the storage and deposition of soft VLLW (e.g. pressed rubber, plastics, soil)
- Metal containers for very low activity waste: Solid metal packaging with a volume of about 1m3 used for the storage and deposition of solid VLLW (e.g. metals, glass, etc.)
- Highly shielded containers: Containers for the storage of middle- and high-active RAW. The marketed containers are made of forging casting (cast in one piece). They feature double lid. Common weight of generally marketed empty containers represents about 100 tons. Proportions:
    - Length: 4 – 5 m
    - Diameter 1.5 – 2.5 m
    - Wall thickness: 0.25 – 0.45 m
- Any other packing unit (may be designed to order or as a prototype, or a sole piece of its kind) respecting the relevant legislative and internal requirements for radiological protection.

As an illustration, one RAW IR module is able to store a maximum of 600 concrete containers 1.7 x 1.7 x 1.7 m (220 FCC x 3 layers); the project contemplates 627 FCCs to be stored in the storage rooms, which will be divided into two parts by a ~ 2.2 m wide aisle. The first part contains regularly positioned 330 FCCs (11 FCC broad wise, 10 FCCs lengthwise in three layers above each other). The other part contains 297 FCCs (11 FCCs broad wise, 9 FCCs lengthwise in three layers above each other).

The hall part of the structure will feature small spaces for the acceptance of stored packing units (PU) and their reloading. Manipulation with FCCs is planned via a 24.0 m wide bridge crane. This crane will transport containers from the arrival section to the storage section of the hall structure. The hall itself is designed of fixed reinforced concrete columns in a modular distance of 6.0 m with consoles

for the crane rails. They are to support steel framework beams and ceiling structure. Floor will be constructed as a reinforced concrete slab to distribute pressure. The 6.3 and 9.0 m high wall separating the first and second storage modules from the common technical support annex will be constructed as a monolithic 50 cm thick reinforced concrete wall for shielding reasons. The remaining outside walls of storage halls and interior partition wall between the storage and entry halls will be constructed as 6 m high monolithic 60 cm thick reinforced concrete walls. The respective storage halls will be divided by a 15 cm thick monolithic reinforced concrete wall. In staggered modules, the external walls will featured concreted 15 cm thick reinforcement walls from the height of 6 m to 14 m. The said assumed wall thickness will be specified closer in the following design documentation stages to respect the relevant legislative and internal regulations in the field of health protection from radiation.
The annex will be constructed of ceramic wall material. The joined hall and annex wall will be made of reinforced concrete for shielding reasons. Ceiling structure will be made of reinforced concrete slabs with heat insulation and covered by bitumen roof.

The RAW IR will consist of the following parts:

Fencing and landscaping
External illumination
Ditches and channels of power cables
Ditches and channels for heavy current distribution, including cables
Exterior weak current distribution lines
Grounding ditches
Storm water sewer
Wastewater sewer
Drinking water distribution
Fire station
Site train
Complex roads, including courtyards and yards
Integral Nuclear Waste Repository

8.2. Technological Solution

The RAW IR technology consists of transport, machine and technology and electric equipment, energy sources, distribution lines and accessories, instrumentation and control and other specialised equipment and appliances, such as laboratories, physical and radiation protection, dosimetry, special sewer, ventilation, etc.

Planned technological equipment may be divided into the following operating units:

Entry and storage of packing units
Active workshops
Decontamination
Ventilation
Radiation and dosimetric control
Contaminated water management
Electrical equipment
Technological process I&C
I&C – Industrial TV
I&C – Special monitoring

Entry and storage of packing units

Core technological equipment includes lifting equipment, its gripping attachments and stands for the control of packaging units arriving for storage.
Bridge cranes for containers storage will feature automated positioning system for containers

placement to places according to a storage plan. Crane operation will be managed from a central control room with an onsite operation option. TV cameras will control the filing operation.

Active workshops

Active workshops will serve for repair and maintenance of equipment found in the controlled zone. Equipment or its part to be repaired will be removed and, if needed, decontaminated in the decontamination room. The workshops will repair the removed parts of gripping equipment, possibly other equipment found in the CZ. The workshops should only be used sporadically.

Decontamination

The purpose of decontamination system is to ensure the following:

- Personal decontamination in the so-called emergency shower,
- Decontamination of transportable equipment parts,
- Decontamination of premises.

In RAW IR, the scope of decontamination work will be based on the character of work performed in standard and non-standard operations.

Standard operation – During standard operation, no contamination of persons, equipment or premises is assumed in the RAW IR premises. Packing units showing surface contamination in the wiping test made at the time of arrival will not be accepted for storage. If needed, packing units will be decontaminated by the sender.

Non-standard situation – from the point of view of contamination, non-standard situation is the following:

- Contamination of individuals, premises and objects arising as a result of compromised packing units integrity caused by manipulation; in this case, consequences of the event are dealt with according to a procedure designated for each actual event following its occurrence,
- Contamination of persons, premises and equipment as a result of contaminated water spillage in the course of its pumping into a collection tank of a vehicle for the transport of liquid radioactive waste,
- Contamination of persons identified in the course of contamination control in the control node,
- Contamination of premises removed from the controlled zone.

Ventilation

This equipment will be used for ventilation of premises in the hall part of the structure.

In case the waste stored in the relevant packing units has no wipe able surface contamination, the ventilation equipment will not be operated and the premises will be ventilated via ventilators.

Should the waste stored in the structure in packing units have positive wipeable surface contamination above 0.38Bq/cm2 for class I of radio toxicity, the exhaust ventilation equipment will be operated in the mode for category III of a worksite with open sources as follows:

- Operation of ventilation system responsible for air exchange five times per hour with pressures preventing radioactive contamination spread.
- The storage rooms ventilation system consists of two exhaust units (one operational and one backup unit). The exhaust unit will include a pre-filter of class G4, exhaust radial ventilator with diffuser, filter F4, and filter F9 and highly efficient filter for radioactive aerosols collection and exhaust air shutter. The air exhausted from the ventilation unit will be connected to a pipe taken up above the storage hall roof to a discharge opening with blinds.
- From the storage space, air will be exhausted via outlets mounted directly on exhaust pipes. Both

storage space exhaust lines will feature regulation flaps.

- In both repositories, exhaust pipe leading to the roof will be equipped with a bypass to allow flow rate and aerosols radioactivity measurements. Filter elements exchange will be carried out according to manufacturer instructions and depending on filter pollution. Interior ventilation units will be made of stainless steel to allow for decontamination. Pollution measurement consoles will be mounted up- and downstream the aerosol high-efficiency filter
- The volume of exhausted air will be regulated to maintain moderate vacuum in both repositories.

Radiation and dosimetric control

The term ‘radiation and dosimetric control’ means systematic measurements, whose ultimate objective is to prove that there is not and will not be any undesirable exposure of RAW IR staff, the general public or the environment.

The following will be controlled by measurements as part of 'radiation and dosimetric control’:

a. Exposure of RAW IR staff;
b. Exposure of individuals staying in the controlled zone a single time (maintenance and servicing, visits, representatives of supervisory authorities, JAVYS management, etc.);
c. Surface contamination of hands, soles and work clothing of RAW IR staff upon exiting the controlled zone;
d. Surface contamination of hands, soles and clothing of one-time visitors to the controlled zone;
e. Contamination of objects removed from the controlled zone;
f. Contamination and dose rate on the surface of vehicles prior to their departure;
g. Equivalent dose rate in the controlled zone, especially in the storage halls;
h. Radioactivity of aerosols and tritium in the storage space;
i. Radioactivity of exhausted air.

Contaminated water management

Contaminated water management will include special sewer system and its collection in a tank. The tank itself will be the crucial part. It will feature an ultrasound level gauge signalling two threshold levels: a threshold for starting tank drainage and a threshold requiring inlet closure until the tank is trained. The signals will be monitored in the central control room. Water will be removed by immersion pump (one in operation, one back-up pump). Prior to the pumping operation, radioactivity will be measured on a representative sample. For this purpose, the tank will feature a stirrer. The sample needed to determine the relevant values in JAVYS laboratories will be collected manually. Measurement will decide whether the tank contents is discharged to the waste water drainage or taken up by a vehicle for the transport of liquid radioactive waste used by JAVYS for this purpose.

Electrical equipment

6 kV Switchgear

The 6 kV switchgear is designed as a standardized switching box up to 7.2 kV. It consists of input fields No. 1, 2 and output to transformer station – fields No. 3, 4. The HV distributor will stand on a steel structure of double floor.

Transformers 6/0.4 kV

To transform 6 kV voltage to 0.4/0.241 kV, 2 three-phase transformers vacuum-embedded in epoxy resin will be used. Their output reaches 400 kVA with the possibility of backup in case of outage.

Cable Interconnection

HV switchgear and transformers are interconnected by a cable clips mounted cable. Wires will be tagged and bundled. HV wires will be installed pursuant to STN 34 1050 and STN 38 2156. Secondary transformer side will be interconnected with the central LV switchgear via single core cables.

Lightning Conductor and Transformer Grounding

Transformer station protection from lightning is covered by protection system of the entire repository.

A joined exterior grounding system (subject to separate documentation) is planned for grounding the R6 switchgear, transformers and LV control room.

R6 switchgear, transformer node and LV distributor will be connected to interior grounding system. All steel structures of the transformer stand and the transformer box will be connected to this interior grounding system too. Through testing clamps, the interior grounding system will be connected to exterior grounding system.

Technological Processes Control and Control system

As the automated control system of technological processes directly related to the stored packaging units (PU), a decentralized control and information system with local autonomous control units and a central control and information system will be used.

The automated control system will be structured into two levels:

a. Local control automats with particular algorithms controlling certain machine components and electrical systems;
b. Central control room with PCs.

The control and information system will be duplicated at the central unit level, important processes related to PU manipulation will be duplicated at the local automats levels. The control and information system will be supplied from a backed up UPS. Should any of the systems break down, the appliance will continue in automatic mode controlled by the central unit of the other system. While in operation, each of the two systems will control the other one and will provide control logs. It will be possible to run technological processes in automatic or manual mode. In manual mode, operation will be monitored by the control and information system.

SKR – Industrial TV

Covers the installation of a camera system to enable visualisation of selected premises. For the monitoring of selected premises or technological processes in the facility, a camera system has been designed with a central control room, joystick control desks, monitors and cameras monitoring the relevant premises or objects.

From technological point of view, the camera system in the RAW IR structure has been designed to monitor the following: transport and manipulation of packaging units and the packaging units' inspection process.

I&C – Special Monitoring

Special monitoring is planned for monitoring of mechanical properties of the structure (especially foundation slab position, or shift measurement using the method of hydrostatic levelling – HYNI), i.e. structural defects, e.g. as a result of seismic activity, geologic disturbance, etc.

The HYNI system includes sensors, connection hoses with liquid and air hoses, connection cables and communication unit. Further processing of metered values will take place within DPS 61.10.01 in the central control and information system located in the central control room.

The construction of the facility is planned to take place in two phases. In the first phase, module 1, module 2 and joined operations annex will be constructed. These RAW IR premises will be subject to individual final inspection. Then, depending on the progress of decommissioning work on A1 NPP and V1 NPP and RAW production in J. Bohunice, modules 3 and 4 will be constructed in phase 2. The entire project will be completed through final inspection of phase 2.

9. Justification of the Activity on the Site

Original plans of power plants with VVER 440 reactor type did not provide for processing and treatment of RAW during the operation of the power plant. The only RAW management activity during power plant operation was its collection, possibly sorting and storage. Towards the end of the seventies, Czechoslovakia adopted a RAW disposal concept. In 1981, an intense implementation programme commenced. Its key mission was "finding a comprehensive solution, involving optimisation of the entire RAW disposal process, based on the optimisation of RAW production, volume of deposited RAW, cost of its disposal and environmental impacts". In line with the adopted "Comprehensive Radioactive Waste Management Strategy for the Slovak Republic", it is also necessary to arrange for safe storage of processed radioactive waste from the decommissioning of A-1 NPP and from the other nuclear facilities.

A study proposed the construction of an integral repository, which would create the technical and technological conditions for safe long-term storage of RAW (for 70 years)m, which, for various reasons, cannot be stored in RAW NR Mochovce, and potentially also for short-term storage of other RAW prior to its processing in Bohunice RAW processing centre.

The principal reason preventing the (final) deposition of certain RAW types is the failure to meet the highest permitted limit of activity of a certain radionuclide (or group of radionuclides) in the processed RAW and the risk that the maximum inventory of certain radionuclides permitted for RAW NR may be exceeded. Specified waste from the decommissioning of NPP A-1 and NPP V-1 (possibly from the decommissioning of other NPPs in the SR) may, pursuant to the current strategy of radioactive waste management, be disqualified for storage in RAW NR Mochovce and will probably be stored in a deep depository. Until its storage in the deep depository, it needs to be stored reliably and safely in a central repository.

10. Total Costs

Total assumed cost of the project: € 26,428,000.00

11. Municipalities Likely to be Concerned

Options 1 and 2

Jaslovské Bohunice
Pečeňady
Radošovce
Ratkovce
Nižná
Žlkovce
Veľké Kostoľany
Malženice

Option 3

Kalná nad Hronom

Malé Kozmálovce
Čifáre
Nový Tekov
Nemčiňany
Telince

12. Affected Self-governing Region

Options 1 and 2
Trnava Self-governing Region

Option 3
Nitra Self-governing Region

13. Authorities Likely to be Concerned

Nuclear Regulatory Authority of the SR, Bratislava

Options 1 and 2
District Environmental Office, Trnava
District Environmental Office, Piešťany
District Environmental Office, Hlohovec
Regional Environmental Office, Trnava
District Directorate of Fire and Rescue Brigade, Trnava
District Directorate of Fire and Rescue Brigade, Piešťany
Civil Protection and Crises Management Department, District Office Trnava
District Office for Road Transport and Roads, Trnava
Railway Transport Regulatory Authority, Bratislava
Public Health Authority of the SR, Bratislava

Option 3
District Environmental Office, Levice
District Environmental Office, Nitra
Regional Environmental Office, Nitra
District Directorate of Fire and Rescue Brigade, Levice
Civil Protection and Crises Management Department, District Office Nitra
Civil Protection and Crises Management Department, District Office Levice
District Office for Road Transport and Roads, Levice
District Office for Road Transport and Roads, Nitra
Railway Transport Regulatory Authority, Bratislava
Public Health Authority of the SR, Bratislava

14. Permission Authority

Options 1 and 2
Regional Construction Authority, Trnava
Nuclear Regulatory Authority of the SR, Trnava

Option 3
Regional Construction Authority, Nitra
Nuclear Regulatory Authority of the SR, Trnava

15. Responsible Department

Ministry of Economy of the SR

16. Type of Permit Required for the Proposed Activity Pursuant to Special Regulations

Relevant consents and permits pursuant to Section 5 of Act No. 541/2004 Coll. on Peaceful Use of Nuclear Energy {the Nuclear Act) and on the change and amendment of certain acts:

- Planning decision (consent to the selection of site for nuclear facility)
- Construction permit (permit for the construction of a nuclear facility)
- Permit for the commissioning of a nuclear facility
- Nuclear facility operation permit
- Radioactive waste or spent nuclear fuel management
- Radioactive waste transport permit

Consent required pursuant to Section 44 of Act No. 355/2007 Coll. on the Protection, Support and Development of Public Healthcare and on the amendment of certain acts:

- Permit to carry out an activity leading to exposure

17. Information about Transboundary Impacts of the Proposed Activity

With respect to the location and character of the proposed activity, no negative transboundary impacts are expected.

III. General Information on Current Environmental Situation in the Relevant Territory

Should the data for the individual options vary, the text of the relevant chapter is structured into paragraphs applicable to the relevant options. Should a chapter have no such structuring, the text is identical for all options.

1. Characteristics of Natural Environment, Including Conservation Areas

1.1. Delineation of Relevant Territory

Options 1 and 2

The relevant territory belongs to the Pannonian basin sub-system, Western Pannonian basin province, sub-province Small Danube fold, Danube Lowland area, Danube highlands unit, Trnava highlands sub-unit, part Trnava tableland (SR Land Atlas, 2002).

In terms of natural conditions characteristics, the affected territory represents a zone with a 5 km radius. For this territory, and sometimes also for its wider surroundings, the description of the individual components of the environment is provided below.

In terms of socio-economic and population characteristics, we consider the affected area to consist of the cadastral areas of all the affected municipalities. These are the municipalities of Jaslovské Bohunice, Pečeňady, Radošovce, Ratkovce, Nižná, Žlkovce, Veľké Kostoľany and Malženice.

When describing environmental characteristics, the terms surroundings and sometimes also wider surroundings of the affected territory are used. This term refers to the neighbouring geo-morphologic units within a 30 km radius from the proposed activity. In terms of socio-economic indicators, these are the territories of Trnava, Piešťany and Hlohovec districts.

Option 3

The affected territory belongs to the Pannonian basis sub-system, Western Pannonian basin province, Small Danube fold sub-province, Danube Lowland area, Danube Highlands unit, Hronská Highlands sub-unit (SR Land Atlas, 2002).

As to natural conditions, the affected are is deemed to mean the spatial intersection of SE-EMO hygiene protection zone and the borders of Mochovce cadastral area. For this territory, possibly its surroundings, we provide a description of the individual natural landscape components.

In terms of socio-economic and population characteristics, we consider the affected area to consist of the cadastral areas of all the affected municipalities. These are the municipalities of Malé Kozmálovce, Čifáre, Kalná nad Hronom, Nemčiňany, Nový Tekov and Telince.

When describing the natural environment, the following terms are used too

- Closer surroundings – i.e. 10 km from the proposed activity,
- Wider surroundings – i.e. 30 km from the proposed activity.

1.2. Geo-Morphological Conditions

Options 1 and 2

From geomorphologic point of view, the affected area belongs to the Danube Lowland area, Danube Highlands unit, Trnava Highlands sub-unit, Trnava Tableland part. The eastern edge of the territory belongs to the Lower Váh bottomland sub-unit, part Dudváh Wetlands. On the western edge, the affected area meets Podmalokarpatská Highlands.

The territory is part of highland transient and tableland level. Their effaced delimitation runs

approximately from NE to SW around the Jaslovské Bohunice site. The tableland level is formed by little inclined tableland, or its remains separated from each other by the valleys of the local rivers. Tableland remains are rugged by shallow gullies, gully depressions, or closed depressions of polygenic origin. The complex is crossed by longitudinal and transversal morpho-structural boundaries separating partial morpho-structural units.
The general relief depression runs in south-eastern direction, namely from 190 m above sea level to 145 m above sea level. The remaining two directions of relief depression are NE and S. They have been caused by erosion activities of rivers flowing mostly southwards.

Option 3
From geo-morphological point of view, the affected territory belongs to Danube Lowland area and its landscape unit Danube Highlands. Danube Highlands are structured into 11 sub-units, of which six are part of the wider area of interest – Nitra bottomland, Žltava Highlands, Žltava bottomland, Hron Highlands, Hron bottomland and Ipeľ Highlands. South of Šurany, part of landscape unit Danube Flatland reaches into the affected territory. The affected area is situated on the territory of landscape subunits Hronská pahorkatina and Kozmálovské vŕšky.
In the East, Hronská pahorkatina is delimited by Hron bottomland, in the South, it ends at the Danube lowland, in the West, it is delimited by Danube Flatland and Žitava bottomland; in the North and North-east, there are Pohronský Inovec and Štiavnické vrchy. Most of the Hronská pahorkatina surface is of highland type with relief denivelisation 31 – 100 m; only in the South and East, it has the character of undulating flat land with relief amplitude up to 30 m. In the flat section, absolute altitude ranges between 200 and 320 m. The relief is quite monotonous with wide flat backs running from north-west to south-east and from north to south. The top is mostly rounded, flat in some places. Along the slopes, there are frequent gullies, hollows, mostly on steep hillsides. Valleys are of gully character with very unstable surface flows significantly impacted by atmospheric rainfall. Orientation of valleys and their rectangular arrangement document their tectonic predisposition. The highlands generally slope southwards.

1.3. Geological Conditions

Options 1 and 2

Geological Structure

From geologic point of view, the affected area belongs to Blatno depression representing one of the northern spurs of the Danube basin. Most of the basin was formed during Neogene and Post-Tertiary. In Blatno depression, pre-Neogene basin sub grade is formed by units of Central Western Carpathians.
Tectonic structure of Danube Flatland is quite complicated. During Egenburg and Ottnang, mostly NW-SE oriented depressions and N-S left sided shifts were activated. In Karpat, N-S compression led to the generation of depocentres of pull-apart type. En example of such depocentre is the Blatno depression that was generated along the deep fault system of NE direction. N – S compression also prevailed in early Baden, when subsidence along the NW – SE oriented faults was accelerated. In middle Miocene, main compression component in the potential field changed direction from N – S to NE – SW, which resulted in the extension of Danube basin under the impact of the NW – SE extension. In this period, subsidence speed was the highest in Blatno depression. It gradually faded out towards the more eastern depressions in Rišňov and Komjatice. In middle to late Baden, thermal relaxation is typical for basin tectonics. In the central part of the basin, graben depocentres started opening in extension regime of NW-SE direction. During early Pannonian, subsidence is only expressed in the central and south parts of the basin and secondary basins with older Miocene

grabens are created in Pliocene.

Pre-Post-Tertiary filling is formed by Neogene sea clastic sediments reflecting multiply repeating transgressive – regressive sedimentary cycles. From late Miocene, final sea retreat sets in and sweetened Pannonian lake is gradually created in its place. Therefore, late Miocene sediments are represented by brackish and lacustrine sediments of Pannonian. From Pont, sedimentation changes through fluvio-lacustrine to fluvial in Daka.

Danube basin filling starts in northern marginal sections through complex strata formed by conglomerates and sandstone of Egenburg age, which formed during the transgression in shallow sea environment. In Dobrovodská and Blatnianska depressions, Ottnang and Karpat sediments are represented by planinská complex strata, especially formed by clay, clay stone and siltstone, partially also sandstone and conglomerate objects. In North-western part of the Danube basin, middle and late Baden is represented by Špačince and Madunice complex strata especially formed by grey limestone clay stone, siltstone, layers of sands and sandstone. In northern parts, Pannonian and Pont are in lake development. Pannonian belongs to the most widespread levels in the basin and is represented by sand and clay complex strata. It is represented by Ivánka complex strata with prevailing delta sedimentation fluently changing to Pont. Pont is represented by Beladice complex strata formed by limestone clays to dusts in places with layers of coal beds and lignite. Pliocene sediments are of fresh water type and are formed by Volkov complex strata. In Blatno depression, earlier Pliocene sediments are represented by Kolárovo complex strata of Roman age. Late Pleistocene is especially formed by river gravel sand accumulations. Mindel sediments are especially represented by Eolic loess sediments. During Riss, loess continues to sediment together with fluvial and proluvial sediments. During interglacial period Riss-Wűrm, brown forest soil and black earth are created. Wűrm is represented by fluvial sediments and eolic sands and loess.

Around Trnava Highlands, Post-Tertiary sediments are represented by sedimentation cycle with the representation of Váh terrace sediments, represented by sand with gravel, sand, sandy clay and clays. These sediments probably originated in Ruman to early Pleistocene. Above this complex strata, there are fluvial sediments consisting of gravel, sands and flatland clays, probably of Riss age. The youngest Post-Tertiary sediments in the area of interest are represented by Pleistocene loess and loess loam with limy concretions that dominate and surface in almost the entire Trnava loess plain. Loess complex strata is of Riss and Wűrm age. Negative relief forms – especially gully valleys, are filled by deluvial and fluvial sediments mostly formed by clayey, sand-clayey and loam-clayey areas containing deposited loess.

Engineering-Geologic Conditions

The assessed territory is located in a region of tectonic depressions, sub-region with Neogene sub-grade. According to engineering-geologic regionalisation of the Slovak Republic, the nearest surroundings of the affected territory belongs to the area of Post-Tertiary sediments, regions of loess sediments on river terraces, region of fluvial river deposits and region of loess sediments.

Mineral Resource Deposits

There are no deposits of mineral resources in the given area.

Geodynamic Phenomena

Of exogenous processes, water and wind erosion are the most active in the wider area of interest. Erosion activity of watercourses in the near surroundings is currently stabilised, with the occurrence of overland flow and outwash only. Wind erosion is observed locally especially out of vegetation period.

Of endogenous processes, only seismic movement may take place within the assessed area. The most important source of seismic threat is found in the Dobrovodská depression in the Small Carpathians. Lower importance is assigned to the southern part of the Small Carpathians (Modra, Pernek) and the southern part of the Danube Lowland (Komárno). With respect to the quite high seismic activity, the relevant territory is considered active seismic area. In seismic terms, the affected territory belongs to an area with regional seismic intensity 6-7° MSK. Regional seismic activity isoline with these values passes east of the affected territory.

Option 3

Geological Structure

From regional structuring view, the affected territory belongs to Danube basin, which is an intramountain basin. In the North, Danube basin projects in the form of finger spurs – bays between nuclear mountain ranges of the Small Carpathians, Považský Inovec and Tríbeč. In the north-east, it borders with rock complexes of central Slovak neovulcanites. Pre-Neogene basin sub grade is formed by units of Central Western Carpathians.

Geologic structure of the affected territory and its surroundings is especially formed by Neogene vulcanites, sedimentary filling of Komjatice depression as part of Danube basin and Post-Tertiary sediments.

Neogene Vulcanites

Neovolcanic rock is not of identical development. It differs in respective geographical units, especially by age, volcanic activity expression, various petrographic composition and lithofacial development. Age classifies the rock into Baden and Sarmat periods. Kozmálovské vŕšky, a spur of Štiavnické vrchy, are composed of various neo-volcanic rocks, of which dominant position is taken by pyroxene andesites, large spathic with biotite (so-called Čifár type) and their various small grain variations. Further, pyroxene andesites, pyroxene-amphibolic-biotitic andesites, partial quartz andesites, dacite and basalt.

Neogene Filling of Komjatice Depression

Sedimentation of filling rocks in the north-eastern part of the Danube Lowland lasted from middle Baden through Sarmat, Pannonian, Pont, Daka and Ruman to Post-Tertiary. The Danube Lowland was created as a depression following the Western Carpathians orogenesis between early and middle Baden.

Within the territory, Baden is the oldest palaeontologically proven Neogene level. Early Baden is characterised by light grey to grey, greenish, slightly sandy lime clays and a complex of volcanic rock (tufates of amphibolic andesite) found on Neogene base. In middle Baden, new tectonic movement occurs and causes transgressive expansion of sea sediments in the entire Danube Lowland. Sea sedimentation of middle Baden filled Komjatice depression from Šurany, through Vráble to Zlaté Moravce. A part of this is a complex strata of volcanic sediments dominated by ryolite and ryodacit tufate. A 160 cm thick horizon of clastic sediments developed on this complex strata. It is the result of middle Baden sea transgression into new sedimentation spaces. Their prevailing component is conglomerate with clay or siltstone. Late Baden is represented by grey limy clays with fauna. Brackish character of the complex strata documents sea regression and its shallowing towards the end of Baden (Hók et al., 1999, Kováč et al., 2002).

Early Sarmat is composed of colourful, yellow-spotted, limy clays with frequent sand and sandstone positions. They surface in wider surroundings of Mochovce, where they are especially formed by sandstone and grey limy clays with interlayers of tufaceous sandstones and secondary mid-grain conglomerates. Late Sarmat sediments also include the artificial presence (excavation for waterworks) of grey, sandy, slightly limy clays north-west of Kozárovce. Above them, there are green-grey or grey limy clays with positions of grey limy sandstone, small grain gravel, conglomerates and tufaceous positions. Compared to the previous ones, the character of late Sarmat sediments remains practically unchanged, except for basal positions, where very strong clastics sedimented (Nagy et al., 1998, Hók et al., 1999).

Early Pannonian reaches the thickness of several metres and is formed by basal sands followed by grey, limy pelites – Ivánka complex strata. Late Pannonian in semi-brackish development is characterised by lithological development suggesting the onset of sedimentation changes in the entire Danube Lowland. It is formed by light grey, grey and dark grey or sandy clay, changing into coarse-grained sand and gravel positions in places (Priechodská & Harčár, 1988, Hód et al., 1999).

Pont is mostly politic, layers are formed by light grey sandy clays changing into fine, very clayey siltstones and sands. It represents Beladice complex strata. In the wider surroundings of the affected territory, there is fresh water sedimentation environment limnic to alluvial character of shallow gulf (Kováč et al., 2002). This lithographic unit designates Pont sediments formed by green-grey limy clay with loess and sand addition, or positions of sand (Vass, 2002). Dark coal clay and lignite beds are characteristic for the complex strata.

Daka layers (Volkovce complex strata) developed below Post-Tertiary. They originated in fresh water and are mostly characterised by sandy sediments.

Post-Tertiary

Deluvial-fluvial sediments represent a specific genetic group created in Post-Tertiary. In horizontal and vertical directions, sandy to clayey soils alternate frequently, sometimes with gravel addition. Deluvial sediments belong to the most area widespread Post-Tertiary sediments. An entire scale of deluvia, from clayey sands, through sandy soils, clayey soils to clays and soils with various gravel fragments share may be found. The discharge of Post-Tertiary sediments varies from 0.5 to 10.0 m (Priechodská & Harčár, 1988).

<u>Mineral Resource Deposits</u>

Only non-metallic mineral deposits are found around the affected territory. These are mostly various types of construction materials. Post-Tertiary gravel and sands are especially important, less loess and loess loam used locally as brick making material in the past.

There are locally documented deposits of brown coal and lignite. However, with respect to small discharges, they are not of economic importance. Andesites and their pyroplastics from neo-volcanic minerals, found in Kozmálovské kopce, are also used for construction purposes.

<u>Geodynamic Phenomena</u>

Of endogenous geodynamic phenomena, especially the expression of neo-tectonic activity is found in the affected territory. Based on Post-Tertiary morphology and geologic composition analysis, Hronská pahorkatina is characterised by fault-thrust composition. The movement of respective thrusts was uneven in space and time, just like their intensity. It represents a specific structure within the entire Danube Lowland. Geomorphologic differentiation of the territory and special distribution of Post-Tertiary sediments are the result of mutual impact of geomorphologic processes managed by climatic oscillations at the end of late Pliocene and in Post-Tertiary, and Neogene tectonics.

Assumed presence of macro-seismic intensity dynamic effects represents 5-6°MSK-64. Threat values for the given area, calculated using seismic-statistic method, showed that for a 100 years repetition period, macro-seismic effects of 5-5.5°MSK-64 may be expected in the area. For a period of 10,000 years, it is 6.0-6.5°MSK-64.

Of exogenous geodynamic phenomena, especially erosion and slope movements may take place in the given area. Within the area, shallow slope faults, general and gully erosion, partially bank erosion and also loess transfer may take place. Erosion of banks through water flows activity is intensified during rainfall maximums, since water flows found within the given territory have very unstable regimes and significantly impacted by rainfall. The deforested highland slopes show general erosion traces of loose Post-Tertiary sediments. Less pronounced is also eolic activity manifested in wind transfer of fine surface soil particulates.

1.4. Climatic Conditions

Options 1 and 2

According to Lapin et al. (2002), the affected territory belongs to a warm climatic area, warm, slightly dry district with moderate winter, characterised by average January temperatures above 3°C and Končok irrigation index Iz=0 to -20.

The below climatic data for the given location have been collected by a meteorological station established near the Jaslovské Bohunice nuclear facility, where local climate has been observed and measured since 1959.

TEMPERATURES

Average annual air temperature (1961 – 1990) reached 9.3°C in Jaslovské Bohunice. Average number of summer days represents 57.9. In cold period, 96.6 frost days and 27.9 ice days have been measured. The following Table states characteristic temperatures for year 2008:

Table No. 1: Average monthly air temperatures (°C) measured in Jaslovské Bohunice Station in 2008

Year/ month	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.
2008	1.9	3.1	5.3	10.7	15	19.7	20.3	19.8	14.6	10.9	6.7	2.6

PRECIPITATION

The affected area lies in the lowland part of the Váh River basin. Compared to the rest of the river basin, lower rainfall totals are characteristic for this area. The highest totals are experienced in summer months (May and June), when rainfall is coupled with storms and the lowest totals in winter months (January). Average annual rainfall total measure d in the Jaslovské Bohunice station (1961 – 1990) represents 548 mm. Average number of days with rain ≥ 0.1 mm represents 141.2. The lowest number of rainfall days (above 1 mm) is experienced during the summer half (IV - -IX).
According to STN 73 0035, the location of Jaslovské Bohunice belongs to the second snow area with general snow load of 0.69 kN.m-2. Snow cover (number of days from the moment it reaches the thickness of 1 cm), starts in early December, around the mountains in late November and ends in the first half of March. Average annual relative air humidity reached 76% in years 1961 to 1990. In 2008, it is 75%. The following chart shows average monthly rainfall totals for year 2008:

Table No. 2: Monthly rainfall totals (mm) in measured by the Jaslovské Bohunice station in 2008

Year/ month	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.
2008	27.1	21.1	42.1	35.2	49.9	81.3	132	48.7	51.6	24.9	31.1	38.4

WIND CONDITIONS

Pursuant to STN 73 0035, Jaslovské Bohunice belong to wind area II within our territory, where the basic wind pressure reaches 0.45 kN.m-2. Approximately once every 30 years, immediate wind speed reaches top limit of anemograph registration (40 m.s-1), as recorded in Jaslovské Bohunice (01/03/1990, 10:13 am) - western wind with the speed of 39.4 m.s-1. According to the data of meteorological station in Jaslovské Bohunice, prevailing winds are of north-western, northern and south-eastern direction. Average annual winds speed reached 4-3 m.s-1 in 2008. Maximum wind blast reached the value of 32.6 m.s-1 in years 1961 – 1990.
The following tables present wind characteristics for year 2008:

Table No. 3: Average wind speed measured by Jaslovské Bohunice station in 2008 (m/s)

Year/ month	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.
2008	5	4.4	5	4.9	3.7	2.8	4.3	3.6	4.3	3.7	4.7	5.1

Table No. 4: Occurrence of wind directions measured by the Jaslovské Bohunice station in 2008 (%)

Year / direction	N	NE	E	SE	S	SW	W	NW	CALM
2008	130	17	29	150	39	30	79	161	53

Option 3

Pursuant to Lapin et al. (2002) the affected area is found in warm climatic area, warm, slightly dry district with mild winders characterised by January temperatures above 3°C, with konček irrigation index Iz=0 to -20.

The below specified climatic data for the location of interest have been collected by a meteorological station established near the SE EMO complex (geographical coordinates ϕ = 48°17′22′′ N, λ = 18°27′22′′E) that has been in operation since 1, April 1980. In the existing position H=261 m above sea level, measurements have been taking place since 6, June 1991.

TEMPERATURES

From climate-geographical point of view, most of the affected territory belongs to lowland climate, mostly warm, dry to slightly dry with moderate temperature inversion. The Veľká Vápenná area belongs to mountain climate type, slightly warm, damp to very damp with minimum temperature inversion.

In Mochovce, the average annual air temperature (between 1981 -1996) was 9.3 °C, the absolute maximum was 36.4 °C (according to the most current data 37.4 °C in 2000) and the absolute minimum was 30.8 °C. Average air temperature reaches 1.6 °C in January and 19.9°C in July. Average number of summer days represents 65.5, there are 16.9 tropical days and in cold period, 101.6 frost days and 26.5 ice days. The following table states characteristic temperatures for year 2008:

Table No. 5: Average monthly air temperatures (°C) measures by Mochovce station in 2008

Month/Year	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.
2008	1.3	3.0	5.1	10.9	16.3	20.0	20.1	20.0	14.8	11.2	6.4	2.3

According to long-term observations (climatic stations Nová Baňa – 221 m above sea level; evaluated period 1931 – 1980 and Nový Tekov – 171 m above sea level; evaluated period 1951 – 1980), average annual temperature reaches 8.4-9.5 °C. Long-term maximum air temperatures were recorded in July and minimum in January. The following overview presents average, maximum and minimum temperatures in respective months of the year:

Table No. 6: Average monthly (annual) air temperatures (1931/1951-1980) measured by surrounding stations

Location	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	Year
Nová Baňa	-2.4	-0.4	3.5	8.7	13.2	16.8	18.1	17.3	13.3	8.6	4.1	-0.3	8.4
Nový Tekov	-2.0	0.2	4.5	10.2	14.8	18.4	19.7	19.2	15.1	9.7	4.6	0.2	9.5

PRECIPITATION

Based on the Mochovce station data (1981-1996), average annual sum of rainfall reaches 575 mm, the highest average is in May (71 mm) and the lowest in February (31 mm). According to the most current data, the highest monthly rainfall value was recorded in June 1999 (186.7 mm) and the lowest in February 1998 (0mm). The highest daily rainfall reached 93 mm (25/08/1994). Average number of days with rain ≥ 0.1 mm represents 87.1, with snow 32.6, with frozen rain (i.e. snow, sleet) 41 and snow cover 43.9.

According to long-term observations, June is the wettest month in the affected area (75 mm), least rainfall is recorded in September (36 mm), whereby, there is an average of 88 days per year with total rainfall exceeding 1 mm. Violent rain and cloudburst is only a rare phenomenon in the territory, whereby, strong rainfall is mostly experienced in summer period. There is an average of 30 days with storm phenomena; average number of days with rainfall represents 133 per year. In winter months, the area is covered in snow, with an annual average of 37 days. Relative humidity values oscillate between 69 – 84%, whereby, long-term average air humidity reaches 76%. Annual cloudiness development reaches its peak in December (78%) and minimum between July and September (47 – 52%). A high number of days with sufficient to strong air flow enable clouds dispersion, but does not allow for frequent temperature inversion development, which is the condition for mist and mist based cloudiness formation. The highest number of sunshine hours is experienced in June, the lowest in December. Average cloudiness is around 60%. There are, on the average, 47 clear and 120 cloudy days per year. Average annual number of misty days (visibility below 1 km) represents around 34, whereby, most misty days are experienced in December (9) and least in July (0.1). The following table presents average monthly rainfall for year 2008:

Table No. 7: Monthly rainfall totals (mm) measured by the Mochovce station in 2008

Month/Year	I.	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
2008	37.9	19.5	71.5	27.3	43.8	97.3	124.4	31.2	36.9	31.4	40.9	70.2

WIND CONDITIONS

According to the Mochovce meteorological station data, prevailing winds are north-west, east and south-east. Average annual wind speed reached 3.4 0.s-1 in 2000. The following tables present the mentioned characteristics for year 2008:

Table No. 8: Average wind speed measured by Mochovce station in 2008 (m/s)

Year/ month	I.	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
2008	5.5	3.3	3.6	3.8	2.9	2.6	2.3	2.8	2.4	3.4	4.9	4.8

Table No. 9: Occurrence of wind directions measured by the Mochovce station in 2008 (%)

Characteristic/Direction	N	NE	E	SE	S	SW	W	NW	CALM
Occurrence of wind directions (%)	68	63	196	187	30	37	63	242	114

1.5. Hydrological Conditions

Options 1 and 2

SURFACE WATER FLOWS

The affected area belongs to the Váh River basin. Váh flows east of the affected area. The river has been included in the assessment of hydrologic conditions, because most waste water produced by Jaslovské Bohunice NPP is drained by SOCOMAN pipe collector through Drahovský kanál (channel) directly to Váh and only a smaller volume is drained via the Manivier channel to the Dudváh River. Both rivers, Váh and Dudváh, flow from the north to the south.

Dudváh drains water from the affected area with immediate relation to the Bohunice NPP site. From the side of the Small Carpathians, Dudváh is fed by Holeška, Chtelnička, Blava, Krupiansky potok, Trnávka with its tributaries Parná and Gidra and other smaller watercourses. At the northern border of the location, its water level stands at 157 m above sea level. At the southern border, it is 138 m above sea level. Right hand side tributaries draining water from the affected area are the creeks Chtelnička, Blava, Krupiansky potok and artificial Manivier channel.

WATER RESERVOIRS

The affected area does not feature any natural lakes or artificial water reservoirs. In the wider surroundings, there are water dams established on some of the more important Dudváh tributaries: Chtelnica on Chtelnička, Dolné Dubové, Dolná Krupá and Sĺňava near Piešťany.

Water reservoir Sĺňava is used as a source of surface water for shared JAVYS, a.s. and SE EBO site in Jaslovské Bohunice. Water from the reservoir is pumped by the Pečeňady pumping station and is used for technical and demineralised water production.

SPRINGS AND SPRING AREAS

Around the affected area, natural groundwater springs mostly concentrate to distinct lithological lines situated around the mountain ranges of the Small Carpathians and Považský Inovec. Almost all stronger springs are used to supply population with drinking water.

The most important groundwater sources from natural springs are Dechtice (yield > 100 l×s-1, collected), Čachtice (yield > 100 l×s-1, collected), Ratnovce (yield 10 - 50 l×s-1, collected), Piešťany-Banka (yield 2 - 10 l×s-1, collected), Jalšové (yield 2 - 10 l×s-1, collected), Tepličky (yield 2 - 10 l×s-1, collected), Hlohovec (yield 2 - 10 l×s-1, collected) and Brestovany (three springs with a yield of 2 - 10 l×s-1, not collected, monitored). Except for the mentioned important natural springs of plane groundwater, the affected area features many springs with yield < 2 l×s-1. Springs used to supply the population with drinking water meet the required quality criteria.

THERMAL AND MINERAL SPRINGS

Except for ordinary groundwater, the affected area also features two important thermal water spring areas. Thermal water springs are found in the Piešťany municipal area.

Trajan is the most important well with calcium-phosphate composition and yield of 35 l.s-1. Piešťany mineral springs represent sulphate—hydraulite, calcium-magnesium, sulphuric, hypotonic therm with water temperature 67 – 69 °C with around 1,500 mg of minerals in one litre of water and free gas contents, especially hydrosulphide.

Around Koplotovce, mineral water is collected from 5 wells. Compared to Piešťany, Koploty waters reach significantly lower levels of the contents of minerals. Thermal water from both spring areas contains gas and is being retained and used. In addition to these two important areas, the affected territory also features several unimportant mineral waters.

AREAS PROTECTED FOR WATER MANAGEMENT REASONS

Areas protected for water management reasons are especially found around important groundwater sources supplying the local water distribution network. These are especially groundwater hygienic protection zones of level 2. Except for these protection zones, the Piešťany area also includes a large level II protection zone around a natural healing source in the bottomland of the Váh.

Option 3

SURFACE WATERCOURSES

The affected area belongs to two river basins. The location belongs partially to the Nitra river basin, north-eastern and eastern parts belong to the Hron river basin. The border dividing the affected territory passes through Patianska cerina and Veľká Vápenná. The affected area is directly intersected by Telinský potok (creek) and its unnamed right tributary. Telinský potok is registered as water flow of class IV and it flows through a flat part of the Nitra river basin. It has a lowland character along its entire length. It flows to Žitava, which is a tributary of Nitra. Its spring area lies on the SE slopes of Dobrica. Telinský potok basin covers 37.91 km2, its length represents 15.8 km. At rkm 10.5, there is Čifáre water reservoir. The maximum level difference represents 210 m within the river basin. The long-term annual average flow at rkm 11.5 (below the unnamed right tributary) reaches 40 l.s-1. The long-term average monthly specific total runoff (measured in l.s1.km-2) oscillates between 1.56 in November and 7.72 in March. Long-term average monthly specific basic runoff (measured in l.x.-1.km-2) oscillates between 1.47 in November and 1.95 in March. Basic specific runoff from the RAW NR site was calculated from measurements at profile L2 on the unnamed right tributary as qz=0.8 to 1.1 l.s-1.km-2, whereby, total runoff Qc reaches an average of 5.0 l.s-1, specific total runoff qc an average of 1.4 l.s1.km-2 and basic runoff Qz an average of 3.49 l.s-1. The Hron river rises in the Gemer part of Slovenské Rudohorie, at an altitude of 934 m above sea level and flows into the Danube river near Štúrovo, at an altitude of 103 m above sea level. The river basin surface reaches 5,465 km2 and the river length measured to the estuary represents 279.5 km. Total vertical descent represents 831 m. Runoff regime of the Hron river changes from temporary snow type in the mountainous region, to rain-snow type in the highland-lowland region.

WATER RESERVOIRS

Water reservoir Veľké Kozmálovce was constructed to accumulate water from the Hron to supply the nuclear power plant and the Perec Channel, and is also used for irrigation, small water power plant operation, recreation, sports and fishing. Telinský potok features a water dam called Čifársky rybník, which is used as a source for farmland irrigation. Around the Mochovce cadastral area, there are the water reservoirs of Kozárovce and Veľké Vozokany.

SPRINGS AND SPRING AREAS

To the E, NE and SE from the proposed site, in the cadastral area of Nový Tekov, there are water sources operated by Západoslovenská vodárenská spoločnosť a.s. Nitra, Levice plant. This territory is also crossed by the hygiene protection zone 2.

THERMAL AND MINERAL SPRINGS

Natural mineral and thermal water springs are found along the so-called Levice spring line between Horné Turovce and Kalinčiakovo. It is formed by the Turovce-Levice horst, with partial Turovce and Santovka segments. The thermal waters in Dudince and Santovka, including cold acidulous water in Santovka, are all of the same origin and of the same chemical type. All mineral and thermal water in the Levice spring line (except for Horné Turovce) is used. Thermal springs and areas protected for water management reasons are not found within the affected territory. In the wider surroundings of the affected area, there are geothermal wells Podhájska, Bardoňovo, Horný Oháj and Pohranice.

AREAS PROTECTED FOR WATER MANAGEMENT REASONS

Directly in the affected area, there are no areas protected for water management reasons. Around the affected area, groundwater hygiene protection zones of class 2 are situated as follows:

-SE of the affected area and partially in the affected area (protected zone is
Denominated by Levice, Podlužany, Čajkov, Tlmače, Nový Tekov, nuclear power plant
Mochovce and Kalná nad Hronom)

-around 4.7 km NNW from the affected area (the zone is situated around the Širočina creek below Nevidzany municipality).

The remaining groundwater hygiene protection zones of class II around the affected territory are more than 5 km away from the site being assessed.

1.6. Hydro-geological Conditions

Options 1 and 2

Hydro-geological conditions in the area of interest are the result of its geological and tectonic structure and its morphological and climatic conditions. The 1st watered layer collector consists of gravel, sandy gravel and sands, which may be considered to be equivalent to the Kolárovo formation and the flat sediments of Dudváh Wetlands. These are located on retentive plastic Neogene clays with sands and gravel forming the 2nd watered layer. According to hydro-geological regionalisation of Slovakia, the wider area of interest belongs to the following hydro-geological regions: Nižná - N 049, Veľké Kostoľany - QN 050 and Q 048.

Chemical composition of groundwater in the fluvial sediments is formed rather by the mixing of water with varied mineralisation, composition and origin than by mineralisation processes taking place at the interface between the rock and groundwater phase. Intensity of these processes especially depends on the flow rate, granulometric composition of fluvial gravel-sands and chemical activity of the underlying rock material. These genetic conditions result in extensive special variability of mineralisation and chemical composition of these waters. An important factor participating in the formation of these variability is also the inorganic or organic pollution of varying origin transported into the circulation environment through the infiltration of surface water and rainwater, or direct intrusion.

In the affected area, deep groundwater of Neogene origin (extrapolation from the description of Danube Lowland Neogene) contain varying levels of natrium-chloride and high contents of Br^-, I^-, NH_4^+ and B with a broad interval of total mineralisation dispersion and high values of HCO_3^-/Cl^- index. The chemical composition of Neogene waters varies between spatial zones. This zoning is probably attributable to the growing level of surface secondary pollution in the NE-SW direction, transported into the watered layers mostly by penetrating surface waters. This is evidenced both by the results of hydrometric creek measurements and by the high content of nitrates of 10÷50 $mg.dm^{-3}$ (up to 200 $mg.dm^{-3}$ for strongly polluted sources). Compared to the groundwater of fluvial sediments, the level of secondary pollution is slightly lower.

The average speed of flow of groundwater on the NPP Jaslovské Bohunice site reaches 94.10^{-7} $m.s^{-1}$. Groundwater level is found in gravel sand sediment complex 20 m below the terrain. Groundwater found in this collector has free level and is of strong Ca-Mg-HCO_3 type, mid-mineralised, hard, with slight alkali reaction.

Option 3

Hydro-geological conditions in the area of interest are the result of its geological and tectonic structure and its morphological and climatic conditions. Post-Tertiary flat sediments with intergranular permeability are richest in groundwater. Watered layers are gravel or sand. in the Hron bottomland southwards of Slovenská brána, they reach a thickness of 20 m. The affected territory belongs to Hronská pahorkatina (Hron Highlands) and Hron bottomland. Based on research performed as part of the construction of the Regional Nuclear Waste Depository and its monitoring system, the hydro-geological conditions in the affected territory may be described as follows: Water in post-tertiary deposits does not create continuous water horizon. However, the presence of soaking atmospheric rainfall may not be excluded in periods of heavy rainfall, especially where clayey mantle sits on clay sub-base. Due to the low permeability of post-tertiary loam and structured terrain morphology, most of the rainfall is drained by surface watercourses and usually accumulates in surface terrain depressions. Except for Post-Tertiary groundwater collectors, water accumulated in Neogene sediments is of key importance. In Sarmat sediments of the given area, permeable and impermeable layers alternate – collectors, semi-isolators and isolators. Hydro-geological conditions west and south-west of the location of interest (in Hron Flat) differ from the highlands. Neogene is represented in massive clay complexes, where sand and sandstone positions are only found

sporadically and are of no practical hydro-geological importance. Post-Tertiary fluvial sediments of Hron river form a suitable environment for free surface groundwater flow and accumulation, as suggested by hydro-geological research performed in Levice, Tlmače, Malé and Veľké Kozmálovce, Nový Tekov and Kalná nad Hronom and hydro geological research performed as part of HV installation in Veľké Kozmálovce and the construction of the Mochovce nuclear power plant. The entire right hand side of the Hron River valley around Nový Tekov shows hydro-geologically favourable conditions. These correspond to the geologic structure and granulometric composition of the rock. Clearly, most groundwater is present in the well permeable fluvial complex of "Hron gravel". Their granulometric composition is a pre-condition for good accumulation and circulation of groundwater in Post-Tertiary gravel. Direct contact of gravel and gravel-sand sediments with the recipient produces hydraulic connection of groundwater with the surface water of the Hron. Groundwater replenishment is predominantly linked to bank infiltration from recipient. According to previous research studies, directions of groundwater flow are identical with the direction of the Hron River valley. Hydraulic situation is probably impacted by changing water level of the Hron and use of water sources.
From hydro-chemical point of view, the Ca-Mg-HCO3 type prevails in the affected area. In Post-Tertiary waters, secondary impacts on chemicals status (especially anthropic) are visible more clearly.

1.7. Soil Conditions

Options 1 and 2

SOIL TYPES, CLASSES AND THEIR QUALITY

Trnavská pahorkatina (Trnava Highlands) and marginal mountain ranges feature various soil types (with varying kinds, often transitional forms) (Fig. C-6). At the western edge, the dominant type is haplic luvisols. Most of the Trnava Tableland is covered by black soil (muck). The right bank of the Váh River (Dudváh valley) and creek valleys are filled by Mollic Fluvisols, which is the third most significantly represented type. The narrow Váh valley is typical for the presence of fluvisols. At the edges of the Small Carpathians and Považský Inovec ranges, there are rendzic leptosols and calcaric cambisols, mostly non-carbonated cambisol and lithosol. In a large part of the affected area, the content of humus in soil is high (exceeding 2.3%). Soil with medium contents of humus (1.8 – 2.3 %) is less frequent.
Soil ecological units (BPEJ) represent relatively homogenous ground-climatic units further subdivided based on incline, slope exposition, skeletal character, depth of soil and grain composition of surface horizons. BPEJ only apply to farmland. In the affected territory, soil is classified into five main BPEJ types (12001, 12601, 12701, 13901, 14401), whereby, all are categorised as highly productive arable land, or the most productive arable land.

MECHANICAL AND CHEMICAL DEGRADATION OF LAND

Mechanical degradation of land depends on several endogenous (cohesion and consistence) and exogenous factors (relief, vegetation, rainfall and wind). In the given area, chemical degradation of land may be caused by several factors (acidification of land reserves, contamination through heavy metals, organic substances, industrial fertilisers and pesticides). Significant land anthropisation is typical for urban locations. In the last decades, all land types represented in arable land reserves declined in quality as a result of intensification factors and general reduction of environmental quality. This decreased their natural productivity. Productivity increases were reached via increasing volume of energy supplied into the growing of field plants (selected seeds, chemical fertilisers and protecting agents, machinery innovations, etc.).
Contaminants from pesticides and industrial fertilisers decreased in volume as a result of their use reduction due to the poor economic situation of almost farming cooperatives in the given territory.

Nevertheless, farming activity is high in the affected territory. On national level, it belongs to areas with least contaminated land, as far as land contamination through farming is concerned.

Wind erosion occurs only locally. Sites exposed to medium threat of erosion are found around the Biskupice Channel, on the left bank of the Váh River between Sĺňava and Leopoldov and in the area around Veľké Kostoľany. The most endangered area is that south of Pobedim.

Option 3

SOIL TYPES, CLASSES AND THEIR QUALITY

In the north-eastern part of the territory, shallower layers of earth substrates are found on solid rock. In the south-east and west, there are deep layers of earth substrate. This is also related to the presence of shallower and deep soils. The eastern part of the territory (Veľká Vápenná slopes and Hron bottomland) is formed by conglomerate waste, marl and andesites followed by cambisol types (typical, luvial and pseudo-gley) on deeper waste and ranker (typical) on shallower waste of mentioned rock. In the valleys, pseudo-gleys and pseudo-gley fluvisols on deeper Neogene sediments are typical. The narrow stripe along the Hron bottomland and its terraces is covered by Stagni-Haplic Luvisols on loess and Neogene sediments, possibly Haplic Chernozems and Chernozems on older alluvial deposits and loess. The Hron bottomland is filled by mid-heavy to heavy alluvial sediments covered by gley and typical fluvisol types. In this territory, residential areas and vineyards are formed by typical cultivated soil (KTm) in vineyards and degraded and typical anthrosol in gardens and built up areas. Immediate surroundings of the power plant are formed by strongly modified land. The entire area under the outgoing high-voltage lines has been levelled off and features pedogenic substrates, as well as humus layers of typical anthrosol (clayey-loamy to loamy). The flat land around Telinský potok (creek) is formed by original typical fluvisol (clayey-loamy grain). Smaller forest precincts represent typical ranker and cambisol ranker types with loamy to clayey-loamy grain. Part of the paved areas inside developed territory of municipalities is formed by degraded anthrosol with concrete panels and gravel-rocky earth. Western part of the territory is formed by Neogene sediments, loess loam and loess. Positions on more inclined slopes have the following soil types complex: Typical regosol and Haplic Luvisols, clayey grain. Shallower valleys are built of Stagni-Haplic Fluvisols on Neogene sediments, possibly Eutric and gleyic Eutric fluvisols on Post-Tertiary alluvial sediments, clayey-loamy to clayey grain.

MECHANICAL AND CHEMICAL DEGRADATION OF SOIL

Mechanical degradation of land is attributable to several endogenous (cohesion and consistence) and exogenous factors (relief, vegetation, rainfall and wind). Chemical degradation of soil in the affected territory may be caused by several factors (acidification of land reserves, contamination through heavy metals, organic substances, industrial fertilisers and pesticides). Significant land anthropisation is typical for urban locations. In the last decades, all soil types represented in arable land reserves declined in quality as a result of intensification factors and general reduction of environmental quality. This decreased their natural productivity. Productivity increases were reached via increasing volume of energy supplied into the growing of field plants (selected seeds, chemical fertilisers and protecting agents, machinery innovations, etc.). In terms of mechanical and chemical degradation, soil with no vegetation (farmland, or made-ground and areas uncovered by earthworks) is most endangered. Wind and water erosion is a serious threat to soil. Wind erosion threatens most land with no vegetation. Within the location, it mostly occurs on loess. Water erosion threatens land on steeply inclined slopes and land with no vegetation (in the affected territory, these are mostly Haplic Luvisols and Haplic Arenosols).

1.8. Biotic Conditions

1.8.1. Flora

Options 1 and 2

PHYTO-GEOGRAPHIC CHARACTERISTICS AND RECONSTRUCTED VEGETATION

Phyto-geographic structuring assigns the site partially to the Pannonian flora circuit (Pannonicum), Pannonian xerothermal flora area (Eupannonicum) and partially to the pre-Carpathian flora circuit (Praecarpaticum) and the area of Western European flora (Carpaticum occidentale) (Futák, 1980).

ACTUAL VEGETATION

Within the affected area, basic biotopes include communities of soft alluvial forests (Salicion albae) found on the Holocene flat of the Váh river in permanent reach of the high level of groundwater. Most of these areas are currently used as farmland; sometimes, we speak of areas in inundation space between embankments.

In a floristic research of alluvial forests along the motorway axis (performed in the Trnava district), a total of 235 plants were recorded, of that 6 protected species. The remains of alluvial forests represent an important landscaping feature in the monotonous lowland landscape. Further, they are an important fauna refuge. The said fluvial growth islands are disturbed by the motorway route (Trnava – Bratislava).

Communities of ash-elm and oak-elm forests (Ulmenion) were widespread on the wide Váh and Dudváh bottomlands, as well as on the flats of larger creeks (Blava). They are linked to higher and relatively dryer positions of valley flats, where surface flooding takes place regularly and for short periods of time. Today, only small remains were preserved amidst farmland. They are documented on the Dudváh bottomland.

Shore alder and ash-alder alluvial forests (Alnenion glutinoso-incanae) and shore communities of bush willows (shore willows) continue in the communities of willow-poplar alluvial forests in the residual deposits of narrow valley flats on central and upper river and creek flows.

Oak-hornbeam Pannonian forests are considered to represent the driest forest type (Ulmeto-Querceta). In the affected area, they are found in the Dudváh river basin. On the marginal loess highlands and island hills, it changes to xerophilous communities (Eu-Quercion pubescentis).

Oak-cer forests represent sub-xerophilous to xerophilous forests especially linked to ilimerised Haplic Luvisols on loess or degraded Chernozems on loess. Currently, they represent sprout shoot growths, often with dominating locust tree, in vineyards, orchards and fields with more demanding cultures.

Shrubs formed a natural community on fields and had the function of natural bio corridors and bio barriers. With the transition to large-scale production farming, they were mostly removed from farmland. Shrubs on the banks of water flows in farmland are of shore willows type (Calystegio-Salicetum triandrae).

Option 3

PHYTO-GEOGRAPHIC CHARACTERISTICS AND RECONSTRUCTED VEGETATION

According to the phyto-geographical classification, the site lies in the Pannonian flora (Pannonicum) area, Europannonian xerotherm flora circuit. The northern border of the affected area is in contact with the Western Carpathian flora area (Carpaticum occidentale), Štiavnické vrchy district (Futák, 1980).

ACTUAL VEGETATION

In the affected territory, gradual vegetation changes, together with terrain configuration and localisation on the border line of Pannonian and Carpathian phyto-geographical areas were mostly impacted by the private farming and traditional wine growing. A determining factor is also the existence of edaphically conditioned areas of "rocky forest-free area with relict vegetation of forest steppe character.

In the closer surroundings of the affected area, real vegetation was mostly classified by units used in the Slovak biotopes catalogue (Ružičková, Halada, Jadlička, Kalivodová, 1996). Groups of forest types are classified according to Krížová (1998) and forest management plan (FMP).

Natural Forests

Saliceto – Alnetum, SAI (willow alderwood)

Ulmeto – Fraxinetum, Ufrc (elm-hornbeam ashwood)

Quercetum, Q (oakwood)

Carpineto – Quercetum, CQ (hornbeam oakwood)

Fageto – Quercetum, FQ (beek oakwood)

Carpineto – Quercetum acerosum, CQac (hornbeam-maple oakwood)

Corneto – Quercetum, CoQ (dogwood oakwood)

Secondary Forests

Pinetum culti (monocultures Pinus sylvestris)

Thermophilic edge communities

Geranion sanguinei (shallow soil edges rich in species)

1.8.2. Fauna

Options 1 and 2

Based on the existing composition and situation of the fauna, the affected territory belongs to the Palaeo-Arctic area. According to the prevailing biotopes, it belongs to the zone of steppe and forest steppe of Euro-Siberian sub-area. The most widespread biotopes found within the area are cultural steppe, game refuges and preserved small forests along watercourses.

Invertebrates found in damp forest, or park and orchard soil are represented by worms and molluscs, with the prevalence of arthropods (arachnoids, crustaceans and insects).

Fish species in the Small Carpathian creeks are represented in poorer numbers. Dominant species are gudgeon, loach and minnow rifle. The presence of fish in Dudváh is impacted by the adjacent section of the Váh River. Of the original 47 fish species, 38 species are found on a regular basis. Currently, the said section of the Váh belongs to the lowland zone with its typical representatives, such as e.g. roach, European bream, undermouth, chub, dace, northern pike, chondrostoma nasus, barbell, bleak, European perch and crusian. Compromised water quality is probably one of the reasons behind declining reproduction ability. Together with intense water level swings caused by the operation of Madunice hydro power plant, it led to a reduction in the fish stock. Fish migration is negatively impacted by the construction of water dam in Kráľová.

The limited group of amphibians is represented by 12 species in the territory (e.g. European toad, green frog). Of 7 snake types, sand-lizard is commonly found in sunny spots, as well as ring snake and rare red rat snake requiring water environment.

The most numerous representatives of vertebrae are birds. So far, over 250 species were counted in the territory, of that 110 nesting birds. By biotope fixation, avifauna is classified into three groups: Birds of cultural steppe (gray partridge, common quail, common pheasant, stannel, rook, crow, pied manikin, jack-daw, common skylark), birds of flat groves (titmouse, blue titmouse, nutpecker, grosbeak, yellow-bird). Following the establishment of fishponds and water reservoirs, water and swamp birds were added too (baldicoot, striped rail, little gull, mallard). During migration period, some rare and remarkable birds rest or transmigrate on the water surface.

Compared to birds, mammals have poorer representation. There are especially small species, the most known being Eastern-European hedgehog, common mole, true mouse, giant pouched rat, water rat, migratory hamster, polecat and least weasel. Of bats, common vampire bat is found commonly. Of game animals, it is brown hare and deer.

Option 3

According to the zoo-geographical regionalisation, the area of interest is located at the border line of European steppe province of Pannonian district and the sub-Carpathian district of broad-leaf trees reaching out into the affected site (Kozmálovské vŕšky).

Evertebrata

Within the affected area and its closer surroundings, 77 species of hymenopterans were identified on 15 locations. The presence of many Mediterranean and ponto-mediterannean species was confirmed. At water reservoirs, creeks and channels, David (1992) states the presence of 29 dragonfly species (over 40% of all species living in Slovakia). Molluscs were covered by a publication of Matušková (1985). Around Mochovce, she identified 52 species, of that 25 terrestrial.

Vertebrata

Amphibians and Reptiles (Amphibia and Reptilia)

No detailed research was published for the territory. The presence of e.g. Hyla arborea, Triturus vulgaris, Rana esculenta, Rana sp. , Bombina bombina, Lacerta agilis, Lacerta muralis, Lacerta viridis, Anguis fragilis, Elaphe longissima, Natrix natrix was recorded.

Bird population

On 20 characteristic biotopes in the closer surroundings of the affected territory, 3 species of nesting birds, 61 species of hibernant and 10 migrating birds were identified. Of nesting birds, the following are also found: Accipter nisus, Alcedo attis, Ardea cinerea, Bubo bubo, Caprimulgus europaeus, Dendrocopus medius, Jynx torquilla.

Mammals

14 species were found in various biotopes of Mochovce, Nevidzany and Čifáre, e.g. Sorex araneus, Sorex minutes, Neomys anomalus, Crocidura leucodon, Cricetus cricetus, Arvicola terrestris, Arvicola flavicollis (dominant), Clethrionomys glareolus (dominant), Microtus arvali, Apodemus flavicolis, Apodemus sylvaticus and also Micromys minuttus.

In addition to that, mammals are represented by the so-called game animals. These are especially Cervus elephus and Susu scrofa. The ecosystems do not include natural predators. Another species is Capreolus capreolus and Ovis musiom was seen in Kozmálovské vŕšky. Lepus europaeus is frequent, just as Phasanus colchicus. Another species found here are Vulpes vulpes, Martes martes, Mustela nivalis, Meles meles, Erinaceus europaeus.

1.8.3. Important Migration Corridors

Important migration corridors are mostly ecologically significant landscape segments, often line vegetation communities. They serve as interconnection of biocentres of various levels. They enable the migration of organisms. As part of territorial systems of ecological stability, they are referred to as bio-corridors. They do not need to be continuous.

Options 1 and 2

The following are important migration corridors in the wider surroundings:

- Hydric supraregional bio-corridor: Váh and vegetation stand on its banks
- Terrestric supraregional bio-corridor: Small Carpathians (mountain range system)

Option 3

The following are important migration corridors in the wider surroundings:

- Hydric supraregional bio corridor: Hron and the adjacent bank growths
- Terrestric supraregional bio corridor: Gbelce – Patianska cerina – Zudrok - Včelár

1.9. Conservation Areas and Protection Zones

Options 1 and 2

CONSERVATION AREAS

The affected territory is not subject to any special nature conservation regime and does not extend to any conservation area nor is any small or large scale conservation area located within the territory. Free areas on the site are subject to the first general protection level pursuant to Act of the National Council of SR No. 543/2002 Coll. on Nature and Landscape Protection.

In the wider area (about 15 km from the proposed activity, *Annex No. 3*), there are 6 protected sites (Sĺňava, Trnavské rybníky, Dedova jama, Malé Vážky, Tokajka and manor garden in Hlohovec), 6 nature reserves (NR Katarínka, NR Pod holým vrchom, NR Lančársky Dubník, NR Chríb, NR Orlie skaly and NR Sedliská) and protected landscape area Small Carpathians. Protection levels four to five apply to the territories of these protected sites and nature reserves. Protected landscape area is subject to protection level two pursuant to Act No. 543/2002 Coll. on Nature and Landscape Protection as amended.

Natura 2000 is the name of a system of protected areas in the member states of the European Union. Its key objective is to preserve natural heritage important not only for the member state concerned, but especially for the EU as a whole. NATURA 2000 covers 2 types of areas: special protection areas under the birds directive (protected bird areas) and special protection areas under the habitats directive (areas of European significance) (after pronouncement as a special protection area, the territory is included into the relevant national category of protected areas). The closest protected bird areas are SKCHVÚ026 Sĺňava (11 km NE) and SKCHVÚ032 Trnavské rybníky (17 km SW). The closest territories of European significance are SKUEV0278 Brezovské Karpaty (16 km NW) and SKUEV0175 Sedliská (11 km SE).

PROTECTED TREES

Within Trnava region, there are 35 protected trees or protected groups of trees. None of the said trees or groups of trees is found directly in the affected area.

Option 3

CONSERVATION AREAS

The affected territory is not subject to any special nature conservation regime and it does not extend to any conservation area, nor is any small or large scale conservation area located within the territory. Free areas within the site are subject to the first general protection level pursuant to Act of the National Council of SR No 543/2002 Coll. on Nature and Landscape Protection.

In the wider surroundings (about 15 km from the proposed activity, *Annex No. 4*), there are 4 protected sites (Čifárska skala, Kusá hora, Plešovica and Slovenská brána – Skala), 2 nature reserves (NNR Patianska cerina and NR Krivin) and protected landscape area Štiavnické vrchy. Protection levels four to five apply to the territories of protected sites and nature reserves. Protected landscape area is subject to protection level two pursuant to Act No. 543/2002 Coll. on Nature and Landscape Protection as amended.

Natura 2000 is the name of a system of protected areas in the member states of the European Union. Its key objective is to preserve natural heritage important not only for the member state concerned, but especially for the EU as a whole. NATURA 2000 covers 2 types of areas: special protection areas under the birds directive (protected bird areas) and special protection areas under the habitats directive (areas of European significance) (after pronouncement as a special protection area, the territory is included into the relevant national category of protected areas). The closest protected bird areas are CHVÚ Žitavský luh (13 km SW) and CHVÚ Tríbeč (16 km NW). The closest territories of European significance are SKUEV0262 Čejkovské bralie and SKUEV0263 Hodrušská hornatina (about 11 km NE).

PROTECTED TREES

Within the Nitra region, there are 40 protected trees or protected groups of trees. None of the said trees or groups of trees is found directly in the affected area.

2. Landscape, Landscape Picture, Stability, Protection, Scenery

2.1. Landscape Structure

Naturally, the landscape structure of the affected area has been developing in its entire history. The current landscape structure is the result of constant human activity performed in the original landscape. Except for natural components, its formation and modification is significantly impacted by human activity and the impacts of various anthropogenous features (buildings and structures, paved surfaces and roads, art artefacts and other technical elements). All elements of the existing landscape are mutually interconnected by vertical and horizontal links enabling constant energy and information flows.

Options 1 and 2

The existing landscape structure of the Trnava region in the wider surroundings of the affected area is a combination of natural environment and anthropogenous factors (settlements, farming, transport, industry).

The defining water flow, the Váh River, which formed the Lower Váh plain, is regulated. Its right hand side tributaries Chtelnička (Výtok), Blava, Dubovský and Krupský creeks and Manivier channel, flowing through the affected area, are regulated to a varying extent - in upper sections less, in villages and Dudváh flat fully. In the past, the mentioned tributaries had a significant share in the formation of the Trnava plain (gullies and valleys) and Dudváh flat relief (detrial cones). Today, the basins of creeks, originally rutted by gullies and ditches, were by agricultural mechanisms transformed into continuous arable land areas on the hills of the Trnava Highlands, flatlands of the Trnava Tableland and Dudváh plain.

Forest biotopes only form negligible relics round the edges of the affected area. Over 90% of the existing vegetation is formed by special farming monocultures, mostly yearlings. In a certain part of the year, outside the vegetation period, vegetation is practically absent on arable land.

The structure of settlement and buildings in municipalities are based on pre-historic settlements; the existing rural structure of municipalities was formed in the last 500 – 700 years and the existing municipal structures (except for sacral buildings and historic monuments) mostly in the past 50 – 80 years. A special element in the built-up areas of the affected area is the site of NPP Bohunice forming a closed industrial zone surrounded by farmland.

Road network developed hand in hand with the development of municipal structures as a road network connecting villages within the given territory with neighbouring villages and urban and administration centres – the towns of Trnava, Hlohovec and Leopoldov, Piešťany. As part of the construction of NPP in Bohunice, the road network was extended by two roads (NF Jaslovské Bohunice – Jaslovské Bohunice, NF Jaslovské Bohunice – Žlkovce) and railway track from Veľké Kostoľany to the NF site.

With the construction of NF Bohunice, the infrastructure of the area was extended by the Manivier channel and the covered Socoman channel for the drainage of waste water, by over-ground VHV and

HV power lines interconnecting NPP V-1 and NPP V-2 with the national and international transmission networks and hot water ducts supplying heat to Trnava and Hlohovec.

Option 3

In the wider surroundings, the existing landscape structure is the result of the impact of natural conditions combined with anthropogenous factors (farming being the dominant one). Its impact on the structure of landscape prevails in most parts of the Nitra region today. Other factors include roads and gradual industrialisation of the territory.

Settlements are mostly found in the lowland and rolling highlands with traditionally prevailing farming function. A characteristic feature is the relatively regular spreading of settlements around larger central settlements. It is only disturbed by band settlements along watercourses.

The structure of landscape in the affected territory consists of several landscape units (landscape-ecologic regions) corresponding to geomorphologic units specified in the work of Hrnčiarová et al. (1999):

Hronská pahorkatina (Hron Highlands)

River terrace gravel, levelled rolling sheets of loess and scattered eolic sands sublimate, rolling, slightly elevated flatland, monotonous relief with wide flat ridges, structured by gully valleys. Arable land prevails, smaller orchards and vineyards, smaller forest precincts, rural settlements with farmhouses. It belongs to an area with intense farming (cereal-–eat area with developed fruit and wine growing and livestock production).

Intense land use resulted in allotments consolidation, removal of stabilising landscape features, pollution of surface flows, disrespect for terrain configuration, etc., which disturbed principal ecologic landscape links (erosion, soil compression, drainage, etc.). Smaller hydric bio corridors are represented. Centre of Hron Plain (part of the highlands) is crossed by terrestrial bio corridor. A bio centre is found there.

Kozmálovksé vŕšky

A small geomorphologic unit representing a sub-unit of Štiavnické vrchy. It is separated from this mountain range by the Hron river gulley, the so-called Slovenská brána. it is formed by Neogene pyroxene andesites and their pyroclastics. At the edges, there are Neogene clays and sands. It is a slightly elevated plate with mid-structured terrain of sub-highland character with an amplitude of 101 to 180 m. The highest altitude is measured at Veľká Vápenná – 350 m above sea level. Kozmálovské vŕšky have the character of foothill forested sub-highland landscape, with local cultural forest steppe. Deforested areas show water erosion. Sporadically, there is shallow earth. Kozmálovské vŕšky represent a significant terrestric bio corridor and are very little populated.

2.2. Landscape Scenery

Options 1 and 2

In the 2nd half of the past century, significant changes took place in the original farmland scenery characterised through smaller fields divided by balks and hedges. Development of farming mechanisation and use of chemicals resulted in integration of fields and hides, creating new landscape dimensions.

The Landscape unit of the Small Carpathians is a dominant natural phenomenon and serves as a counterweight to the Danube Lowland relief, or its part called Trnava Tableland. The nuclear power plants in Jaslovské Bohunice were integrated into the already changed landscape scenery. The nuclear power plant established a new dominant and introduced a dynamic element into the relatively static scenery (steam rising from the cooling towers). Their silhouette exceeds the original landscape dominants several times. From a certain point of view, over-ground high and very high voltage power lines are a disturbing landscape element.

Option 3

In the Mochovce location landscape scenery is dictated by its position at the border line of the Danube Lowland and the southern slopes of Pohronský Inovce and Štiavnické vrchy. Dominant natural phenomenon is Slovenská brána formed by spurs of Pohronská pahorkatina and south-western slopes of Štiavnické vrchy. It is passed by the Hron river. Closer surroundings of the affected area is completed by water reservoir Veľké Kozmálovce serving as service water reservoir for SE EMO. Character of the entire location was impacted by construction of nuclear power plant, since the site development and surfaces stability called for large-scale earthwork, when parts of the Kozmálovské vŕšky highlands were removed.

2.3. Territorial System of Ecologic Stability

Options 1 and 2

Wider surroundings of the affected area are crossed by the border line of Central European bio geographical and phytogeographical regions and circuits. The following TSES elements are found in the districts of Trnava and Piešťany representing the mentioned surroundings:

Supraregional bio centres (SRBc):

- SRBc Dubník
- Čachtické Karpaty - part
- SRBc Roštún

Regional bio centres (RBc):

-
- Veľká hora Fáneš
- Chtelnická dolina (Chtelnica valley)
- Striebornica valley
- Nadálky
- Sĺňava and Priesaky
- Gravel deposits in the Váh residual deposits
- Záruby
- Klokoč
- Čierna skala
- Slopy-Dobrá voda
- Orešany
- VN Boleráz
- Trnavské rybníky
- Horná Krupá-Horný háj
- Podháj
- Brestovianske háje
- Vlčkovský háj
- Križovanský háj
- Šúrovce

Bio-corridors of supraregional significance (SRBc):

- The Váh river
- Ridge system of the Small Carpathians

Regional biocoridors (RBc):

- Dudváh
- Holeška
- Kočínsky potok
- Lopašský potok
- Striebornica
- Šteruský potok
- Trnávka
- Gidra
- Parná
- Blava
- Dudváh
- Krupianský potok
- Derňa
- Ronava

Option 3

Wider surroundings of the affected area has an important position in terms of territorial supraregional and regional system of ecologic stability functioning. The territory is located at the border line of southern Slovakia with different geological development, geomorphologic and climatic conditions. The border line between Central European bio geographical provinces and phytogeographical areas and circuits also passes through the area of interest.

In the wider surroundings, there are significant supraregional and regional bio centres and bio corridors of terrestric and hydric types. They are arranged in zones according to terrain configuration with prevailing north-south arrangement.

Supraregional bio centres (SRBc):

- Štiavnické vrchy
- Patianska cerina

Bio corridors of supraregional significance (SRBc):

- Hydric corridor – it passes through the Hron bottomland and interferes with the territory in the area of Nový Tekov - Kozárovce
- Terrestric corridor – partially incontinuous, along the Žitava and Hron divide, it connects SRBc Patianska cerina and SRBc Včelár (direction Pohronský Inovec).

Regional bio centres (RBc):

- Kozárovce – Skala
- Kozmálovské vŕšky (
- Slance – Zadný vrch – Rohožnická hôrka – Kozí chrbát

Local bio centres (LBc):

- Alluvial Hron growths
- Staré vinice – Chladnov – Podkamenie
- Staré vinice – Čovánoš – Boťkova hora Nad čerešňami – Okolo šarovských hájov

Further TSES features also include important landscape segments, such as Slovenská brána and Nevidza water reservoir.

3. Population and Its Activities, Infrastructure and Cultural-Historic Values Within the Territory

3.1. Demographic Data

Options 1 and 2

This preliminary environmental study looks at the population in two locations, which also represent the risk zones:

- Population of territories affected by the proposed activity, i.e. a radius of 5 km from NF Jaslovské Bohunice,
- Population of territory generally used for environmental impact assessment for nuclear facilities, usually a radius of 25 - 30 km.

3.1.1. Population in the Affected Area

There are 8 rural municipalities in three districts in the affected area. Trnava district includes Jaslovské Bohunice, Malženice and Radošovce. In the Hlohovec district, there are Žlkovce and Ratkovce and Veľké Kostoľany; Nižná and Pečeňady are part of the Piešťany district.

Population of the Municipalities likely to be concerned

According to the data of the Statistical Office of SR included in RegDat (Regional Statistics Database) and MOŠ (Municipal statistics) collected at the end of 2008 (31/12), a total of 8,363 people lived in the mentioned municipalities, of that 4,154 men (49.7% and 4,209 women (50.3%). These municipalities, just like Slovakia in general (51.4%) have a slight predominance of women. The following table presents population numbers in the municipalities likely to be concerned.

Table No. 10: Population of the respective villages at the end of 2008

Municipality:	Permanent residents		
	Total	Men	Women
J. Bohunice	1,927	978	949
Malženice	1,323	638	685
Radošovce	412	195	217
Žlkovce	653	321	332
Ratkovce	294	153	141
Pečeňady	524	263	261
V. Kostoľany	2,708	1,348	1,360
Nižná	522	258	264
Total	8,363	4,154	4,209

Age Structure of Population in the Municipalities likely to be Concerned

In year 2008, of the total of 8,363 inhabitants, 16.5% 19.4% in 2001) were in pre-productive age (0-14 years), 64.2% (60.1% in 2001) in productive age (men 15-59 and women 15.54) and 19.3% (20.2 % in 2001) were in post-productive age (men 60 plus, women 55 plus). The following table shows population of the municipalities likely to be concerned structured according to age (productivity).

Table No. 11: Age Structure of Population in the Municipalities likely to be Concerned in 2008

Municipality:	Population in 2008		
	Pre-productive age	Productive age	Post-Productive age
J. Bohunice	308	1,275	344

Malženice	237	859	227
Radošovce	57	267	88
Žlkovce	99	414	140
Ratkovce	38	202	54
Pečeňady	79	328	117
V. Kostoľany	479	1,704	525
Nižná	82	318	122
Total	1,379	5,367	1,617
Total %	16.5	64.2	19.3

Compared to 2001, the pre-production age population declined in the municipalities likely to be concerned, productive age category increased and the post-productive age group slightly declined.

<u>Economic Activity of Population in the Municipalities likely to be concerned</u>

According to the 2001 census, a total of 7,602 people lived in the said municipalities (general data of the Statistical Office of SR on population, houses and apartments). Of this number, 3,815 people (49.7%) were economically active. Economic activity of population in the municipalities likely to be concerned in 2001 is presented in the following table.

Table No. 12: Economic Activity of Population in the Municipalities likely to be concerned

Municipality:	Economically active persons		
	Total	Men	Women
J. Bohunice	894	478	416
Malženice	568	310	258
Radošovce	186	99	87
Žlkovce	281	149	132
Ratkovce	141	76	65
Pečeňady	225	127	98
V. Kostoľany	1,253	701	552
Nižná	267	139	128
Total	3,815	2,079	1,736

Economic activity of population was comparable with the situation in other Slovak regions. Increased employment in agriculture and industry is typical for rural municipalities. The number of commuting people is inversely proportional to the municipality size.

In the past decades, demographic development and structure of the municipalities likely to be concerned were impacted by building ban (1967 – 1983) and the trend of land urbanisation, with people from rural municipalities moving to towns and migrating for job reasons.

The Trnava region, to which the municipalities likely to be concerned belong, maintains the long-term unemployment rate below the Slovakian average. At the end of 2009, unemployment rate reached 9.1% in the Trnava region. It is the third lowest rate compared from all regions of Slovakia and 3 percent less than the national average (12.1%).

3.1.2. Population in the Wider Assessed Territory (25-30 km from Bohunice NF site)

The wider assessed territory is generally an area with a radius of 25-30 km, which is used for the assessment of impacts of nuclear facilities.

Currently, this area reaches into Trnava region (Trnava, Piešťany, Hlohovec, Galanta, Senica districts), Trenčín region (Nové mesto nad Váhom and Myjava districts), Nitra region (Nitra and Topoľčany districts) and Bratislava region (Pezinok district).

There are around 200 municipalities in the wider assessed territory (25 – 30 km from the NF), where environmental impacts of the NF operation are assessed. They are inhabited by up to 400 thousand people.

Originally, the hazard area for nuclear power plants in the Jaslovské Bohunice site (V-1 and V-2) was defined with a radius of 30 km. After Slovakia became an independent country, the hazard areas remained unchanged. They were defined by former regulation of the Ministry of Interior No. 300/1996 Coll. on Hazardous Substances. In the annex to the said regulation, a radius of 30 km was defined for nuclear power plants in Bohunice site. Following the privatisation of Slovenské elektrárne, a.s., two entities held the licence for the operation of NF (Slovenské elektrárne, a.s and Jadrová a vyraďovacia spoločnosť, a.s.). In the first period of existence, the hazard areas remained unchanged for both license holders in the J. Bohunice site, i.e. a radius of 30 km for V-1 and V-2. Following nuclear safety increases and extensive reconstruction and modernisation programmes in both power plants (V-1 and V-2) and in line with Act No. 541/2004 Coll. on Peaceful Use of Nuclear Energy and change and amendment of certain acts as amended and Regulation of Nuclear Regulatory Authority No. 55/2006 Coll. laying down details of emergency planning in case of incidents and emergencies, the license holders asked for the change of the respective hazard areas in 2006 and 2007:

- For nuclear facility operated by JAVYS, a.s., in its Resolution No. 362/2006 and Resolution No. 39/2007, SR NRA approved the 25 km hazard area radius for nuclear facility V-1 with the centre in the ventilation chimney of generation unit V-1, with effect from 01/01/2007.
- Currently, SE, a.s. operates two units of NPP V-2. By resolution No. 355/2007 of NRA, the hazard area with a radius of 21 km from the centre in the ventilation chimney of the main generation unit of V-2 was approved, with effect from 01/01/2008.

In 2010, NRA issued Resolution No. 382/2010 approving a change of nuclear facility hazard area for NPP V1 operated by JAVYS, a.s., defining the radius at 11 km with the centre in the ventilation chimney of NPP V1 and repealing its former resolution No. 39/2007.

Option 3

In terms of socio-economic and population characteristics, we consider the affected area as a sum of the cadastral areas of the municipalities likely to be concerned. These are the municipalities of Malé Kozmálovce, Kalná nad Hronom, Nový Tekov (Levice district), Čifáre, Telince (Nitra district) and Nemčiňany (Zlaté Moravce district).

When describing their characteristics, we use the terms wider and closer surroundings of the affected area. The following criteria were used for their delineation:

- The affected area – up to 10 km from the proposed activity
- Wider assessed territory – up to 50 km from the proposed activity

3.1.1. Population in the Affected Area

Population of the Municipalities likely to be concerned

Population using a certain territory significantly impacts the intensity of land use. Historical development of the population in the municipalities likely to be concerned is characterised by population increase from 1970 until 1991; after that year the trend changed to a continual population decline. The development is attributable in particular to changed social conditions, economic and social changes, which resulted in the relocation of population to towns. This resulted in reduced marriage and birth rates with negative impact on the reproduction process. A slight population increase recorded in the past decade may be attributable to back migration to countryside, as well as the fact that the strong population years from the seventies are in the age of highest fertility.

Table No. 10: Population of the municipalities likely to be concerned at the end of 2008

Municipality:	Population		
	Total	Men	Women
Malé Kozmálovce	403	181	222
Kalná nad Hronom	2,100	1,014	1,086
Nový Tekov	846	419	427
Čifáre	631	314	317
Telince	391	188	203
Nemčiňany	713	336	377
Total	5,084	2,452	2,632

Source: Statistical Office of SR, 2009

Age and Nationality Structure of Population in the Municipalities likely to be concerned

Data of the Statistical Office as at 31/12/2008 suggest a less favourable age structure compared to the national average. It is characterised by lower presence of pre-productive age and higher share of population in the productive and post-productive age.

Table No. 14: Age Structure of Population in the Municipalities likely to be concerned in 2008

Municipality:	Pre-productive age		Productive age		Post-Productive age	
	Population	%	Population	%	Population	%
Malé Kozmálovce	60	14.89	237	58.81	106	26.30
Kalná nad Hronom	317	15.10	1,402	66.76	381	18.14
Nový Tekov	116	13.71	535	63.24	195	23.05
Čifáre	95	15.06	384	60.86	152	24.08
Telince	94	24.04	223	57.03	74	18.93
Nemčiňany	102	14.31	425	59.61	186	26.08
Total	784	15.42	3,206	63.06	1,094	21.52

Source: Statistical Office of SR, 2009

Permanent residents with Slovak nationality represent 56.51 to 86.57%. With respect to the territory location close to districts with high Hungarian nationality representation, this minority has a strong presence here too, ranging from 11.94 to 42.98%. Other nationalities represent less than 1% of the total population. The only significant group is the Roma population in Kalná nad Hronom (5.6% in 2001).

Economic Activity of Population

Overall economic activity level is especially impacted by the potential of employment opportunities in the place of residence and the accessibility of economic centres, just as population age structure. Economic activity of population in the wider surroundings is positively impacted by the construction and operation of nuclear power plant Mochovce. Significant factors of this parameter include the pronounced restructuring of manufacturing and service industries and the resulting changes in population economic activities.

According to 2001 census data, the share of economically active population reached 39.8 – 50.3%. In years 2001 – 2006, unemployment rate represented 16 – 24%. Lack of employment opportunities increases the number of people commuting to other municipalities and districts of the SR.

Table No. 15: Economically active population in the respective villages (2001)

Municipality:	**Permanent residents**	**Economically active persons**		**Economically active population in %**
		Men	**Women**	
Malé Kozmálovce	402	94	66	39.8

Kalná nad Hronom	2,073	542	500	50.3
Nový Tekov	835	201	178	45.4
Čifáre	591	169	112	47.5
Telince	277	60	59	43.0
Nemčiňany	784	181	170	77.8

3.2. Settlements and Build-up Areas

Options 1 and 2

According to settlement structure, municipalities in the affected territory are categorised as rural area – independent municipalities, settlements of local significance. The principal form of living and housing stock is family houses of rural type with the relevant facilities. The housing stock also includes limited number of blocks of flats. Except for these housing structures, there are also farms, livestock farms, warehouses, maintenance structures and space for subsidiary enterprises.

As already mentioned in the previous chapter, development of the municipalities likely to be concerned was affected by the 1967 – 1983 building ban in the past decades, when construction activities were stopped in these municipalities. After 1983, the possibility to build family houses was reopened.

Family houses were constructed on original farms and free plots of land inside the municipalities.

Option 3

Settlements include the municipalities of Malé Kozmálovce, Kalná nad Hronom and Nový Tekov (Levice district), Čifáre and Telince (Nitra district) and Nemčiňany (Zlaté Moravce district). In the municipalities likely to be concerned, the housing stock is the result of long historical development and is marked by preserved historic centre dominated by church. Newer family houses are being built in marginal sections of these municipalities. The housing stock may be characterised as old and partially unused, which increases the number of empty houses and apartments.

3.3. Industrial Production

Options 1 and 2

In Trnava region, industrial production concentrates in larger settlement centres, such as Trnava, Piešťany, Hlohovec, Vrbové.

In the affected territory, industrial production focuses on electricity generation and decommissioning of nuclear power plants. Near Malženice, there is a combined cycle power plant with installed output of 430 MW and annual production of 3 billion kWh of electricity. In the Bohunice site, Slovenské elektrárne, a.s. operate nuclear power plant V-2 with two generation units, each with 505 MW installed capacity. Following the completion of modernisation programme, whose objective was to increase the capacity, V2 NPP generates around 7,500 billion kWh of electricity per year. Another entity within the Bohunice site is JAVYS, a.s. active in the back part of the nuclear cycle. It is responsible for the operation enclosure and preparation for decommissioning of V1 NPP and decommissioning of the first Czechoslovak nuclear power plant A1; it stores, treats, processes, transports and deposits radioactive waste and spent nuclear fuel. The project of a new nuclear facility in Jaslovské Bohunice is managed by Jadrová energetická spoločnosť Slovenska, a.s.

The remaining industrial and construction production has supplementary character in the given territory. Around the proposed activity, the largest environmental pollution sources include asphalt mixing plant in Veľké Kostoľany and partially the concrete plant of AGS TRNAVA, s.r.o. in Malženice.

Option 3

In terms of industrial production, nuclear power plant Mochovce has the biggest importance and significance for Slovak economy in the given area. In the wider surroundings, there are industrial capacities established and operated in Levice, Vráble and Tlmače with developed machinery industry. Smaller industrial capacities are found in Kalná nad Hronom, e.g. seed cleaner, manufacturing of pre-fabricates for infrastructure projects and farming projects company. Similar plants are located in several municipalities in the wider surroundings.

In the affected territory, construction activity focuses in particular on the completion of the NF Mochovce site and MO34. In a smaller scale (as necessary) some construction activity also takes place in the municipalities likely to be concerned.

3.4. Agriculture and Forestry

Options 1 and 2

The potential of agricultural use is very high in the given location. Except for electricity generation in NF, agricultural production is the second dominant production branch. Plant production prevails, especially the growing of cereals, oil bearing plants, technical plants and corn, less root crops and vegetables.

Trnava region belongs to the most productive agricultural regions in the SR (following just after the Nitra region). Of the total territory of the region, farmland takes up 70.6%. The share of arable land (89.8%) is the highest of all Slovak regions (national average reaches 58.7%). Vegetable production is complemented by livestock production with a significant share of black cattle and pigs.

Option 3

Agricultural production belongs to the most widespread activities in the affected area. The affected area has very good natural conditions for growing of various agricultural plants. Main representatives of agricultural land are arable land, vineyards, hop-fields, orchards, gardens and permanent grass growths. Arable land represents a decisive share of agricultural land. Permanent grass growths are found at the foot of mountains and on land plots of lower quality (slopes, wet land, banks of watercourses).

Vegetable Production

In recent years, the structure of areas under crop recorded a slight increase in the share of high-production plants with the lowest costs, such as cereals (of which mostly wheat).

In terms of agricultural land protection, the presence of plants protecting top soil from water and wind erosion is important (densely sowed cereals, perennial fodder-plants). Sunny slopes feature vineyards and orchards. Gardens are located close to or within settlements.

Since 1989, livestock production significantly reduced its production and reproduction basis with the decline of all efficiency parameters. Significant reduction of farming animals emptied some livestock production centres, which are currently partially or fully unused (e.g. former large-capacity farm in Kalná nad Hronom). In the given territory, livestock production concentrates on cattle.

The affected area extends into the forest area of Podunajská pahorkatina (with no bottomlands), the bottomlands of Podunajská pahorkatina and Štiavnické vrchy. In forest production, timber production slightly prevails. It is followed by growing activities and other forest production. Part of the forests in the affected area fulfils a protection function leading to the preservation and use of forest as natural environment especially valued for its originality (Patianska cerina and others). Forestry production is covered by the state forest management enterprise (its branch in Levice) and private owners. This area serves also as a genetic base of fallow-deer.

3.5. Transport

Options 1 and 2

The wider assessed territory includes road, railway and air transport networks. Road network is formed by 1st, 2nd and 3rd class roads and D1 motorway Bratislava – Žilina. Of railway tracks, it is important to mention the track Bratislava – Trnava – Žilina. The said railway tracks, as well as the D1 motorway, do not pass directly through the affected territory.

In the affected territory, there are only 1st, 2nd and 3rd class public roads. In the built-up areas and cadastral areas of municipalities, state roads are replaced by municipal and local roads.

To provide for passenger and material cargo transport, the NF J. Bohunice complex has road and railway connection to the transport network. Public passenger transport is secured by SAD in the entire territory. Transport areas of special importance are not found in the municipalities likely to be concerned.

Within a radius of 30 km from NF J. Bohunice, there is the military airport in Piešťany, the Aero club airport in Boleráz and an airport for farming purposes in Trnava. Above the NF site, there is protective air space LK P29 (radius of 2 km, height of 1,200 m).

Option 3

Road and railway transport represents the dominant mode of transport in the affected area. Other transport types are not found in the territory. In the wider surroundings, there are small airports with grass fields, especially used for farming and sport purposes (Levice).

Wider surroundings are linked to international roads. The power plant site is connected to international route No. 65. In the given territory, the main transport routes are class I roads Nitra-Levice and Hronský Beňadik – Tlmače – Kalná nad Hronom – Želiezovce.

Wider surroundings has good connection in the west-east direction, due to its location on the planned southern axis of the Slovak Republic represented by the railway track Leopoldov – Kozárovce – Zvolen – Košice, which is fully electrified within the given territory. The area has direct connection to the Kozárovce station via the track from Bratislava through Palárikovo, Šurany and Levice to Zvolen. The area is connected with other regions in the north-south direction via the Štúrovo - Šahy – Zvolen track.

From the NPP EMO, a factory track leads to the railway station Kalná nad Hronom. Considering the economic importance of the region, railway transport is sufficient. Its development depends on the construction of high-speed railways across the Slovak territory.

3.6. Technical Infrastructure

Options 1 and 2

The affected area features high numbers of over ground power and cable lines (especially over ground VHV and HV). In addition to these distribution lines of national and regional significance, distribution power lines also lead outside the built-up areas of municipalities. Part of the electric power lines and telecommunication networks are embedded in underground cable distributors.

Another group of energy lines is represented by heat ducts (over ground pipelines DN 500) diverting access heat from NF Bohunice for municipal heating.

In a 10 km zone around NF J. Bohunice, there are product line routes. These include gas pipelines of international, national and regional significance, oil pipelines and other product lines.

Municipalities are connected to group water duct Veľké Orvište with other additional water sources. This water duct supplies drinking water to NF J. Bohunice. Service and cooling water is pumped from Sĺňava reservoir through pumping station in Pečeňady.

Public sewage system connected to a waste water treatment plant is built in Jaslovské Bohunice only. A second WWTP is constructed on the site of former local barracks. Waste water treatment plants are, or will be constructed also in other municipalities.

Option 3

Drinking water to a part of the affected area is supplied via the water management system of Gabčíkovo. The most extensive water management system in Nitra region supplies drinking water to most of the municipalities in all Nitra region districts, except for Topoľčany. Only groundwater sources are used, with the crucial sources located outside the region, in Dunajská Streda and Galanta districts (Trnava region). These are large-scale sources of Gabčíkovo and Jelka with a capacity of 1,520 l.s-1. They supply water ducts of the municipalities likely to be concerned in the Levice district via group water duct in Kalná nad Hronom – Nový Tekov – Malé Kozmálovce. These sources form the base for further development of public water ducts in the entire territory.

Of own water sources localised within the region, the Kolíňany source with a capacity of 10.0 l.s-1 and HGM-2 well with a capacity of 11.0 l.s-1 are used for the supply of group water duct Vráble – Zlaté Moravce. Group water duct was established through the integration of independent water ducts Vráble and Zlaté Moravce and supplies municipalities likely to be concerned in the Nitra district via water supply Vráble – Telince - Čifáre and in Zlaté Moravce district through water supply Nemčiňany.

Within the affected territory, there is one of the most important electric power sources within the SR distribution network – NPP EMO, currently operating two generation units with an output of 440 MW each. In the closer surroundings of the affected territory, in Veľký Dur and within about 12 km from the site, there are VHV and HV transformer rooms connected to electric distribution network of the SR. In the close surroundings, additional electricity sources, connected to the distribution network, are the factory power plant in Bavlnárske závody and hydroelectric power plant in Veľké Kozmálovce.

In the wider surroundings, gas pipelines are represented by transit, international and national gas pipelines supplying natural gas to the local municipalities. Within the given territory, distribution gas network is only established in Malé Kozmálovce and Kalná nad Hronom. Gas distribution is operated by Slovenský Plynárenský priemysel.

Public sewage system development significantly lags behind the development of public water ducts in the wider surroundings of the affected territory. The same situation prevails in the entire republic. Male Kozmálovce and Kalná nad Hronom have a sewage system connected to a WWTP. In Nemčiňany, sewage system is under construction. However, Nový Tekov, Čifáre and Telince have no sewage system.

3.7. Recreation and Tourism

Options 1 and 2

In the wider surroundings, the most important recreation facility is represented by the Piešťany reservoir Sĺňava. Drain mouth of waste water from NF J. Bohunice is below the mentioned reservoir. Therefore, there no pollution impact by this waste water is expected.

Option 3

Tourism and recreation may be considered mid-developed in the affected territory. In the territory itself and its closer surroundings, there are several water reservoirs especially used for farming. Municipal fishpond in male Kozmálovce is also used for recreation and sports purposes. Reservoir Veľké Kozmálovce on the Hron river has the potential for water sports. Dredged lakes, or flow arms

are used to a larger extent. The given territory also offers good conditions for sport fishing in suitable sections of water flows, but also in farming reservoirs and fishponds.
Nemčiňany offer walks around a mountain park to the tomb of Kostolániy family, which established this park.
In the wider surroundings, sport horseback riding also developed around horse breeding locations, and there are also horse-riding sides in Nový Tekov and Jura nad Hronom or Mýtne Ludany.
Suitable conditions for recreation and tourism are especially found in the wider surroundings of the affected territory. In the region, especially on the Levice thrust, there is wealth of geothermal waters. These waters are used by thermal spas Santovka and Margita and Ilona. Further potential presence of geothermal water is reported in Želiezovce.

3.8. Cultural and Historic Monuments and Sights

Options 1 and 2
The most interesting cultural and historical monument around the proposed activity is the large neo-Baroque mansion with a belfry and English park in Jaslovské Bohunice. The mansion was constructed in the 18th century. Its last owner, count Platen, used the mansion as a summer residence.
The mansion is surrounded by a large English park covering 4 ha with paved roads and a parking lot. Currently, the mansion and its surroundings offer its visitors accommodation capacities, restaurant services, space for company and social events, as well as relaxation facilities (sauna, pool, and massage).
Outside the mansion site, there is a municipal fishpond with the possibility of fishing, new natural amphitheatre, covered air-conditioned tennis courts, horse riding complex and pellet shooting range.

Option 3
Wider surroundings of the affected area belong to specific cultural – historic region represented by the Levice and Zlaté Moravce areas. The oldest records on settlement in this area date back to Palaeolite. Younger Bronze Age is documented by settlement documents, so-called čačianská culture in the cadastral area of Nový Tekov. This area acquired a strategic importance as it was a gate to the mountainous parts of central Slovakia. This is documented by a dense network of Great Moravian settlements between Veľké Kozmálovce and Hronský Beňadik.
From a younger period, Hronský Beňadik is assessed as an important historic centre with its monastery, Levice castle and the no longer existing Tekov castle.
Conservation Authority of the SR registers the following monuments within the affected area:
- Memorial house of battle fame, 19th century, Kalná nad Hronom
- Classicist statue of the Holy Trinity from the 2nd half of the 19th century, Čifáre
- Statue of citizens killed in WW I and II, Čifáre
- Roman-Catholic Church of Holy Michael, Nemčiňany

4. Current Environmental Quality

4.1. Air Pollution

4.1.1. Non-Radioactive Air Pollution

Options 1 and 2

In 2009, 27 large and medium pollution sources, recorded in the National Emission Inventory System, were identified in cadastral areas of the municipalities likely to be concerned. The following table shows an overview of emissions generated by the respective sources in 2009.

Table No. 16: Overview of pollution sources in the wider surroundings of the area of interest

Cadastral area	Name of operator	Name of source	TZL (t)	SO2 (t)	NO2 (t)	CO (t)	TOC (t)
Ratkovce	Farming cooperative Ratkovce	Livestock production Ratkovce	0	0	0	0	0
Žlkovce	Farming cooperative Žlkovce-Ratkovce	Livestock production Žlkovce	0	0	0	0	0
Nižná	Farming cooperative Nižná	Drying plant LS 025 G 30/2	0.036	0	0.005	0.002	0
Nižná	Farming cooperative Nižná	Livestock production	0	0	0	0	0
Pečeňady	Farming-sales cooperative Pečeňady	Livestock production	0	0	0	0	0
Veľké Kostoľany	HYDROSTAV a. s. in liquidation	Gas boiler room	0	0	0	0	0
Veľké Kostoľany	HYDROSTAV a. s. in liquidation	Paint shop	0	0	0	0	0
Veľké Kostoľany	HYKOZINK spol. s r.o.	Bating and galvanic metal coating	0	0	0	0	0
Veľké Kostoľany	Farming cooperative of joint owners in Veľké Kostoľany	Livestock production	0	0	0	0	0
Veľké Kostoľany	Slovasfalt, spol. s r.o.	OS Teltomat V	0.01	0.003	0.308	0.583	0.276
Veľké Kostoľany	Elementary school Veľké Kostoľany	Gas boiler room	0.004	0	0.075	0.03	0.005
Veľké Kostoľany	PUK plus s. r. o.	Bating – surface coating of metals	0	0	0	0	0
Veľké Kostoľany	ASTRA L1 s.r.o.	Fuel storage	0	0	0	0	0
Veľké Kostoľany	TOWERCOM	Gas boiler room - RVS	0	0	0	0	0
Jaslovské Bohunice	Slovenské elektrárne,a.s.	Diesel generators	0.052	0.001	0.185	0.03	0.004
Jaslovské Bohunice	Slovenské elektrárne,a.s.	Fuel pumping station	0	0	0	0	0.02
Jaslovské Bohunice	Jadrová a vyraďovacia spoločnosť, a.s.	Start up and back up boiler room	0.064	0.008	1.401	0.47	0.06
Jaslovské Bohunice	Jadrová a vyraďovacia spoločnosť, a.s.	Boiler room 740-IX.1	0.011	0.001	0.22	0.089	0.015
Jaslovské Bohunice	Jadrová a vyraďovacia spoločnosť, a.s.	Inciniration plant BSC RAO	0.004	0.005	1.17	0.094	0.018
Jaslovské Bohunice	Jadrová a vyraďovacia spoločnosť, a.s.	Diesel generators NP V - 1	0.038	0.001	0.133	0.021	0.003
Jaslovské Bohunice	Jadrová a vyraďovacia spoločnosť, a.s.	K4 boiler for the production steam used by bitumen line	0.001	0	0.022	0.009	0.001
Jaslovské Bohunice	Farming cooperative Jaslovské Bohunice	Livestock production	0	0	0	0	0
Jaslovské Bohunice	Farming cooperative Jaslovské Bohunice	Post crop line	0.683	0	0	0	0
Jaslovské Bohunice	SLOVNAFT a.s.	Service station Jaslovské Bohunice	0	0	0	0	0.3
Malženice	Farming cooperative Malženice	Livestock production	0	0	0	0	0
Malženice	AGS TRNAVA, s.r.o.	Concrete plant	0.218	0	0	0	0
Radošovce - Paderovce	Farming cooperative of joint owners Radošovce - Paderovce	Livestock production	0	0	0	0	0

(Source: NEIS, 2009)

Another source of air pollution (also generating heat) around the area of interest is the newly constructed combined cycle power plant Malženice.

Option 3

In 2008, 23 large and medium pollution sources, recorded in the National Emission Inventory System, were identified in the cadastral areas of the municipalities likely to be concerned. The following table shows an overview of emissions generated by the respective sources in 2008.

Table No. 17: Overview of pollution sources in the wider surroundings of the area of interest

Cadastral area	Source ID	Name of source	TZL (t)	SO2 (t)	NO2 (t)	CO (t)	TOC (t)
Kalná nad Hronom	823112	Boiler room – Training college Kalná nad Hronom	0.004	0.001	0.086	0.035	0.006
Kalná nad Hronom	823112	Service station Kalná	0	0	0	0	0.718
Kalná nad Hronom	823112	Boiler room	0.016	0.002	0.305	0.123	0.021
Kalná nad Hronom	823112	Service station Jurki Kalna	0	0	0	0	0.828
Kalná nad Hronom	823112	Grain dryer	0.326	0.001	0.125	0.051	0.008
Kalná nad Hronom	823112	Boiler room	0.001	0	0.022	0.009	0.001
Kozárovce	827860	Bakery Pekný deň	0.005	0.001	0.101	0.041	0.007
Kozárovce	827860	Primary school Kozárovce	0.551	0.447	0.318	2.687	0.367
Kozárovce	827860	Livestock production	0	0	0	0	0
Malé Kozmálovce	835587	Livestock production M.Kozmálovce	0	0	0	0	0
Mochovce	838152	Diesel generator station	0.114	0.002	0.403	0.064	0.009
Mochovce	838152	Boiler room GDT	0.009	0.001	0.178	0.072	0.012
Mochovce	838152	Boiler room locksmith workshop	0.001	0	0.027	0.011	0.002
Mochovce	838152	Boiler room Oblicovka	0.005	0.001	0.099	0.04	0.007
Mochovce	838152	Boiler room Tesáreň	0	0	0	0	0
Mochovce	838152	Boiler room SA-3	0.013	0.002	0.255	0.103	0.017
Mochovce	838152	Boiler room Šala	0.004	0.001	0.084	0.034	0.006
Mochovce	838152	Boiler room PSV	0.003	0	0.052	0.021	0.004
Mochovce	838152	Central boiler room	0.009	0.001	0.185	0.075	0.012
Mochovce	838152	Boiler room Guarding complex	0.009	0.001	0.178	0.072	0.012
Mochovce	823112	Support start up boiler room	0.055	0.007	1.211	0.406	0.052
Nemčiňany	839566	Livestock production Nemčiňany	0	0	0	0	0
Nový Tekov	842931	Pig production N.Tekov	0	0	0	0	0

(Source: NEIS, 2008)

Options 1 and 2

Emission situation is not monitored within the affected territory. The closest monitoring stations are in Topoľníky (regional network station for the monitoring of regional air pollution and chemical composition of rainwater), Žiar nad Hronom and Bystričany (automatic air pollution monitoring stations). The following tables present an overview of monitored pollutants and their concentrations for year 2008.

Table No. 18: Monitored pollutants

Station	NO_x	SO_2	NO_2	NOx	PM10	$PM_{2.5}$	CO	Benzene
Žiar nad Hronom					*	*		
Bystričany		*			*	*		

(Source: SHMÚ, 2010)

Table No. 19: Average annual concentrations ($\mu g.m^{-3}$) of pollutants in air (2008)

Station	SO_2-S	NO_2 N	HNO_3 -N	SO_4^{2-} S	NO_3^- N	O_3	Pb	Mn	Cu	Cd	Ni	Cr	Zn	As
	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	ng/m^3	ng/m^3	ng/m^3	ng/m^3	ng/m^3
Topoľníky	2.8	2.81	0.1	1.56	1.1	41	18.25	8.07	4.51	0.21	6.82	4.33	33.33	33.33

(Source: SHMÚ, 2009)

4.1.2. Air Pollution through Radionuclides

Atmospheric vents are controlled by automated monitoring system. The measured values are compared with authorised limits. Limit values of spewed radioactive emissions were approved by regulatory authority, just like the authorised limits.
Activity of spewed radioactive substances (rare gases, aerosols, strontium, iodine ^{131}I, transuraniums, tritium ^{3}H and carbon ^{14}C) departing through ventilation chimneys are monitored through continuous measurement inside the ventilation chimneys (rare gases), laboratory evaluation (aerosols and iodine ^{131}I – using Gama spectrometry, tritium ^{3}H – using liquid scintillation spectrometer, transuraniums – using alpha spectrometry, strontium and carbon ^{14}C - using radiochemical analysis).

Options 1 and 2

In 2009, all JAVYS, a.s. and SE ENEL, a.s. all types of atmospheric outputs were deep below the authorised limits. Closest to the annual limit were gamma aerosols – 0.42%.

Option 3

In 2006, all types of atmospheric outputs from NF Mochovce were deep below the defined authorised limits. Closest to the annual limit were rare gases – 0.075%.

4.2. Water Pollution

4.2.1. Non-Radioactive Water Pollution

GROUNDWATER

In 2001, groundwater quality was monitored in 26 areas important for water management (alluvial river sediments, Mesozoic and neo-volcanic complexes). Overall, 328 structures were monitored - 205 wells of the Slovak Hydro meteorological Institute network, 35 used and 19 unused wells (research wells), 44 used and 25 unused springs with monitoring frequency once per year.

Options 1 and 2

The site of nuclear power plant in Jaslovské Bohunice belongs to the monitored area of the Váh River basin "Váh River fluvial sediments from Varín to Hlohovec" (area 1). In 2004, over 50% analyses did not meet the requirements of Ministry of Health Regulation No. 151/2004 Coll. on Drinking Water Quality Requirements and Drinking Water Quality Control. From among the 26 monitored Slovak areas, the area of fluvial sediments of the Váh from Varín to Hlohovec takes rank 17 according to percentage of measurements not conforming to Regulation No. 151/2004 Coll. (currently replaced by Government Regulation No. 354/2006 Coll.). In area 1 of the Váh River basin, from Piešťany to Hlohovec, limit values (particularly manganese and iron) were exceeded on numerous occasions. The values of nitrates and aluminium and of homopolar substances exceed the limits around Hlohovec and Piešťany, respectively.

Option 3

The closest wells are found in the alluvium of the Hron. In all the wells, concentrations of Fe and Mn, SO42- and Cl-, EL-UV and trace elements were below the limit concentrations pursuant to STN 75 7111 (currently replaced by Government Regulation No. 354/2006 Coll.). Concentrations of nitrogen substances have been exceeded in some wells (>50 mg.l-1 NO3).

SURFACE WATER

In 2001, surface water quality was monitored in 178 general and 3 special sampling spots in Slovakia. The basic method of surface water quality assessment used in Slovakia is the classification of surface water quality pursuant to STN 75 7221 (in force as of January 2000). It classifies surface water quality according to the defined indicators into quality classes using a system of limit values.
By quality, surface waters are classified into 5 quality classes:
Class I – very clean water
Class II – clean water
Class III – polluted water
Class IV – very polluted water
Class V – strongly polluted water

In the affected territory, surface water and watercourses are contaminated especially through run offs of humus, earth, fertilisers and pesticides, including waste water spread over fields and gardens. Organic waste from gardens is sometimes poured into creeks.

Options 1 and 2
Since the affected territory belongs to the Váh River basin, the following table presents water quality classes for Váh and Dudváh river sections by indicator groups.

Table No. 20: Quality classes for surface flows Váh and Dudváh, 2005 - 2006

station	Biologic indicators	Physical-chemical indicators	Oxygen content	Micro-biologic indicators	Micro-pollutants	Nutrients	Radioactivity
Váh - Piešťany	I	II	II	III	III	IV	
Váh - Hlohovec	II	II	II	III	V	I	
Váh – above Sereď	II	II	II	III	III	III	I
Horný Dudváh - Veľké Kostoľany							I
Horný Dudváh - Trakovice							I
Dolný Dudváh - Hoste	V	IV	V	V	V	V	V

(Source: SHMÚ, 2011)

Option 3
Since the affected territory belongs to the Nitra (Telinský potok) and Hron (Malokozmálovský potok) river basins, the following table presents water quality classes for the relevant sections of the Žitava and Hron by indicator groups.

Table No. 20: Quality classes for surface flows Žitava and Hron, 2005 - 2006

station	**Biologic indicators**	**Physical-chemical indicators**	**Oxygen content**	**Micro-biologic indicators**	**Micro-pollutants**	**Nutrients**	**Radioactivity**
Žitava - Húl	II	IV	IV	IV	IV		
Hron - Kalná nad Hronom	III	II	III	III	IV	IV	I

(Source: SHMÚ, 2011)

4.2.2. Water Pollution Through Radio-Nuclides

Options 1 and 2
GROUNDWATER
Around NF Bohunice, the main large-scale source of contamination of geological environment remains the site of NPP A-1. There are also several spot, line and small-scale sources, of which

building 41 is most important. However, radiological situation with respect to groundwater improved following the implementation of decontamination measures (decontamination pumping) removing contaminated groundwater from the geological environment and slowing down the spreading of residual contamination outside the site.

Tritium is the key contaminant of geological environment. Underneath the NPP A-1 site, its activity concentration reaches up to 10^5 $Bq.dm^{-3}$. In the remaining part of the affected territory, groundwater is not radioactively contaminated (< 10 $Bq.dm^{-3}$), except for groundwater near the river of Dudváh (the result historic infiltration of wastewater discharged into Dudváh into groundwater – activity of up to 30 $Bq.dm^{-3}$. Compared to historic measurements, however, activity concentrations are gradually decreasing to natural background levels) and the close surroundings of SOCOMAN, especially around its sluice to Drahovský channel (values measured especially in new monitoring well SK-6: up to 85 $Bq.dm^{-3}$ in the 3^{rd} quarter of 2009).

Activity of artificial radio-nuclides other than tritium was not identified in groundwater outside the NF Bohunice site, except for sporadic presence in infiltration area in close proximity to Drahovský channel and SOCOMAN (or in close proximity to the SOCOMAN sluice into Drahovský channel).

In the first watered layer around the closest municipalities surrounding NF Bohunice, groundwater contamination through tritium (with origin in the NPP A-1 and NPP V-1 complexes) may never exceed the value of 100 Bq.dm-3 (existing assessments defined the value of 200 Bq.dm-3). In the area of key contamination cloud axis (source - NPP A-1), it is 500 Bq.dm-3 (in existing assessments: 1,000 Bq.dm-3). Identified and forecasted tritium activity concentrations in groundwater underneath municipalities and around them are low. From radio-biological perspective, their level may not exceed 1/100 of the population exposure limit pursuant to Section 15 of Government Regulation No. 345/2006, i.e. possible effective dose of critical individual from ingestion may not reach the value of 10 µSv.year-1. To sum up, in and around the Bohunice site, existing radioactive pollution of groundwater may not, even under the most conservative assumptions, cause any health detriment to any individual at a level exceeding 1/100 of the population exposure limit pursuant to Section 15 of Government Resolution No. 345/2006, i.e. the possible effective dose of an individual from the critical group of population from ingestion is below 10 µSv.year-1. All limit indicators included in valid legal regulations and international recommendations are higher than the real values.

The above assessment applies to groundwater in the 1^{st} watered layer. Based on the monitoring of the 2^{nd} watered level (NPP V-1 and NPP V-2), this groundwater may be considered uncontaminated.

SURFACE WATER

The water monitoring system "ČMS Vody" assesses the quality of surface water in the territory of the SR in line with the adopted Water Monitoring Program. Along important watercourses, 179 surface water sample collection points were installed in 2004. Monitoring network concentrates on sections affected by drained contamination, identification of moving contamination, assessment of long-term trends in water quality development. Since 2004, surface water samples are collected and analysed by Slovenský vodohospodársky podnik, š.p. Banská Štiavnica (SVP, š. p.), Štátny geologický ústav Dionýza Štúra in Spišská Nová Ves (ŠGÚDŠ) and Výskumný ústav vodného hospodárstva in Bratislava (VÚVH).

Based on radioactivity assessment in sections Váh-above Sereď and Váh- Komárno, the water of the Váh River is classified as very clean water (quality class 1). The same statement applies to the Upper Dudváh near Veľké Kostoľany and Trakovice.

Option 3

GROUNDWATER AND SURFACE WATERS
In and around the site of the radwaste national depository, there are 52 monitoring wells in total (for groundwater monitoring), from which samples were taken and analysed according to plan in 2009.
In addition to groundwater, drainage water from ND RAW is also monitored. In the 1st half of 2010, activity concentration of individual radionuclides were below the limits set by Decision of the principal hygiene officer No. HH SR SOZPŽ/5179/05.
The drainage system consists of two subsystems, namely controlled and monitored drainage. The role of controlled drainage (CD) is to collect and drain possible seepage water. The role of monitored drainage (MD) is to drain seepage water from the exterior side of clay isolator. Drainage water is drained through rain collectors. The volumes are recorded and analyses are made as part of monitoring of discharged waters.

Results of radiochemical analyses of groundwater, surface water and drainage water:

Measured quantity	Activity value (BQ/l)
3 H	< 2.2
Total beta activity	< 1
137 Cs	< 0,026
60 Co	< 0,025
90 Sr	< 1
239 Pu	< 0,03

Overall, radio-chemical measurement results reach the values of natural background.

4.3. Ground Pollution

4.3.1. Non-Radioactive Ground Pollution

Generally, agricultural land is more contaminated by nitrates and heavy metals than forest land. Of course, this is the result of intense farming (incorrect application of fertilisers and pesticides) and the removal of vegetation cover. This fact also increases the risk of water and wind erosion. Around the area of interest, soils on steeper slopes without the barrier effect of vegetation lines are most exposed. Inside and around municipalities, ground may be contaminated by capillary action of pollutants originating from sewage and septic tanks leakage. Point (small-scale) pollution is caused by depositing of solid waste on illegal landfill sites.

4.3.2. Ground Pollution Through Radionuclides

options 1 and 2
Soil samples are collected once per year from grassed areas (in spring in two layers) and from arable land (in autumn from one layer). The samples are evaluated by gamma-spectrometry. In an average sample ^{90}Sr a ^{239,240}Pu is determined. In 2001, the highest measured value of ^{137}Cs was 32 Bq/kg (within the NPP V-2 site). U ^{90}Sr did not exceed the method detection limit of 8,9 Bq/kg. The highest measured value for ^{239,240}Pu reached 457 mBq/kg.

Option 3

Concentrations of radionuclides found in the ground are comparable with the concentrations of natural background. Activity concentrations of the main radionuclides in the ground, detected during the pre-operation period of EMO12 in years 1995-1999, were 0,2 – 4,0 Bq/kg for ^{137}Cs , 450 –- 600 Bq/kg for ^{40}K, 20 – 35 Bq/kg for ^{238}U and 20 – 40 Bq/kg for ^{232}Th.

4.4. Waste

In 2008, the lower Váh area, including the affected territory, generated a total of 493,691.98 t of waste (of that other waste – 380,039.98 t, hazardous waste – 16,192.71 t and municipal waste – 97,459.29 t). In 2008, the following companies had the largest shares in the production of hazardous and other waste:

- Slovenské cukrovary, a.s., Sereď producing 125,070 t of waste;
- ZAD Dvory nad Žitavou producing 51,812 t of waste,
- Heineken Slovensko, a.s., Hurbanovo producing 42,172 t of waste,
- Poľnohospodár, a.s., Nové Zámky producing 28,754 t of waste,
- Novogal, a.s., Dvory nad Žitavou producing 19,233 t of waste.

In 2008, waste management activities included mostly other forms of waste disposal and depositing on landfills. With “other forms of disposal” 36% of the annual production of other waste and 50% of the annual production of hazardous waste was disposed of. Depositing on landfill sites was the method chosen for 35% of the annual production of other waste and 32% of the annual production of hazardous waste. 28% of other waste annual production and 11% of hazardous waste annual production was recovered (SR Ministry of Environment, 2009).

4.5. Noise and Vibrations

options 1 and 2

Except for the power plant, there are no other significant noise and vibration sources in the affected area. Noise generated by the operation of the Jaslovské Bohunice NPP is negligible in the wider surroundings. In addition to that, the closest house is around 3 km away, where the level of noise generated by the power plant is practically zero.

Option 3

Except for the power plant, there are no other significant noise and vibration sources in the affected area. Noise generated by the operation of the Mochovce nuclear power plant is negligible in the wider surroundings. In addition to that, the closest house is around 3 km away, where the level of noise generated by the power plant is practically zero.

4.6. Radiation Sources and Other Physical Fields

The technology of the nuclear power plant is based on the use of primary Ra radiation sources, i.e. fuel elements made of enriched uranium. Reactor operation generates ionising radiation (gamma radiation and neutron flux). The secondary source of radiation is the reactor cooling medium in the primary circuit and the activated parts of AZ reactor. Tertiary sources include spent fuel elements deposited in spent fuel pond and later in the interim storage for radioactive waste and all types of RAW collected and temporarily stored in NPP. Equipment for handling these Ra sources are designed and constructed to meet strict hygiene standards and exposure limits applicable to NPP staff. If these limits are observed, no health damage can occur among the staff. Similarly, hygiene standards and defined limits were defined to protect the health of the population living close to the NPP and the environment. Compliance with these standards and limits is monitored continuously. For various emergency situations, NPP developed emergency plans and made adequate material and organisational arrangements.

4.7. Heat and Odour Sources

Heat is generated during the controlled atomic fissure of nuclear fuel (uranium, enriched by 235U) in NPP reactors.

It is carried away by the cooling medium of primary circuit. This heat is used to produce hot steam powering the turbines of the turbo generator, which eventually generates electricity. Only 32% of heat energy generated by the reactor is used for electricity production. The remaining heat energy, not used by other heat consuming equipment and structures of the NPP is discharged as waste heat into the air through the cooling towers (or to a recipient watercourse, in the form of warm waste water). For this reason, NPP may be considered a large heat “pollution” source.

The technological process of NPP does not produce any specific odours, which would compromise the quality of the environment.

4.8. Existing Health Condition of Population

The existing health condition of the population in the affected area is the result of the interplay of various factors, including social, economic, environmental factors and the work environment. Each disease may be attributable to several risk factors (specific and common).

In general, the environment is the determining factor of health. The best known environmental factors comprise demographic and biologic factors (age, gender, nationality and others), socio-economic factors (lifestyle, education, job, social contacts, etc.), living and working environment and level of health care. As part of the general statistical surveys of diseases in Slovakia, population health condition is monitored at district level.

Options 1 and 2

During the construction of the Mochovce nuclear power plant and prior to its commissioning, a background database of environmental, demographic and health characteristics was compiled for the surrounding population. In case of NF Jaslovské Bohunice, the monitoring of environmental, demographic and health characteristics in the surrounding areas started after the plant had been commissioned. Therefore, no data is available allowing qualified comparison of the population health prior to construction and today.

Long-term monitoring of the individual elements of the environment around the Bohunice site shows that the exposure to radiation (both natural and antropogenous), is lower that natural radioactivity in other Slovak locations. Within the site, exposure to non-radioactive contaminants is equally lower than or comparable with other locations.

Health condition of the population in the wider assessed territory (a radius of 30 km from the NF) has been monitored in detail and systematically since 1993. It is evaluated on an annual basis based on the monitoring of all general demographic-epidemiological indicators. Results of this monitoring are presented in summary annual reports on the monitoring of population health and environment around the nuclear site in Jaslovské Bohunice (VÚJE a.s., Environment, a.s.).

The evaluation of population health is based on data (data examples are listed in brackets) divided into the following groups:

- Demographic data (population % in productive age, average age)
- Reproduction health (number of newborns per 1,000 fertile women)
- Death rate (gross death rate, indirectly standardised death rate of men and women)

- Incidence of tumours (% of death cases caused by tumours, % of death cases caused by leukaemia)
- Tuberculoses (incidence of proven cases)
- Chronic lung diseases (incidence of chronic lung diseases)

The data is compared against the nationwide average. Leukaemia, as the most discussed health indicator around nuclear facilities, is subject to separate analyses, which analyse all types of the disease, which could be attributed to radioactivity. NF staff living in the affected territory is included amongst the population living in the surroundings of the power plant.
Based on the said analyses, it is possible to conclude that leukaemia death cases occurrence has been stable on national and local levels, without any trends or extremes. The division of deaths by leukaemia type has been accidental within the entire territory of the Slovak Republic. Results suggest no increased level of leukaemia caused death rate amongst population, or staff compared to other regions of Slovakia.
General conclusions from statistical surveys:

- Increased share of older population;
- Lower share of children and lower relative number of newborns;
- Increased share of spontaneous miscarriages;
- Increased death rate, as a result of increased older population number;
- Significantly lower premature death rate, characterised by all indicators;
- Increased death rate caused by cardio—vascular diseases and tumours.

The area extending up to 10 km from Jaslovské Bohunice site has the character of a larger town, if looking at its demographic and health indicators. This may be explained by the existence of developed industry affecting the distribution of population (age, education and financial standing). The radius of 30 km appears as quite healthy countryside (with older population). Monitoring results from the surroundings of JAVYS, a.s. site document that, from the aspect of radiation protection, the operation of JAVYS, a.s. was stable and reliable and had only a negligible radiological impact on its surroundings in 2009. All existing studies proved that it is not possible to draw a statistical or other line between the presence of nuclear facilities in Jaslovské Bohunice and development of population health in the affected territory. Increases of annual radiation dose are four times lower in order than the background values of natural and artificial sources. Therefore, they may be considered negligible.

Option 3

The existing health condition of the population in the affected area is the result of the interplay of various factors, including social, economic, environmental factors and the work environment. Each disease may be attributable to several risk factors (specific and common).
In general, the environment is the determining factor of health. The best known environmental factors comprise demographic and biologic factors (age, gender, nationality and others), socio-economic factors (lifestyle, education, job, social contacts, etc.), living and working environment and level of health care.

The affected area belongs to Levice and Nitra districts. Levice district is characterised by the highest morbidity and death rate in Slovakia. Circulatory system diseases exceed the nationwide average. Tumours are another frequent group of diseases.

Table No. 22: The most common death causes in Levice and Nitra districts in 2008

Death cause		Levice district	Nitra district
Tumour	No. of diseases	315	411
	per 100,000 inhabitants	266.6	250.3
Circulatory system diseases	No. of diseases	759	796
	per 100,000 inhabitants	642.3	484.7
Respiratory system diseases	No. of diseases	67	114
	per 100,000 inhabitants	56.7	69.4
Gastrointestinal system diseases	No. of diseases	104	116
	per 100,000 inhabitants	88	70.6
External causes of morbidity and death rate	No. of diseases	90	91
	per 100,000 inhabitants	76.2	55.4

Source: Health Information and Statistics Institute (ÚZIŠ)

The previous table suggests that the inhabitants of the affected area mostly die of circulatory system diseases, followed by tumours, gastrointestinal diseases and respiratory diseases. As to the first two death causes, we can conclude, that they have been developing negatively in the long term. A specific group of death causes is that including injuries and poisoning, as well as wilful self—inflicted trauma.

IV. General Data on the Expected Environmental Impacts of the Proposed Activity, INCLUDING HEALTH Impacts, and on Possible Mitigation Measures

Should the data for the individual options vary, the text of the relevant chapter is structured into paragraphs applicable to the relevant options. Should a chapter have no such structuring, the text is identical for all options.

1. Requirements on Inputs

1.1. Ground Requirements

Option 1

The project implementation will be limited to the NF site in Jaslovské Bohunice and no other ground occupation is assumed.

Option 2

As a result of the construction of new structures and paved surfaces, implementation of the proposed activity will permanently occupy 5,400 m2. Further permanent occupation will be required for the construction of paved surfaces and new infrastructure (around 2,842 m2).

Design documentation will include details of permanently occupied surfaces. In addition to buildings, the site will also include greenery covering around 6,760 m2).

Option 3

As a result of the construction of new structures and paved surfaces, implementation of the proposed activity will permanently occupy 6,550 m2. Further permanent occupation will be required for the construction of paved surfaces and new infrastructure (around 3,990 m2).

Design documentation will include detailed and itemised parameters of permanently occupied surfaces. Design documentation will include details of permanently occupied surfaces. In addition to buildings, the site will also include greenery covering around 2,170 m2).

1.2. Water Consumption

The integral repository operation has negligible water supply requirements. Drinking water will be used for staff hygiene purposes only. If necessary, technological water will be used for the preparation of washing and decontamination solutions.

The existing drinking water supply system connected to the existing group water duct will be used as drinking water source. The integral repository will be connected to in-site fire-drinking water duct. Drinking water supply is only required for staff social needs.

Average daily water need:	Qp = 1800 l/day=0.0208 l/s
Maximum daily water need:	Qd = 0.0292 l/s
Maximum hourly water need:	Qd = 0.0525 l/s

1.3. Material Resources

The integral repository operation has no requirements on raw materials, except for chemicals necessary for the preparation of decontamination solutions.

1.4. Energy Sources

Heat Energy

130/70°C hot water is planned to be used as the heat-transport medium for the heating system. An independent heat exchanger will be installed in the clean ventilation machine room to secure heating. Only parts of the building will be heated (changing rooms, social facilities, control rooms, training and information centre, workshops and solutions storage rooms).

Planned annual heat consumption	97,140 MWh/year

Electric Power

Electric power will be supplied via two independent 6 kV supply cables.

Total installed input power	Pi = 397,2 kVA
Maximum input power	Ps = 278,0 kVA
Annual power consumption	332.5 MWh

1.5. Requirements on Transport and Other Infrastructure

Option 1

The necessary infrastructure has been constructed as part of the construction of JAVYS site in Jaslovské Bohunice. The scope and the type of operations to be carried out in the integral repository do not necessitate the construction of other infrastructure. For the transport of excess excavation soil to recycling or landfill sites and for the transport of construction materials during the construction phase, public roads will be used. Their parameters are satisfactory and, as a result, no changes are needed due to the construction of IR RAW. Considering the scope of the project, no extreme traffic load on public roads is expected. Partial limitation may occur during the transport of large reinforced concrete bearing columns of the storage halls.

For internal haulage of RAW to be stored in the repository, internal roads or the side track of JAVYS will be used (in the latter case using special RILS carriages of type 9-212.01). IS RAW will be accessible through a newly constructed branch of factory track 7c from the existing branch 7a. Transport will take place in line with the provisions of NRA Regulation No. 57/2006 Coll., or Ministry of Health Regulation No. 545/2007 Coll.

Option 2

The necessary infrastructure has been constructed as part of the construction of JAVYS site in Jaslovské Bohunice. All infrastructure networks necessary for the operation of IR RAW will be connected to those available in JAVYS site (electric power, water, heating, waste water and storm water sewage, etc.)

Access roads to the newly constructed IR RAW will be connected to JAVYS, a.s. roads. Similarly, it will be necessary to complete the side track and connect it to the existing tracks.

This Option requires the extension of AKOBOJE (physical protection system) in line with BIDSF project A3-A “Reconstruction of AKOBOJE physical protection system” and the construction of cargo gate-house (for road and railway transport) on exit through the existing AKOBOJE of JAVYS site. The remaining specifications are the same as for option 1.

Option 3

For this option, it will be necessary to build a separate access road to the new site and build all infrastructure networks needed for the operation of IR RAW (electric power, water, waste water sewage, etc.). In terms of site protection, it will be necessary to construct new protective fencing for nuclear facility.

Railway connection, i.e. construction of a new railway track, seems to be technologically and financially very demanding and, based on discussions with the investor, not feasible.

Transports of RAW for storage will only be carried out by roads (assuming no railway connection is constructed), which represents a significant burden on public roads, especially in case of transport of oversized loads and increased transport frequency.

1.6. Labour Force Requirements

The integral repository operation is planned to be operate in irregular shifts (about 2 shifts per week). For reloading operations and handling of RAW, 8 employees (existing employees of JAVYS) are planned for one shift.

2. Output Data

2.1. Air Pollution Sources

2.1.1. Spot Sources

RAW integral repository will only store solid waste, compacted in fibre cement containers, barrels and large metal pieces, which, prior to disassembly, went through the decontamination process. This waste is not a source of radioactive gases or aerosols.

2.1.2. Area Sources

Area sources of air pollution may exist only temporarily, during the construction phase, (when earth is uncovered and moved or during other construction works producing dust in dry weather). The spatial impact will be merely of a local character.

2.1.3. Line and Mobile Sources

During the construction phase, mobile air pollution sources will include construction mechanisms and supply trucks transporting materials or waste. The existence of these sources is limited in time. In the operation phase, mobile sources will include RAW transport vehicles. Closer specification of transport mechanisms and routes will be provided in the next phase of the planning process (Assessment Report) for all options.

2.2. Waste Water

A collection tank will be used for the collection of waste water generated in normal and emergency IR RAW operation (collection of contaminated water - liquid RAW).

Under normal operation, no production of active water or decontamination solutions is expected in the IR. The collection tank collects water from three sources – decontamination of persons, decontamination of equipment and decontamination of premises. Under normal IR RAW operation, around 6.0 m3/ year of water to be collected in the contaminated water collection tank could be produced. From the collection tank, based on activity concentration, water will be pumped into waste water sewage or special sewage using immersion pump.

Non-standard situations will result in the increase in production of all waste types. In non-standard situations, prior to decontamination work, water from the collection tank will be pumped into waste water sewage (provided this is possible, due to the activity of the water). This will free up the tank for the decontaminated water (with higher contamination). Then, only radioactive water from decontamination work will have to be pumped over into a transport vehicle for transport to the processing site (BSC RAO).

2.3. Waste

Construction Waste Produced in the Construction Phase

Construction waste will originate from the demolition of structures necessary to free up space (option 1). To a smaller extent, construction waste will also be produced by the construction of new channels (all options).

Table No. 23: Construction Waste

Waste type No.	Waste Group	Waste Category	Waste type
17 01 07	Concrete, bricks, tiles and ceramics	O	Mixtures of these materials without the contents of any hazardous substances
17 02 01-03	Wooden and plastic windows, PVC, etc.	O	Wood, glass, plastics
17 03 02	Asphalt cardboard and coverings, etc.	O	Bitumen mixtures other than those mentioned in 170301
17 04 05	Metal products	O	Iron and steel
17 04 07	Sheeting (e.g. zinc coated sheets)	O	Mixed metals
07 04 11	Cables CU, Al	O	Cables other than those mentioned under 170410
17 05 06	Excavated soil and dredging spoil	O	Excavated soil and dredging spoil not containing dangerous substances
17 06 04	Heat insulation, mineral wool	O	Insulation materials other than those mentioned under 17 06 01 and 17 06 03
17 09 04	Other construction and demolition wastes	O	Mixed wastes other than those listed under 17 09 01, 17 09 02, 17 09 03
20 03 01	Other municipal wastes	O	Mixed municipal wastes

O – other waste H – hazardous waste

Waste from Operation

This waste will be generated in the course of operation. It will include a small volume of hydraulic oils from lifting equipment, possibly small volume of liquid radioactive waste from decontamination, spent ventilation filters and negligible volume of municipal waste.

Table No. 24: Waste from Operation

Waste type No.	Waste Group	Waste Category	Waste type
13 01 13	Waste hydraulic oils	H	Hydraulic oils
08 01 11	Wastes from MFSU and removal of paints and varnish	H	Waste paints or varnish containing organic solvents or other dangerous substances
15 01 10	packaging	H	Packaging containing residues of or contaminated by dangerous substances
20 03 01	Other municipal waste	O	Mixed municipal waste

O – other waste H – hazardous waste

2.4. Noise and Vibrations

The only local noise source, and this only in the construction phase, will be construction mechanisms. During operation, no noise and vibration emissions are assumed.

2.5. Radiation and Other Physical Fields

Storage space will be the source of ionising radiation. It is assumed that the overall activity of waste found in solid form in IR RAW will be 1.10^{18} Bq. This activity will be merely relocated from other nuclear facilities within the site. It does not increase the total activity on the site (applies to options 1 and 2. In case of option 3, activity on the site will increase).

The prevailing radionuclide causing activity is ^{137}Cs. Its radiation will be shielded by the building sheeting. Further, an additional concrete shielding wall will be constructed around the structure perimeter. The parameters of shielding walls will be designed to reach the required dose rate values on the exterior shielding wall. Therefore, IR RAW impact on the population and personnel in the immediate vicinity of IR RAW will be negligible (as far as external exposure to radiation is concerned). In immediate proximity of the integral repository, the dose rate will be at the level of natural background deviation. Therefore, it may be concluded that direct exposure of the population (not from the discharges) from full integral repository will equal to zero.

2.6. Odour and Other Outputs

The proposed activity (IR RAW) will not produce any smells or heat during the construction and operation phase.

3. Assumed Direct and Indirect Environmental Impacts

3.1. Population

Options 1 and 2

All existing studies proved that it is not possible to draw a statistical line between the existence of nuclear facilities in the Jaslovské Bohunice site and the development of population health in the affected territory.

In terms of radiological protection, SR Principal Hygiene Officer issued a decision establishing a hygiene protection zone with no permanent settlement around the JAVYS site in Jaslovské Bohunice. This zone is of irregular shape between the fencing of the site and the closest municipalities and ranges from 2.5 to 3 km from the centre of the site. The inhabited parts of the closest municipalities are included in the affected area. As to the use of this zone for farming production, no specific conditions have been set, except for monitoring of radiological situation. In addition to the hygiene protection zone, a radiation control zone with 3 and 5 km radius and a monitored zone with a radius of 25 km have been established around the NF. Radiation situation is monitored in all three mentioned zones.

When assessing the pollution of the environment, the Jaslovské Bohunice site can be characterised as a site with nuclear-energy facilities, whose operation may cause environmental pollution, especially as a result of discharges or leakage of radioactive substances leakage and releases of residual heat.
Radioactive substances are released from the individual nuclear facilities into the atmosphere or into the hydrosphere. Radionuclide activity in gaseous discharges and liquid waste is limited by the so-called authorised limits. Compliance with the said limits is a precondition for obtaining the operation licence. Compliance with annual activity limits is monitored and measurement results are reported to the relevant authorities of state hygiene supervision.
All past experiences and knowledge show that the impact of gaseous radioactive discharges is so small, that it reaches the level of monitored background values, which are not measurable in any of the elements of the environment. The existing radiological situation around the JAVYS site causing exposure of the population within the reach of gaseous discharges is virtually identical to that of the so-called radioactive background created by the existence of cosmic radiation and natural radionuclides in the environment. The real impact of the nuclear facility in regional scale is that of an element increasing the radiation background. In wider surroundings of the JAVYS site, the radiological situation is not specific in any way, when compared with the situation in any location with similar geo-chemical composition of the sub-base. The integral dose rate of gamma radiation created by radionuclides in the sub-base and cosmic radiation, reaches 95 mGy.hour-1.

For the sites of JAVYS and SE ENEL, a.s., supervisory hygiene authorities defined, pursuant to Annex 3 of Government Regulation No. 345/2006 Coll., the exposure limit for individuals from the critical group of population at 250 µSv/year.
Experience from the operation of NF J. Bohunice up to date shows (except for some extremes) that the real values of radionuclide activity in gas discharges are lower than 1 % of the authorised limits; discharges into the hydrosphere reach up to 10% of the authorised limits. This means that in the present case, as a result of low flow rates in water recipients, hydrosphere is the critical route for increased exposure to radiation during normal operation. The most represented nuclide is tritium ^{3}H.
The above text suggests that population exposure, expressed as effective dose equivalent for individuals from the critical group of population will be below 0.25m mSv.year-1, which is the exposure limit for individuals around a NF site.
A facility, to which existing RAW will be relocated for safer storage, will have no negative impact on population health.

Option 3
Limit values of gaseous and liquid discharges of the NF Mochovce as a whole were defined in such a way, that the effective dose resulting from gaseous and liquid discharges does not exceed 0.25 mSv.year-1 for individuals from critical population group. The real activity values of radionuclides released into the environment are far below the limits, which means that the calculated effective doses received by individuals from the critical group of the population are negligible compared to background effective doses. The above text suggests that population exposure, expressed as effective dose equivalent for individuals from the critical group of the population will be below 0.25m mSv.year-1, which is the exposure limit for individuals around a NF site.
A facility, to which existing RAW will be relocated for safer storage, will have no negative impact on population health.

3.2. Impacts onto Natural Environment

Based on the character of the activity, as described in the preliminary environmental study, we do not expect any negative impacts of the proposed activity (IR RAW) on:

- rock sub-base, mineral deposits, geodynamic and geomorphologic conditions,
- climate and ambient air (integral repository will not have any discharges in normal operation, which means it will not impact the volume or concentration of radioactive emissions in the affected territory),
- Water conditions (integral repository will only store solid RAW, water from personal decontamination room emergency shower will be collected in a collection tank)
- Soil,
- Fauna, flora and their biotopes.

3.3. Impacts on Landscape

Based on the character of the activity, as described in the preliminary environmental study, we do not expect any negative impacts of the proposed activity (IR RAW) on:

- Landscape structure and use,
- Landscape scenery
- Conservation areas,
- Territorial System of Ecologic Stability.

3.4. Impacts on Urban Sites and Land Use

We do not expect any negative impacts of the proposed activity (IR RAW) on:

- Industrial and farming production,
- Cultural and historic monuments,
- Archaeological sites,
- Paleontological sites and important geological sites,
- Cultural values of intangible nature.

The proposed activity will have some impacts on traffic during the construction phase in the form of a slight increase in traffic in the affected territory, which will be adequate to the size of the project. Option 3 is specific in this respect. During operation of the repository, traffic on roads used for the transport of RAW from Jaslovské Bohunice to Mochovce will be affected significantly. In addition to increased traffic and emissions, the risk to population and environment will increase significantly.

Option 1

Since the proposed activity (IR RAW) impacts the use of land only within the JAVYS site, there will be no change with respect to land use.

options 2 and 3

The proposed activity (IR RAW) is planned on land with an area of about 15,000 m2. In this extent, the original land use will change (currently farmland).

4. Health Risks Assessment

Population

Potential health risks for the affected population are in the first place related to possible exposure, secondarily to transport and emissions of noise and pollutants from transport.

The proposed activity, taking into account the solution chosen and the nature of the activity itself, does not pose any further risk to the affected population, not even in terms of air or water pollution, or noise and vibrations generation.

As far as population exposure is concerned, it should be regulated by applying the process of protection optimisation and effective dose limits should be applied in exceptional cases only.

The recommended population irradiation limit according to Government Regulation No. 345/2006 Coll., is the effective dose limit of 1 mSv per year. Under exceptional circumstances, the value of 5 mSv per year is acceptable, provided, however, the average effective dose does not exceed the value of 1 mSv per year in 5 successive years.

As the NRA SR decided, in its decision No. 97/2006 that the endangered area is limited to the borders of the V-1 NPP site, for emergency planning purposes, it is not necessary to assess radiological impacts against intervention levels for the implementation of population protection measures pursuant to Annex No. 10 of Government Regulation No. 345/2006 Coll.

Personnel

Pursuant to Government Regulation No. 345/2006 Coll., the effective dose limit for a worker working with ionising radiation sources is defined as follows: Effective dose 100 mSv in five successive calendar years, where the effective dose may not exceed 50 mSv in any single year.

For the purpose of radiation protection optimisation, the indicative exposure value for proving the reasonably achievable level of radiological protection during activities leading to irradiation is the effective dose of an employee working with sources of ionising radiation of 1 mSv per calendar year.

The purpose of the structural part of the storage halls of the integral repository is to provide the shielding of radiation sources and to create conditions which will enable to minimize and optimize doses received by operating personnel during work activities inside the hall and to minimize the impact of operation on the radiological situation in the surroundings.

Model Calculation of Effective dose for Personnel

For the purpose of effective dose model calculation, FCC (627 pcs), steel MEVA barrels (1,800 pcs) and ISO containers (total volume of 2,150 x 1,500 x 731 cm) were used as model packing units.

For the calculation of dose received by personnel handling package units containing RAW, the activity of these external radiation sources is created in particular by radionuclide ^{137}Cs. Other radionuclides possibly found in RAW, e.g. ^{14}C, ^{41}Ca, ^{59}Ni, ^{63}Ni, ^{79}Se, ^{90}Sr, ^{93}Mo, ^{93}Zr, ^{94}Nb, ^{99}Tc, ^{107}Pd, ^{126}Sn, ^{129}I, ^{151}Sm, ^{238}Pu, ^{239}Pu, and ^{241}Am have a negligible share in overall activity. Therefore, their contribution to the overall dose, considering the shielding by package material, may be evaluated as negligible.

The results of effective dose model calculation inside and around the IR suggest the following conclusions:

- In case of fully stocked halls, (all packaging units with surface effective dose rate 10 mSv) and under the assumption of 800 hours spent by an employee in the IR (the project assumes IR operation in two shifts per week), in the place of the highest effective dose in the annex of the repository, the employee would receive an annual effective dose from external sources of 0.6 mSv.
- In case of fully stocked halls and under the assumption of 2,000 hours spent at a distance of 2 m from the structure surface, an employee would receive an annual effective dose from external sources of 0.05 mSv.

Real calculations and definition of stay scenarios will be needed to support the detailed planning process, in order to meet the conditions of personnel protection from ionising radiation in the IR

RAW premises and exclude unjustified and unlimited exposure of personnel in line with the valid legislation.

5. Information on Assumed Impacts of the Proposed Activity on Protected Areas

The proposed activity will have no impact on protected areas or their protection zones.

6. Assessment of Assumed Impacts in Terms of their Significance and Timing

Currently, solidified or solid RAW is stored in existing premises. Each option of decommissioning of NPP A-1 assumes that these premises will be freed to allow decommissioning work. RAW have to wait until a next management operation is possible, be it packaging and depositing in national depository or in deep depository or releasing into the environment after their radioactivity declines below the relevant limit defined by law.

The integral repository also has a positive impact, since it addresses the already urgent need for safe storage of solid or solidified RAW in a manner, which is significantly safer than the currently used method (thus, the risk of possible environmental impact is significantly reduced). The same applies to existing radioactive waste containing higher volumes (activities) of radionuclides, which disqualifies it for deposition in ND RAW. They need to wait for safe deposition in deep depository.

Under normal operation (incoming waste, inspection, manipulation-placement in storage halls, inspection during storage, manipulation-release from repository for further management operations), there will be virtually no gaseous or liquid discharges; i.e. the facility will have virtually no negative impacts on the surrounding environment.

7. Expected Transboundary Impacts

Considering the location and the character of the proposed activity, no negative transboundary impacts are expected.

8. Induced Interrelations Possibly Resulting in Impacts, Considering the Current State of the Environment in the Affected Territory

In the affected area, no induced interrelations were identified.

9. Further Possible Risks of Proposed Activity Implementation

Since the integral repository will be used for the storage of solid or solidified RAW, the risk of emergencies is very low. As a result of the below-listed initiation events, the following could occur:

- releases into the atmosphere through structural leaks
- releases into sub base

The assumption that these consequences will not be material is based on the following facts:

- The integral repository is not a facility, where fission reaction takes place.
- Only solid and solidified RAW will be stored in the repository. It will not contain any gaseous and short lived radionuclides, which contribute with the highest share to activity releases (and their consequences) from power plants in operation, and which, as a result, materially influence the decision-making process on interventions to be taken.

In case of an unforeseen event, it is possible to intervene at the source and minimise leakage of radioactive aerosols (which is not possible in an operated power plant).

Initiation events of accidents may be:

External - Fire
- Explosion
- Earthquake
- Plane crash
- Flood

Internal - Operator error
- Equipment failure

The territory proposed for the IR (options 1 and 2) is found in seismic area with intensity 6-7˚of the MSK-64 scale (for option 23, it is 6-6,5˚ of the MSK scale). The building object is classified as category SC1 object. Seismic resistance is calculated for the building structure, not for the equipment.
So far, no floods occurred in the affected area. Even under heavy rain, there is no risk that the stored material could be flooded, as the floor level of the storage halls is not below the terrain level.
Repository destruction through a plane crash is a very unlikely external event.

Qualitative estimates of the consequences of an accident are, for risk assessment purposes, defined as the product of the consequences of the event and the probability that the event will occur. The fall of packaging waste unit resulting in the loss of its integrity or destruction, either caused by personnel or equipment failure, is relatively the most probable event of all. In the original safety case, safety analyses also cover falling FCC and assume that two containers will loose integrity: the falling container and the one, on which the falling container lands. Conservative expert estimate determined that in such an event, 10^{10} Bq of aerosol radioactivity (0.1% of container activity) may be released into the air. If thinking very conservatively, it all could leak into the environment. This value is by one order higher than the annual limit of aerosols discharges valid for NPP A-1 and intermediary spent fuel storage facility and significantly lower than the aerosol limit for operated NPP. Thus, it may be surely assumed that in the analysed event, it will not be necessary to take any corrective measures contemplated by the legal regulations: Iodine prophylaxis (it has no justification in our case), hiding or evacuation.

Naturally, the effects of a strong explosion or a plane crash at the RAW storage site could be much stronger; however, the probability of such an initiation event is significantly lower.

Another relatively important emergency, with respect to possible environmental impacts, is the risk of accident during the transport of RAW. This risk applies almost exclusively to option 3, since the waste to be stored in the integral repository mostly originates in NPP Jaslovské Bohunice. In case of option 1, potential consequences would be limited to the NPP site, or the immediate surroundings (option 2). However, in case of option 3, any location along the transport route may be affected.

10. Measures for the Mitigation of Negative Environmental Impacts of the Individual Options for the Proposed Activity

Measures related to zoning

The location of the project on a site (or in direct proximity) of existing nuclear facilities in all options may be considered to be a measure related to zoning.

Technical Measures

Technical measures include the effort to store processed RAW in fibre-cement containers, which are able to maintain their high integrity under more unfavourable conditions than those prevailing in the

integral repository.
Technical measures also include the proposal for mitigation of consequences of operational events through filtration of air exhausted from the integral repository premises. In the design phase and during management of operation, further technical-organisational measures will be required for staff radiation protection.
Compensatory Measures
In terms of impacts on individuals, the given activity is considered optimised under the ALARA principles. Compensatory measures are not planned.

11. Assessment of Expected Development of the Territory Should the Proposed Activity Not Be Implemented

Storage of solid and solidified RAW prior to further management operations in an independent integral repository or using the existing premises of NPP A-1 premises will have no impact on the development of the territory. Territory development would not be directly affected even if the activity is not implemented In the latter case, however, the risks related to RAW management in the site increase. Possibly, this could negatively impact the process of decommissioning of nuclear power plants in the Bohunice site.

12. Assessment of Conformity of Proposed Activity with Valid Local Planning Documentation and Other Relevant Strategic Documents

Option 1
The zoning plan of Jaslovské Bohunice, whose binding part was published in generally binding regulation No. 49 of 20, March 2008, defines the affected territory as nuclear power plant site. Opinion of Regional Office (Environmental Department, Building Regulations Unit) in Trnava No. KÚ-OŽP-SP-2001/09504 of 19/09/2001 concludes that the proposed project is in line with the planned project "NPP A-1 Decommissioning, Phase I", which was assessed pursuant to Act No. 127/1994 and in line with the project of V-1 decommissioning (financed from BIDSF fund).

Option 2
In the zoning plan of Veľké Kostoľany, whose change 1/2008 was approved by the municipal council on 30 September 2008, the proposed site is not categorised and its use is not specified. Currently, it is used as arable land.

Option 3
According to the zoning plan of Nitra self-governing region amended by amendment No. 2, with the binding part announced in generally binding regulation No. 1/2008, the relevant site is not categorised and has no specified use.

13. Further Assessment Process Listing the Most Significant Problem Issues

In this preliminary study, the expected impacts and relations of the individual options were only shortly described with the aim to decide on their suitability for implementation. We assume the next step in the assessment process will be the preparation of the Assessment Report based on previous scoping. The assessment report will detail selected options and elaborate on problem issues based on the comments received from the affected authorities.

V. Comparison of Proposed Options and Proposal of Optimum Option (Including Comparison With Zero Option)

1. Definition and Weighing of Criteria for the Selection of Optimum Option

Assessment criteria were defined with the aim to assess objectively the suitability of the individual options for implementation. The key criteria for the selection of optimum option include in particular safety and the scope of their negative or positive impacts on population. During the preparation of this preliminary study, impact on transport proved to be an important criterion. Further important criteria include impact on environment and technological level of waste management.

2. Selection of Optimum Option or Ranking of Assessed Options

The preliminary environmental study for the proposed activity has been submitted in three options and the zero option. For assessment, the method of allocating quantifiers to individual impacts (from -3 to +3) was used.

Impacts evaluation scale:
+3 Significant positive impact, long-term, mostly with regional and supraregional significance
+2 Mid-important positive impact, mostly with local to regional significance
+1 Little important positive impact, mostly with local significance
0 No impact
- -1 Little important negative impact, mostly with local significance
- -2 Mid-important negative impact, mostly with local to regional significance
- -3 Significant negative impact, long-term, mostly with regional and supraregional significance

Table No. 25: Comparison of suitability of individual options

	Option 0	Option 1	Option 2	Option 3
Ground environment	0	0	0	0
Soil	0	0	- 1	- 1
Surface water	0	0	0	0
Groundwater	0	+ 1	+ 1	+ 1
Air	0	- 1	- 1	- 2
Flora	0	0	0	0
Fauna	0	0	0	0
Biotopes	0	0	0	- 1
Landscape	0	0	0	0
Urban sites	0	0	0	0
Population	0	+ 1	+ 1	-1
Waste and technology	0	+ 3	+ 3	+ 3
Transport	0	0	0	- 3
Total	**0**	**+ 3**	**+ 2**	**-3**

Ranking of respective options by suitability.

1. Option 1
2. Option 2
3. Option 0
4. Option 3

Overall, according to the preliminary assessment, options 1 and 2 are suitable for implementation and option 3 is not suitable (it seems even less suitable than the zero option).

3. Justification of Optimum Option Proposal

Zero option is defined as a situation, in which the proposed activity is not implemented. As a result of the interrelations between RAW management and nuclear power plants decommissioning, this option is not viable. The reason is the impact on NPP A-1 and NPP V-1 decommissioning. Decommissioning of NPP A-1 and V-1 would be suspended until the time, in which decommissioning waste, currently disqualified for storage in ND RAW, would become suitable for storage (in deep depository). Current practice shows that the impossibility to store also other types of radioactive waste for limited period of time could compromise nuclear safety of RAW management system. The proposed activity is an inevitable consequence of the already approved activities related to the decommissioning of NPP A-1, NPP V-1, which are already being carried out and of the current RAW management system. For the stated reasons, zero option was not further analysed.

Options 1 and 2 appear to be optimal, with option 1 being slightly better due to limited (zero) farmland occupation. In other aspects, its environmental impacts are practically identical with option 2.

The unsuitability of option 3 is attributable in particular to its location outside the Jaslovské Bohunice site, which results in significant impacts on transport, air and population.

4. Comparison of Optimum Option with Option D

The Environmental Impacts Assessment Report of 2002, written in line with Act No. 127/1994 Coll. as amended, assessed three options A, C and D for the location of RAW integral repository. In the assessment report, option D was selected as the optimum one (integral repository with later construction of two further modules). Comparison of option 1, assessed in this preliminary study and option D mentioned in the assessment report would not be fully correct, since both options were assessed in different scopes, structures and stages of environmental impacts assessment process. Nevertheless, it is possible to at least briefly describe the differences between the environmental impacts of the two options.

Since the mentioned options are only 500 metres from each other, we may conclude with certainty, that their environmental impacts within the wider surroundings of the site are identical in all items of assessment Table No. 25. The only difference is their potential impact on personnel, which is the result of the different position relative to the routes, along which individuals move within the JAVYS site. This fact determines the possible need to take appropriate measures in order to comply with the relevant legal and internal regulations concerning health protection from radiation.

VI. Maps and Other Picture Documentation

Annex No. 1: Location of proposed activity (options 1 and 2)
Annex No. 2: Location of proposed activity (option 3)
Annex No. 3: Conservation areas in the wider surroundings of the affected territory (options 1 and 2)
Annex No. 4: Conservation areas in the wider surroundings of the affected territory (option 3)
Annex No. 5: RAW integral repository, Structure 801, cross sections

VII. AMENDING INFORMATION

1. List of Text and Graphic Documentation Prepared for the Preliminary Environmental Study and Literature Used

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BRIEF LIST OF RELEVANT LEGISLATION

- Act No. 541/2004 Coll. on Peaceful Use of Nuclear Energy (Nuclear Act) and change and amendment of certain acts as amended
- Act No. 28/2006 Coll. on National Nuclear Fund for the Decommissioning of Nuclear Facilities and Spent Nuclear Fuel and Radioactive Waste Management (Nuclear Fund Act) and change and amendment of certain acts as amended
- Act No. 24/2006 Coll. on Environmental Impacts Assessment and change and amendment of certain acts as amended
- Act No. 355/2007 Coll. on the Protection, Support and Development of Public Healthcare and change and amendment of certain acts as amended
- Regulation of the SR Ministry of Health No. 524/2007 Coll., defining details of radiation monitoring network
- Regulation of the SR Ministry of Health No. 545/2007 Coll. defining detailed requirements for radiation protection in activities resulting in irradiation and activities important for radiation protection
- SR Government Regulation No. 345/2006 on General Safety Requirements for Personnel and Population Health Protection from Ionising Radiation

USED ABREVIATIONS

BSC RAO	Bohunické spracovateľské centrum RAO/Bohunice RAW processing centre
ČMS	Čiastkový monitorovací systém/Partial monitoring system
ČOV	Čistiareň odpadových vôd/Waste-water treatment plant
EMO	Jadrová elektráreň Mochovce/NPP Mochovce
EP	Energoprojekty a.s. Bratislava
JE	Jadrová elektráreň/Nuclear power plant (NPP)
JE A-1	Jadrová elektráreň A-1 Jaslovské Bohunice/Nuclear power plant A-1 J. Bohunice
JE V-1	Jadrová elektráreň V-1 Jaslovské Bohunice/Nuclear power plant V-1 J. Bohunice
JE V-2	Jadrová elektráreň V-2 Jaslovské Bohunice/Nuclear power plant V-2 j. Bohnice
JEZ	Jadrové energetické zariadenie/Nuclear energy facility
JZ	Jadrové zariadenie/Nuclear facility (NF)
KP	Kontrolované pásmo/Controlled zone (CZ)
MDA	Minimálna detekovateľná aktivita/Minimum detectable activity
MKP	Mimokontrolované pásmo/uncontrolled zone
MSK	12 stupňová seizmická stupnica intenzity zemetrasenia (Mercalli, Cancini, Sieberg)/12 degree seismic intensity scale (Mercalli, Cancini, Sieberg)
MSVP	Medzisklad vyhoreného paliva/Interim spent fuel storage
MZ SR	Ministerstvo zdravotníctva Slovenskej republiky/Ministry of Health of the SR
MŽP SR	Ministerstvo životného prostredia Slovenskej republiky/Ministry of Environment SR
PUŽ	Zozbierané uzavreté žiariče, u ktorých skončilo ich využívanie u užívateľa/Collected closed sources no more used by their user

PÚ	Požiarny úsek/Fire section
RAL	Rádioaktívne látky/Radioactive substances
RAO	Rádioaktívny odpad/Radioactive waste (RAW)
RÚ RAO	Republikové úložisko rádioaktívnych odpadov Mochovce/National Depository of RAW
SE	Slovenské elektrárne
SE a.s.-VYZ	Slovenské elektrárne akciová spoločnosť, organizačná zložka Vyraďovanie jadrovoenergetických zariadení Jaslovské Bohunice/Slovenské elektrárne akciová spoločnosť, organisational unit Nuceal Energy Facilities Decommissioning Jaslovské Bohunice
SR	Slovenská republika/Slovak Republic
TRB	Technik radiačnej bezpečnosti/Radiation Safety Engineer
TV	Televízia/Television
ÚJD	Úrad jadrového dozoru/Nuclear Regulatory Authority (NRA)
ÚPD	Územnoplánovacia dokumentácia/Local planning documentation

2. List of Opinions and Consents Required for the Proposed Activity Prior to Preparation of Preliminary Environmental Study

No opinions or consents were issued for the preliminary environmental study.

3. Further Amending Information on Proposed Activity Preparation Process and Assessment of Its Environmental Impacts

Several meetings between the proponent and the authors took place to coordinate the ongoing work. There has also been a meeting with the representatives of the Environmental Impacts Assessment Department at the Ministry of Environment, where the individual options of the proposed activity were discussed.

VIII. Place and Date of Drafting the Preliminary Environmental Study

Bratislava, 6, April 2011

IX. Confirmation of Data Accuracy

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