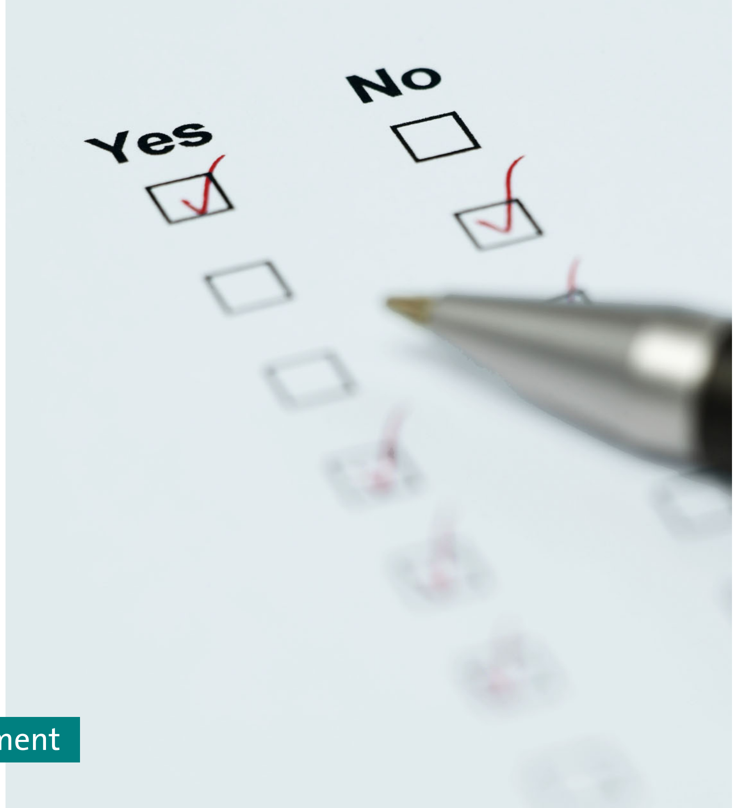
ENVIRONMENT AGENCY AUSTRIA umweltbundesamt

# EIAR for the new NPP at the Jaslovské Bohunice site




Expert Statement

MINISTERIUM FÜR EIN LEBENSWERTES ÖSTERREICH

enco

ENVIRONMENT AGENCY AUSTRIA umweltbundesamt

# EXPERT STATEMENT ON THE ENVIRONMENTAL IMPACT ASSESSMENT REPORT FOR THE NEW NPP AT THE JASLOVSKÉ BOHUNICE SITE

ENCO

Erstellt im Auftrag des
Bundesministeriums für Land- und Forstwirtschaft,
Umwelt und Wasserwirtschaft
Abteilung I/6 Allgemeine Koordination von Nuklearangelegenheiten
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LEBENSWERTES
ÖSTERREICH

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Provider of independent Nuclear Safety expertise

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# CONTENT


**EXECUTIVE SUMMARY ....................................................................... 5**

**ZUSAMMENFASSUNG ....................................................................... 10**

**ZHRNUTIE ....................................................................... 16**

**1 EVALUATION OF THE SELECTED NUCLEAR TECHNOLOGY ............ 21**

**2 EVALUATION OF COMPLETENESS OF INFORMATION PRESENTED IN EBO3 EIAR ....................................................................... 29**

**3 EVALUATION OF ESTIMATED RADIOLOGICAL TRANSBOUNDARY IMPACT OF EBO3 ON AUSTRIAN TERRITORY ....................................................................... 35**

**4 EVALUATION OF PROPOSED RW AND SF MANAGEMENT SOLUTIONS FOR EBO3 ....................................................................... 46**

**5 EVALUATION OF ANSWERS PROVIDED TO AUSTRIAN EXPERT OPINION ON SCOPING DOCUMENTATION ........................... 52**

**6 COMPILATION OF QUESTIONS ....................................................................... 56**

**7 ANNEX ....................................................................... 59**

**A. Basic data ....................................................................... 59**

**B. Data on the direct impacts ....................................................................... 64**

**C. Complex characteristics and impact assessment ..................... 64**

**C.I. Delimitation of the borders of the area concerned .................... 65**

**C.II. Characteristics of the current status of the environment ....................................................................... 65**

**C.III. Environmental impact assessment including health ................ 66**

**C.IV. Measures for the impacts mitigation .......................................... 68**

**C.V. Comparison of variants ....................................................................... 69**

**C.VI. Proposal for the monitoring and after-project analysis ............ 69**

**C.VII. Assessment methods and data sources .................................... 69**

**C.VIII. Shortcomings and uncertainties in the knowledge ................... 70**

**8 LIST OF ABBREVIATIONS ....................................................................... 71**

**9 REFERENCES ....................................................................... 72**

# EXECUTIVE SUMMARY

**Introduction**

Half of the electricity produced in the Slovak Republic is generated by four nuclear power reactors, located at Bohunice and Mochovce sites. Both Bohunice NPP and Mochovce NPP are owned and operated by Slovenské Elektrárne (SE). All four units consist in VVER 440/V-213 pressurized water reactors.

Bohunice NPP is a complex of nuclear reactors located close to Jaslovské Bohunice village in the district of Trnava in western Slovakia. The first NPP built on Bohunice site was the A1 (still under decommissioning) followed later by V1 NPP consisting in two VVER-440 V-230 reactors which were put in operation in 1978 and 1980 respectively. These two units were shut down in 2006 and respectively, 2008, as a precondition of Slovakia's accession into the EU. The second NPP located on Bohunice site (V2 NPP) consists in two VVER-440 V-213 reactors which are in operation since 1984 and respectively, 1985. Both V2 units were subject to a modernization program started in 2000 and completed in 2010 with a power increase of up to 505 MWe (gross) per each unit. However, by 2025 the two V2 units will reach 40 years of operation, so their life would have to be extended or new nuclear capacity would have to be built for nuclear capacity is to be maintained.

Plans for a new NPP on Bohunice site (V3 NPP or EBO3) were announced in 2008, as outlined in the Energy Policy of the Slovak Republic which basically aims to maintain the proportion of electricity generated by NPP at around 50% through a number of measures, including the construction of a new reactor block at Bohunice.

In March 2014 the Ministry of Environment of the Slovak Republic (MZP) submitted to Austria, in conformity with Article 3 of the Espoo Convention on transboundary environmental impact assessment and Article 7 of the Directive 2011/92/EU and the Agreement between the Slovak Republic and the Republic of Austria on the Implementation of the Espoo Convention, documents regarding the project “New nuclear power plant at Jaslovské Bohunice”.

The Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW) replied that the Republic of Austria will take part in the transboundary Environmental Impact Assessment (EIA) since the proposed project could have significant transboundary impacts.

Within the EIA, a Scoping Report was prepared in order to identify which data the project applicant (Jadrová Energetická Spoločnosť Slovenska, a. s., JESS) needs to present in the next step of the EIA procedure, the Environmental Impact Assessment Report (EIAR). JESS commissioned Amec Foster Wheeler s.r.o. and subcontractors to prepare the Scoping Report. The Scoping Report was made publicly available in Austria. The comments received including an Expert Statement which was commissioned by the Federal Ministry of Agriculture, Forestry, Environment and Water Management (BMLFUW) were sent to Slovakia for further consideration.

This Expert Statement assessed the EIA Scoping Report presented by the Slovak side, in order to evaluate whether the content suggested by the EIA Scoping Report for the EIA is sufficient to determine the safety of the project and the potential risk for Austria. The topics required for the EIAR for the project were submitted to the Slovak side, in order to be considered for the development of the EIAR.

In September 2015 the Ministry of Environment of the Slovak Republic transmitted to Austria, in accordance with Article 4 in conjunction with Article 2 of the Espoo Convention on transboundary environmental impact assessment the EIAR on the project "New nuclear power plant at the site Jaslovské Bohunice". The study was prepared by JESS, Amec Foster Wheeler s.r.o. and subcontractors.

ENCONET Consulting Ges.m.b.H. was commissioned to prepare an Expert Statement on the assessment of the EIAR presented by the Slovak side. The objective of the assessment was to investigate whether the information presented in the EIAR are reliable and sufficient to determine the safety of the proposed project and the potential risks for Austria, as well as to review if and to which extent the Austrian Expert Statement assessing the EIA Scoping Report has been considered. The present Expert Statement on the EIAR for a new NPP at Bohunice site presents the results of the assessment of the EIAR submitted by the project developer to the authority. This EIAR has to be in conformity with the technical requirements based on the EU EIA Directive. The content of the EIAR is also determined by the scoping position of the Ministry of Environment of the SR. Due to the technical nature of the project, the EIAR has to present aspects related to nuclear safety too. This Expert Statement on EBO3 EIAR contains the topics to be considered in future bi-lateral consultations within the Espoo procedure, with a view to enable the formulation of well-founded recommendations to minimize potential adverse transboundary impacts.

### Environmental Impact Assessment Report

The alternatives to EBO3 project are only in general terms presented in EIAR, and only in relation with the Energy Policy of SR (2014) and the related strategy documents and government resolutions. Apart from the energy aspects, there is no other indication on the reasons for this selection, as requested by the EIA Directive (art.5 paragraph 3(d)). Therefore:

- Would it be possible to clarify how this selection was done and in particular if the environmental impact aspects were considered?
- Was any detailed analysis on the alternatives enumerated in section A.II.6.5.4 of EIAR performed?
- If yes, would it be possible to present the selection criteria and the rationale for the decision?

### Consideration of Austrian comments to EIA Scoping Document

The findings of the evaluation of the EIAR show that the nuclear safety questions were mostly answered, while the questions on the energy economics were considered only in a very low proportion. From the questions not considered, or inadequately/incompletely answered, the following ones should be followed up during the bilateral consultations:

- Would it be possible to provide information about the achieved level of development: plants under construction/in operation, licensing, etc., for the 6 reactor models envisaged for the new NPP?

- Would it be possible to provide the results of the examination of technically and economically feasible alternatives to the present project, including renewables, modern cogeneration and biomass power plants?
- Would it be possible to provide a detailed presentation stating the probable development of the Slovak power plant capacities (decommissioning and new build) to 2030, clarifying how EBO3 would fit in the whole Slovak power generation system (both in terms of installed capacity as well as the annual production)?
- Would it be possible to indicate how the project developer will guarantee the achievement of a high level of safety with rising investment needs and permanently low electricity market prices?

**Nuclear safety aspects**

*Nuclear technology*

- The findings of the evaluation of the state-of-the-art technology envisaged for the new NPP show that all proposed designs are GEN III/III+ reactors, evolutionary PWR reactors, using different combinations of passive and active safety features. However, their description does not mention any post-Fukushima measure introduced by the vendors. Therefore, would it be possible to know how the developer plans to access and evaluate the implementation of stress-tests/post-Fukushima measures in the design of the considered reactors?
- The EIAR considers a fuel burn-up up to 60 GWd/tU, but some of the new designs considered for construction of the new NPP foresee burn-ups up to 70 GWd/tU; would it thus be possible to explain how the developer plans to address this issue, as the fission products pattern for 60 and 70 GWd/tU will substantially differs and this will be reflected in the RW activity level?

*Transboundary impacts*

- The radiological impact of the operation of the new NPP has been assessed for both normal operation, as well as accident conditions. But the cumulative impact of the parallel operation of all nuclear installations on the site was assessed only for normal conditions. Would it be possible to provide data about the cumulative impact of EBO3 and the existing nuclear installations on Bohunice site, in accident conditions too? This should include an estimation of the impact of one nuclear installation affected by accident conditions on the others, as well as the impact of all nuclear installations on the site affected in the same time by accident conditions.
- What sources (publicly available or provided by the possible suppliers) were used by the developer in order to determine the “envelope” source term for normal operation (which for some radionuclides shows lower values than the source term of one of the reactor models envisaged for EBO3)?
- Why a calculation of the accident source terms was performed, as long as in some parts of EIAR it is mentioned that the safety documentation was made available by the possible providers to the developer?
- Would it be possible to get more information about the validation of the RDEBO computer code?

- Why 2 different codes were used for the estimation of radiological consequences of design basis accident and severe accident, and in particular why PC COSYMA (which is a validated code, accepted by EC) was used only for severe accidents?
- Would it be possible to provide the maximum values (or at least values corresponding to the 99% quantile) provided by PC COSYMA for the doses calculated in case of severe accidents?
- All doses calculated at distances higher than 40 km from the plant for the considered accident conditions are below the intervention levels. However, the time integrated concentration in air and the maximum ground deposition values in case of the severe accident show rather high values, which may lead to exceeding the threshold values used in Austria for selecting the adequate sampling strategy in case of emergency situations. In order to allow a direct comparison with these values, would it be possible to provide data on the contribution of Cs-137 and I-131 to the time-integrated concentration in air and ground deposition in case of design basis accidents and severe accidents?
- Also, in order to allow a direct comparison with the intervention levels, would it be possible to provide the effective doses projected for 2 days and 7 days, as well as the avertable committed doses to thyroid calculated for design basis accidents too?

*Emergency preparedness*

The emergency preparedness arrangements for EBO3 are presented in EIAR only in general lines, with no connection with the existing arrangements for the other units in operation at the site. Therefore, would it be possible to clarify the following aspects:

- If the future operator of EBO3 will develop a stand-alone response plan (in which case it is necessary to describe how this plan will be correlated with the other installations' plans) or the necessary response arrangements for EBO3 will be integrated into an on site response plan (if such a plan exists);
- In case an on site response plan exists:
  - Who is in charge with its development?
  - Who is in charge with its approval?
  - How is the correlation between the on site and off site response plans verified?

**Radioactive waste and spent fuel**

Following the detailed evaluation of the proposed solutions for RW and SF management at the new NPP it was found that the foreseen activities are in line with the international standards and good practices. In the same time, a detailed analysis of the SR policies and strategies governing the RW management, it was found that the EU Waste Directive is transposed into the Slovak legislation. However, one aspect needs to be clarified in relation with the RW and SF to be generated by the new NPP.

- Would it be possible to clarify why the RW and SF to be generated by the new NPP were not taken into consideration in the National Program, and in particular if the planned extension of the storage capacities for both RW and SF at Bohunice site as well as of the LILW disposal capacity at Mochovce Repository will be sufficient to accommodate these additional amounts of RW and SF?

- Also, in section C.IV of EIAR, it is mentioned as a measure for the impacts mitigation, the inclusion of RW and SF that will be generated by EBO3 into the balances of necessary capacities for storage and disposal in the future update of the National Program for RW and SF Management; would it be possible to provide a deadline for this measure?
- In addition to these, it is suggested to correct in the text of the EIAR the constant confusion between “storage” and “disposal” and “treatment” and “management” (of RW), as well as the contradicting statement appearing in the non-technical summary (“Crucial minority of wastes will be very low active and low active wastes”).

**Energy Economics aspects**

In today’s global energy environment, NPP investors need to consider many dimensions of risk in addition to the basic nuclear safety-related risk. Therefore:

- Would it be possible to indicate what is the risk management strategy for EBO3 project?
- In addition, it is also suggested to correct the titles of:
  - Table A.II.1 and Figure A.II.1 – instead of “Forecast of the gross electricity consumption development pursuant to scenarios of Energy Policy of SR” it should be “Forecast of the gross domestic energy consumption development pursuant to scenarios of Energy Policy of SR”;
  - Section A.II.6.5.2. should be “Final Energy Consumption” and not “Final Power Consumption”;
  - Table A.II.2 and Figure A.II.2 – instead of “Forecast of the final power consumption development pursuant to the scenarios of Energy Policy of SR” it should be “Forecast of the final energy consumption development pursuant to the scenarios of Energy Policy of SR”.

# ZUSAMMENFASSUNG

### Einführung

Die Hälfte des in der Slowakischen Republik erzeugten Stroms wird von vier Kernkraftwerken an den Standorten Bohunice und Mochovce generiert. Sowohl das KKW Bohunice als auch das KKW Mochovce sind im Besitz und werden von Slovenské Elektrárne (SE) betrieben. Alle vier Einheiten bestehen aus WWER 440 / V-213 Druckwasserreaktoren.

Das KKW Bohunice ist ein Komplex von Kernreaktoren in der Nähe der Ortschaft Jaslovské Bohunice im Kreis Trnava in der Westslowakei. Das erste KKW, das am Standort Bohunice gebaut wurde, war der A1 (derzeit immer noch in Stilllegung befindlich), später gefolgt vom KKW V1, bestehend aus zwei WWER-440 V-230 Reaktoren, die 1978 bzw. 1980 in Betrieb genommen wurden. Diese beiden Einheiten wurden, als Voraussetzung für den Beitritt der Slowakei zur EU, in den Jahren 2006 respektive 2008 abgeschaltet. Das zweite KKW am Standort Bohunice (V2 KKW) besteht aus zwei WWER-440 V-213 Reaktoren, die seit 1984 bzw. 1985 in Betrieb sind. Beide V2-Einheiten unterlagen einem Modernisierungsprogramm, begonnen im Jahr 2000 und abgeschlossen im Jahr 2010, mit einer Leistungssteigerung von bis zu 505 MWe (brutto) pro Einheit. Im Jahr 2025 werden die beiden V2-Einheiten 40 Betriebsjahre erreichen, sodass entweder ihre Laufzeit verlängert werden müsste oder neue Kernkraftkapazitäten gebaut werden müssten, um die nukleare Kapazität beizubehalten.

Pläne für ein neues KKW am Standort Bohunice (KKW V3 oder EBO3) wurden im Jahr 2008 bekannt gegeben, wie in der Energiepolitik der Slowakischen Republik umrissen, die im Grunde darauf abzielt, den Anteil des von Kernkraftwerken erzeugten Stroms von etwa 50% durch eine Reihe von Maßnahmen beizubehalten, einschließlich der Errichtung eines neuen Reaktorblocks in Bohunice.

Im März 2014 übermittelte das Umweltministerium der Slowakischen Republik (MZP) in Übereinstimmung mit Artikel 3 des Übereinkommens über die Umweltverträglichkeitsprüfung im grenzüberschreitenden Rahmen (Espoo-Konvention) und Artikel 7 der UVP-Richtlinie 2011/92/EU sowie dem Abkommen zwischen der Slowakischen Republik und der Republik Österreich über die Durchführung der Espoo-Konvention Unterlagen über das Projekt „Neue Kernkraftanlage am Standort Jaslovské Bohunice“.

Das Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft (BMLFUW) antwortete, dass die Republik Österreich an der grenzüberschreitenden Umweltverträglichkeitsprüfung (UVP) teilnehmen wird, da das vorgeschlagene Projekt erhebliche grenzüberschreitende Auswirkungen haben könnte.

Im Rahmen der UVP wurde ein Scoping-Bericht erstellt, um festzulegen, welche Daten der Antragsteller (Jadrová Energetická Spolocnost Slovenska, a.s., JESS) im nächsten Schritt des UVP-Verfahrens, der Umweltverträglichkeitserklärung (UVE), vorlegen muss. JESS beauftragte Amec Foster Wheeler s.r.o. und Subunternehmer mit der Erstellung des Scoping-Berichtes. Der Scoping-Bericht wurde in Österreich der Öffentlichkeit zugänglich gemacht. Die eingegangenen Stellungnahmen einschließlich einer Fachstellungnahme, die durch das Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft (BMLFUW) in Auftrag gegeben wurde, wurden der Slowakei zur weiteren Behandlung übermittelt.

Diese Fachstellungnahme überprüfte den von slowakischer Seite vorgestellten UVP-Scoping-Bericht in Hinblick darauf, ob der vorgeschlagene Umfang der UVE ausreichend ist, um die Sicherheit des Projekts und das potenzielle Risiko für Österreich zu bestimmen. Die für die UVE für das Projekt erforderlichen Themen wurden der slowakischen Seite übermittelt, damit diese bei der Erstellung der UVE berücksichtigt werden.

Im September 2015 hat das Umweltministerium der Slowakischen Republik der Republik Österreich gemäß Artikel 4 i.V.m. Art 2 des Übereinkommens über die Umweltverträglichkeitsprüfung im grenzüberschreitenden Rahmen (Espoo-Konvention) den Umweltverträglichkeitsbericht über das Vorhaben „Neue Kernkraftanlage am Standort Joslovské Bohunice" übermittelt. Die Studie wurde von JESS, Amec Foster Wheeler s.r.o. und Subunternehmern erstellt.

Enconet Consulting GmbH wurde beauftragt, eine Fachstellungnahme zur Beurteilung der von der slowakischen Seite präsentierten UVE zu erstellen. Ziel der Bewertung war es zu untersuchen, ob die in der UVE enthaltenen Informationen zuverlässig und ausreichend sind, um die Sicherheit des vorgeschlagenen Projekts und die möglichen Risiken für Österreich festzustellen, sowie ob und in welchem Umfang die österreichische Fachstellungnahme zum UVE-Scoping-Bericht berücksichtigt wurde. Die vorliegende Fachstellungnahme zur UVE für ein neues KKW am Standort Bohunice präsentiert die Ergebnisse der Beurteilung der UVE, die vom Projektentwickler bei der Behörde eingereicht wurde. Diese UVE muss in Übereinstimmung mit den technischen Anforderungen auf Grundlage der EU-UVP-Richtlinie sein. Der Inhalt der UVE wird auch durch die Scoping-Position des Umweltministeriums der Slowakischen Republik bestimmt. Aufgrund der technischen Natur des Projekts hat die UVE auch Aspekte der nuklearen Sicherheit zu präsentieren. Diese Fachstellungnahme zur EBO3 UVE enthält die Themen, die in zukünftigen bilaterale Konsultationen im Rahmen des Espoo Verfahrens berücksichtigt werden sollten, auch in Hinblick auf die Formulierung fundierter Empfehlungen zur Minimierung möglicher nachteiliger grenzüberschreitender Auswirkungen.

### Umweltverträglichkeitserklärung

Die Alternativen zum EBO3 Projekt werden in der UVE nur in allgemeiner Form und nur im Zusammenhang mit der Energiepolitik der Slowakischen Republik (2014) und den damit verbundenen Strategiedokumenten und Regierungsresolutionen vorgestellt. Neben den Energieaspekten gibt es keine andere Angabe über die Gründe für diese Auswahl, wie eigentlich von der UVP-Richtlinie (Artikel 5 Absatz 3 (d)) gefordert. Deshalb:

- Wäre es möglich zu klären, wie diese Auswahl getroffen wurde, und insbesondere, ob die Umweltauswirkungen in Betracht gezogen wurden?
- Wurde irgendeine detaillierte Analyse der im Abschnitt A.II.6.5.4 der UVE aufgezählten Alternativen durchgeführt?
- Wenn ja, wäre es möglich, die Auswahlkriterien und die Gründe für die Entscheidung darzulegen?

### Berücksichtigung der österreichischen Kommentare zum UVE-Scoping-Bericht

Die Ergebnisse der Auswertung der UVE zeigen, dass die Fragen zur nuklearen Sicherheit großteils beantwortet wurden, während die Fragen über die Energiewirtschaft nur in einem sehr geringen Ausmaß berücksichtigt wurden. Aus den Fragen, die nicht berücksichtigt oder unzureichend/unvollständig beantwortet wurden, sollten die folgenden während der bilateralen Konsultationen weiter verfolgt werden:

- Wäre es möglich, Informationen über den erreichten Entwicklungsstand für die 6 für den geplanten Neubau ins Auge gefassten Reaktormodelle vorzulegen: Anlagen im Bau/in Betrieb, Lizenzierung, etc.?
- Wäre es möglich, die Ergebnisse der Prüfung der technisch und wirtschaftlich realisierbaren Alternativen zum vorliegenden Projekt vorzulegen, einschließlich erneuerbarer Energien, KWK und Biomassekraftwerke?
- Wäre es möglich, eine detaillierte Darstellung mit Angabe der voraussichtlichen Entwicklung der slowakischen Kraftwerkskapazitäten (Stilllegung und Neubau) bis 2030 bereitzustellen, damit geklärt werden könnte, wie EBO3 in das gesamt-slowakische Energieerzeugungssystem passen würde, sowohl hinsichtlich der installierten Leistung als auch der jährliche Produktion?
- Wäre es möglich anzugeben, wie der Projektentwickler das Erreichen eines hohen Sicherheitsniveaus bei steigendem Investitionsbedarf und dauerhaft niedrigen Strommarktpreisen garantieren kann?

### Aspekte der nuklearen Sicherheit

*Nukleartechnik*

- Die Ergebnisse der Auswertung der state-of-the-art Technologie, die für das neue KKW in Betracht gezogen wird, zeigen, dass alle vorgeschlagenen Designs GEN III/III+ Reaktoren sind, also evolutionäre Druckwasser-Reaktoren mit verschiedenen Kombinationen von passiven und aktiven Sicherheitseinrichtungen. Allerdings erwähnt deren Beschreibung keine von den Herstellern eingeführten Post-Fukushima Maßnahmen. Wäre es daher möglich zu erfahren, wie der Antragsteller die Umsetzung der Stresstests/Post-Fukushima Maßnahmen bei der Entwicklung der berücksichtigten Reaktoren in Erfahrung zu bringen und zu bewerten plant?
- Die UVE berücksichtigt einen Kernbrennstoffverbrauch von bis zu 60 GWd/tU, aber einige der neuen Designs, die für den Bau des neuen KKW vorgesehen sind, sehen einen Brennstoffverbrauch von bis zu 70 GWd/tU vor. Wäre es möglich zu erklären, wie der Antragsteller plant, dieses Problem anzugehen, da sich die Spaltproduktezusammensetzung für 60 und 70 GWd/tU wesentlich unterscheidet, und wie sich dies im Aktivitätsniveau des nuklearen Abfalls niederschlagen wird?

*Grenzüberschreitende Auswirkungen*

- Die radiologischen Auswirkungen des Betriebs des neuen KKW wurden sowohl für den normalen Betrieb als auch hinsichtlich Unfallbedingungen bewertet. Die kumulativen Auswirkungen des Parallelbetriebs aller kerntechnischen Anlagen auf dem Gelände wurden nur für normale Bedingungen bewertet. Wäre es möglich, Daten über die kumulative Wirkung von EBO3 und den bestehenden Kernanlagen am Standort Bohunice unter Unfallbedingungen zu erhalten? Diese sollten eine Abschätzung der Auswirkungen einer kerntechnischen Anlage unter Unfallbedingungen auf die anderen beinhalten, aber ebenso die Auswirkungen für den Fall, dass alle kerntechnischen Anlagen auf dem Gelände zur gleichen Zeit von Unfällen betroffen sind.

- Welche Quellen (öffentlich zugänglich oder durch die möglichen Lieferanten zur Verfügung gestellt) wurden vom Antragsteller verwendet, um den umfassenden ("envelope") Quellterm für den Normalbetrieb zu bestimmen (der für einige Radionuklide niedrigere Werte zeigt als der Quellterm eines der für EBO3 in Betracht gezogen Reaktormodelle)?
- Weshalb eine Berechnung der Unfallquelleterme durchgeführt wurde, in einigen Teilen der UVE aber erwähnt wird, dass die Sicherheitsdokumentation dem Antragsteller von den möglichen Anbietern zur Verfügung gestellt wurde?
- Wäre es möglich, mehr Informationen über die Validierung des RDEBO Computer-Codes zu erhalten?
- Warum wurden 2 verschiedene Codes zur Abschätzung der radiologischen Folgen eines Störfalls und eines schweren Unfalls benutzt, insbesondere, warum wurde PC COSYMA (ein validierter, von der EC akzeptierter Code) nur für schwere Unfälle verwendet?
- Wäre es möglich, die durch PC COSYMA erstellten Maximalwerte (oder zumindest Werte entsprechend dem 99%-Quantil) für die im Falle von schweren Unfällen berechneten Dosen zur Verfügung zu stellen?
- Alle Dosen, die für Entfernungen größer als 40 km von der Anlage für die betrachteten Unfallbedingungen berechnet wurden, liegen unterhalb der Interventionsgrenzwerte. Die zeitintegrierte Konzentration in der Luft und die maximalen Bodendepositionswerte im Falle des schweren Unfalls zeigen jedoch recht hohe Werte, die zu einer Überschreitung der Schwellenwerte führen können, die in Österreich für die Auswahl der angemessenen Probenahmestrategie im Falle von Notsituationen gelten. Wäre es möglich, Daten über den Beitrag von Cs-137 und I-131 auf die zeitintegrierte Konzentration in der Luft und die Ablagerung am Boden im Falle von Störfällen und schweren Unfällen zu erhalten, um einen direkten Vergleich mit diesen Werten zu ermöglichen?
- Wäre es möglich, um einen direkten Vergleich mit den Interventionsgrenzwerten zu erlauben, die veranschlagten effektiven Dosen für 2 Tage und 7 Tage sowie die veranschlagten vermeidbaren Folgedosen für die Schilddrüse, berechnet für Auslegungsstörfälle, zur Verfügung zu stellen?

*Notfallvorsorge*

Die Vorkehrungen betreffend Notfallvorsorge für EBO3 werden in der UVE nur in groben Zügen dargestellt, unabhängig von den für die anderen am Standort betriebenen Einheiten bestehenden Regelungen. Wäre es daher möglich, die folgenden Aspekte zu klären:

- Ob der zukünftige Betreiber von EBO3 eine Stand-alone-Notfallschutzplan entwickeln wird (in diesem Fall ist es notwendig, zu beschreiben, wie dieser Plan mit den Plänen der anderen Anlagen korrelieren wird) bzw. ob die notwendigen Vorsorgevorkehrungen für EBO3 in einen Standortnotfallschutzplan integriert werden (falls ein solcher Plan existiert);

- Für den Fall, dass ein Standortnotfallschutzplan existiert:
  - Wer ist verantwortlich für seine Entwicklung?
  - Wer ist verantwortlich für seine Genehmigung?
  - Wie wird die Korrelation zwischen den on-site und den off-site Plänen geprüft?

**Radioaktiver Abfall und abgebrannte Brennelemente**

Im Anschluss an die detaillierte Auswertung der vorgeschlagenen Lösungen für das Management von radioaktivem Abfall (RA) und abgebrannten Brennelementen (AB) im neuen KKW wurde festgestellt, dass die vorgesehenen Maßnahmen im Einklang mit den internationalen Standards und bewährten Verfahren stehen. Zur gleichen Zeit stellte eine detaillierte Analyse der Vorschriften und Strategien der Slowakischen Republik für das RW-Management fest, dass die EU-Abfallrichtlinie in den slowakischen Rechtsvorschriften umgesetzt wurde. Jedoch muss ein Aspekt hinsichtlich des RA und der AB, erzeugt vom neuen KKW, geklärt werden.

- Wäre es möglich zu klären, warum die vom neuen KKW erzeugten RA und AB nicht im nationalen Programm berücksichtigt wurden, und insbesondere ob die geplante Erweiterung der Lagerkapazitäten für RA und AB am Standort Bohunice sowie der Entsorgungskapazität für schwach- und mittel radioaktiven Abfall im Mochovce Zwischenlager ausreichen werden, um diese zusätzlichen Mengen an RA und AB unterzubringen?
- In Abschnitt C.IV der UVE wird die Einbeziehung der von EBO3 erzeugten RA und AB in die Salden der erforderlichen Kapazitäten für die Lagerung und Entsorgung in der künftigen Aktualisierung des Nationalen Programms für RA und AB Management als eine Maßnahme zur Schadensbegrenzung erwähnt; wäre es möglich, einen Termin für diese Maßnahme bekannt zu geben?
- Zusätzlich wird vorgeschlagen, die im englischen Text der UVE ständig auftretenden Verwechslungen von "storage", "disposal", "treatment" und "management" (von RA) sowie die widersprüchliche Aussage in der nichttechnischen Zusammenfassung ("Crucial minority of wastes will be very low active and low active wastes") zu korrigieren.

**Energieökonomische Aspekte**

Im heutigen globalen Energiepolitischen Umfeld müssen KKW-Investoren zusätzlich zum Hauptrisiko der nuklearen Sicherheit viele andere Risiken berücksichtigen.

- Wäre es deshalb möglich, die Risikomanagement-Strategie für das EBO3 Projekt zu beschreiben?
- Zusätzlich wird auch vorgeschlagen, zumindest in der englischen Übersetzung folgende Titel zu korrigieren:
  - Tabelle A.II.1 and Abbildung A.II.1 – anstelle von “Forecast of the gross electricity consumption development pursuant to scenarios of Energy Policy of SR” sollte es “Forecast of the gross domestic energy consumption development pursuant to scenarios of Energy Policy of SR” heißen;
  - Section A.II.6.5.2. “Final Energy Consumption” anstelle von “Final Power Consumption” sein;

- Tabelle A.II.2 and Abbildung A.II.2 – anstelle von “Forecast of the final power consumption development pursuant to the scenarios of Energy Policy of SR” sollte es “Forecast of the final energy consumption development pursuant to the scenarios of Energy Policy of SR” heißen.

# ZHRNUTIE

### Úvod

Polovica elektriny produkovanej v Slovenskej republike je vygenerovaná štvormi jadrovými reaktormi, situovanými v Bohuniciach a v Mochovciach. AE Bohunice aj AE Mochovce sú vo vlastníctve a prevádzke Slovenských Elektrární (SE). Všetky štyri reaktory sa stavajú z tlakovodných reaktorov VVER 440/V-213.

AE Bohunice je komplex jadrových reaktorov situovaných v blízkosti dediny Jaslovské Bohunice na západnom Slovensku, neďaleko mesta Trnava. Prvá AE postavená v Bohuniciach bola AE A1 (prebieha vyraďovanie), a následovne AE V1, ktorá pozostáva z dvoch reaktorov VVER-440 V-230, ktoré boli spustené do prevádzky v rokoch 1978, a 1980. Tieto dve jednotky boli odstavené v rokoch 2006 a 2008, podla požiadavku Európskej komisie, ako jednu z podmienok vstupu Slovenskej republiky do EU. Druhá AE situovaná v Bohuniciach (AE V2) pozostáva z dvoch reaktorov, ktoré sú aktívne od roku 1984 a 1985. Obidve jednotky V2 podliehali modernizacií, ktorá bola zahájená v roku 2000, a dokončená v roku 2010, so zvýšením výkonu na 505 MWe každej jednotky. Do roku 2025 ale jednotky dosiahnu 40 rokov prevádzky, a ich životnosť bude musieť byť predĺžená, alebo budú musieť byť postavené nové reaktory, aby sa udržala ich výkonnosť.

Plány novej AE v areáli v Bohuniciach boli oznámené v r. 2002, podľa energetickej politiky Slovenskej republiky, ktorá si kladie za cieľ udržať pomer elektriny generovanej AE okolo 50% opatreniami ktoré zahŕňajú výstavbu nového bloku reaktorov v Bohuniciach.

V marci 2014 dodalo Ministerstvo životného prostredia Slovenskej republiky (MŽP) Rakúsku v súlade s článkom 3 dohovoru z Espoo o hodnotení vplyvov na životné prostredie presahujúcich štátne hranice, a článku 7 Rady 2011/92/EU a dohodou Slovenskej republiky a Rakúskej republiky o implementácií dohovoru z Espoo, všetky dokumenty ohľadne projektu „Nová atómová elektráreň Jaslovské Bohunice“.

Ministerstvo poľnohospodárstva, lesníctva, životného prostredia a vodohospodárstva (BMLFUW) odpovedalo že Rakúsko sa zúčastní vyhodnotenia vplyvov na životné prostredie presahujúce štátne hranice (Environmental Impact Assessment – EIA), pretože navrhnutý projekt by mohol mať následky, ktoré by významne presahovali štátne hranice.

V rámci EIA bola pripravená správa, ktorá mala za účel identifikovať ktoré údaje musí žiadateľ projektu (Jadrová Energetická Spoločnosť Slovenska, a.s., JESS) prezentovať v ďaľšom kroku EIA procedúry – správa o vyhodnotení dopadu na životné prostredie (EIAR). JESS poverila Amec Foster Wheeler s.r.o. a subdodávateľov, aby pripravili správu. Správa bola verejne prístupná v Rakúsku. Pripomienky, ktoré boli obdržané behom odborného prehlásenia experta, ktorý bol poverený Ministerstvom poľnohospodárstva, lesníctva, životného prostredia a vodohospodárstva (BMLFUW), boli zaslané na Slovensku pre ďaľšie uváženie.

Odborné prehlásenie experta vyhodnotilo EIA správu prezentovanú Slovenskou stranou, za účelom vyhodnotiť či obsah navrhnutý EIA správou pre EIA je dostatočný pre určenie bezpečnosti projektu a potencionálneho nebezpečenstva pre Rakúsko. Témy vyžadované pre EIAR pre tento projekt boli odovzdané Slovenskej strane, aby boli zvážené pri rozvoji EIAR.

V septembri 2015 poslalo Ministerstvo životného prostredia SR Rakúsku, v súlade s článkom 4 spolu s článkom 2 dohovoru z Espoo o hodnotení vplyvov na životné prostredie presahujúcich štátne hranice EIAR o novom projekte „Nová atómová elektráreň Jaslovské Bohunice“. Štúdia bola vyhotovená JESS, Amec Foster Wheeler s.r.o. a subdodavateľmi.

ENCONET Consulting Ges.m.b.H. bola poverená pripraviť odborné prehlásenie experta o vyhodnotení EIAR prezentované slovenskou stranou. Účelom vyhodnotenia bolo vyšetriť či informácie prezentované EIAR sú spoľahlivé a dostatočné pre stanovenie bezpečnosti navrhnutého projektu a potencionálnych rizík pre Rakúsko, a tiež vyhodnotiť či, a ak áno, do akej miery bolo zohľadnené odborné prehlásenie rakúskeho experta o vyhodnotení vplyvov na životné prostredie presahujúce štátne hranice. Súčasné odborné prehlásenie EIAR o novej AE v areáli Bohunice predkladá výsledky vyhodnotenia EIAR dodané developerom projektu orgánu. Toto EIAR musí byť v súlade s technickými požiadavkami založené na Smernici Rady o postupe posúdenia vplyvu na životné prostredie (85/337/EHS). Obsah EIAR je stanovený určenou pozíciou Ministerstva životného prostredia SR. Kvôli technickému charakteru projektu musí EIAR prezentovať aj aspekty jadernej bezpečnosti. Toto odborné prehlásenie o EBO3 EIAR obsahuje témy, ktoré by mali byť zvážené v budúcich bilaterálnych konzultáciách v rámci Espoo – procedúry, s cieľom umožniť formuláciu opodstatnených doporučení a minimalizovať možnosť nepriaznivých cezhraničných dopadov.

### Správa o posúdení vplyvu na životné prostredie

Alternatívy k projektu EBO3 sú prezentované v EIAR len všeobecne, a len v súvislosti so slovenskou energetickou politikou (2014) a súvisiacimi strategickými dokumentami a vládnymi uzneseniami. Okrem energetických aspektov nie je iný náznak dôvodu pre tento výber, ako požadované Smernicou Rady o postupe posúdenia vplyvu na životné prostredie (85/337/EHS), (článok 5, odstavec 3(d)). Preto:

- Bolo by možné ujasniť ako bol výber vykonaný, a obzvlášť či boli zvažované aspekty životného prostredia?
- Bola vykonaná detailná analýza alternatív uvedených v časti A.II.6.5.4 EIAR?
- Ak áno, bolo by možné prezentovať výberové kritéria a odôvodnenie pre vaše rozhodnutie?

### Posúdenie rakúskych pripomienok k EIA dokumentu

Nálezy vyhodnotenia EIAR ukazujú, že otázky jadernej bezpečnosti boli z väčšiny zodpovedané, zatiaľ čo otázky ohľadne ekonómie energetiky boli zohľadnené len vo veľmi malom pomere. Z otázok ktoré neboli zvážené, alebo ktoré boli neadekvátne či neúplne odpovedané, by malo byť na tieto následujúce naviazané v bilaterálnych konzultáciách:

- Bolo by možné poskytnúť informácie o dosiahnutej úrovni rozvoju: rozostavané/aktívne elektrárne, licencovanie atd., pre 6 modelov reaktorov ktoré sú plánované pre novú AE?

- Bolo by možné poskytnúť výsledky skúšok technicky a ekonomicky prijateľných alternatív k súčasnému projektu, včetne obnoviteľných zdrojov energie, kogeneračných jednotiek a elektrární na biomasu?
- Bolo by možné poskytnúť detailovanú prezentáciu uvádzajúcu pravdepodobný vývoj kapacity slovenských elektrární (odstavovanie a stavba nových) do roku 2030, a ujasnit ako by zapadal EBO3 do celého slovenského systému výroby energie (z hľadiska kapacity a ročnej výroby)?
- Bolo by možné vyjadriť ako plánuje developer projektu zaručiť dosiahnutie vysokej úrovne bezpečnosti so zvyšujúcov sa potrebou investícií a dlhodobo nízkymi cenami na trhu?

**Aspekty jadernej bezpečnosti**

*Jaderná technológia*

- Nálezy vyhodnotenia najmodernejšiej technológie plánovanej pre novú AE ukazujú, že všetky navrhované návrhy sú reaktory GEN III/III+, vývojové PWR reaktory, využívajúce rôzne kombinácie pasívnych a aktívnych bezpečnostných prvkov. Avšak ich popis nezmieňuje žiadne bezpečnostné opatrenia zavedené po nehode vo Fukušime. Bolo by preto z týchto dôvodov možné vedieť, ako vývojový projektant plánuje sprístupniť a vyhodnotiť implementáciu záťažových testov a po-Fukušimových opatrení v návrhu týchto reaktorov?
- EIAR zvažuje spaľovanie paliva v rozsahu až 60 GWd/tU, ale niektoré nové návrhy zvažované pre výstavbu novej AE predvídajú spaľovanie až do 70 GWd/tU; bolo by možné vysvetliť ako vývojový projektant plánuje riešiť tento problém, pretože vzor produktov štiepenia pre 60 a 70 GWd/tU sa výrazne líšia, a toto sa bude odrážať v aktivite rádioaktívneho odpadu?

*Cezhraničné dopady*

- Rádiologický dopad výstavby novej AE bol vyhodnotený ako v podmienkach normálnej prevádzky, ale aj v nehodových situáciách. Súhrnný dopad paralelnej prevádzky všetkých jadrových zariadení bol vyhodnotený len v bežnom prevádzkovom režime. Bolo by možné poskytnúť data o súhrnnom dopade EBO3 a existujúcich jadrových zariadení v areáli Bohunice aj v nehodových situáciách? Toto vyhodnotenie by malo obsahovat odhad dopadu jednoho jadrového zariadenia v nehodovej situácií, ale aj dopad v prípade že by v nehodovej situácií boli všetky jadrové zariadenia naraz.
- Aké zdroje (verejne prístupné,alebo poskytnuté možnými dodavateľmi) boli použité pre to, aby sa zistil zdrojový člen pre normálnu prevádzku (ktorý pre niektoré rádionuklidy vykazuje nižšie hodnoty než zdrojový člen jednoho z reaktorových modelov plánovaných pre EBO3)?
- Prečo bol vykonaný výpočet nákladov na nehodové zdrojové členy, aj keď v niektorých častiach EIAR je zmienka o tom, že bezpečnostná dokumentácia bola sprístupnená možnými dodavateľmi vývojovému projektantovi?
- Bolo by možné získať viac informácií o validácií počítačového kódu RDEBO?
  - Prečo boli použité dva rôzne kódy na odhad rádiologických dôsledkov návrhov nehôd a závažných nehôd, a obzvlášť prečo bol PC COSYMA (ktorý je overený kôd, schválený EK) použitý len pre závažné nehody?

- Bolo by možné uviesť maximálne hodnoty, (alebo aspoň hodnoty odpovedajúce 99% kvantilu), poskytnuté PC COSYMA pre dávky vypočítané v prípadoch závažných nehôd?
- Všetky dávky uvedené vo vzdialenostiach vyšších ako 40km od elektrárne sú nižšie než hranice intervencie. Avšak, časovo integrovaná koncentrácia vo vzduchu a maximálne hodnoty usadenín v zemi vykazujú vysoké hodnoty, ktoré môžu viesť k prekročeniu prahových hodnôt v Rakúsku pre výber adekvátneho spôsobu odberu vzoriek v prípade havárie. Aby bolo umožnené priame porovnanie s týmito hodnotami, bolo by možné poskytnúť údaje o kontribúcií Cs-137 a I-131 k časovo-integrovanej koncentrácií vo vzduchu a usadeninám v zemi v prípade maximálnych projektových nehôd a závažných nehôd?
- Aby bolo umožnené priame porovnanie medzi úrovňami intervencie, bolo by možné poskytnúť efektívne dávky predpokladané na 2 dni, a na 7 dní, spolu s odvrátiteľným úväzkom účinnej látky na štítnu žľazu vypočítanú pre maximálnu projektovú nehodu?

*Havarijná pripravenosť*

Dohody o havarijnej pripravenosti pre EBO3 sú prezentované v EIAR len všeobecne, bez spojitosti k existujúcim dohodám pre ostatné jednotky v areáli. Preto, ak možné, by bolo treba vyjasniť následujúce aspekty:

- Ak budúci operátor EBO3 vyvinie samostatný núdzový plán (v ktorom prípade je nutné popísať ako tento plán bude súvisieť s plánmi ostatných jednotiek) alebo opatrenia ktorými bude EBO3 integrovaný do existujúceho plánu areálu (ak taký existuje);
- V prípade že havarijný plán existuje:
  - Kto má na starosť jeho vývoj?
  - Kto má na starosť jeho schválenie?
  - Ako je overená korelácia medzi havarijnými plánmi v rámci a mimo areálu?

**Rádioaktívny odpad a vyhorené palivo**

Po detailnom vyhodnotení navrhnutých riešení pre RO a VP v novej AE bolo stanovené že predpokladané aktivity sú v súlade s medzinárodnými štandartmi a osvedčenými postupmi. Tiež bolo stanovené, po analýze politiky a stratégií SR voči RO, že smernica EÚ o odpade bola prenesená do slovenskej legislatívy. Avšak, jeden aspekt musí byť dodatočne upresnený vo vzťahu k RO a VP, ktorý bude vygenerovaný novou AE.

- Bolo by možné upresniť prečo RO a VP ktoré budú vytvorené novou AE neboli zohľadnené v národnom programe, a špecificky ak plánované rozšírenie skladovacích kapacít pre RO a VP v Bohuniciach, aj krátkodobého nízkoaktívneho a strednoaktívneho odpadu (LILW) v Mochovciach bude dostatočné, aby vyhovelo týmto dodatočným objemom RO a VP?
- Tiež v časti C.IV EIAR je zmienené ako merítko zmiernenia dopadov zakomponovanie RO a VP, ktoré budú vygenerované EBO3, do bilancie potrebných kapacít pre skladovanie a zneškodnenie v budúcej aktualizácií národného programu pre riadenie RO a VP. Bolo by možné poskytnúť konečný termín pre toto opatrenie?

- Okrem týchto je navrhnuté upraviť v texte EIAR pravidelnú zámenu medzi „skladovaním“ a „zneškodnením“ a „zaobchádzaním“ a „riadením“ (RO), tiež protirečiacim tvrdením v netechnickom zhrnutí („základnou menšinou odpadov budu veľmi nízko a nízko aktívne odpady“).

**Aspekty energetického hospodárstva**

V dnešnom prostredí globálnej ekonómie musia investori AE zvážiť niekoľko dimenzí rizika okrem základého rizika jadernej bezpečnosti. Z tohto dôvodu:

- Bolo by možné vyznačiť čo je stratégia riadenia rizika pre projekt EBO3?
- Ďalej je doporučené pozmeniť nadpisy:
  - Tabuľky A.II.1 a obrázku A.II.1 – miesto „Predpoveď vývoja hrubej spotreby elektrickej energie podľa scenárií energetickej politiky SR“ by sa mali nazývať „Predpoveď hrubej spotreby elektrickej energie podľa scenárií energetickej politiky SR“;
  - Oddiel A.II.6.5.2 by mala byť „Konečná spotreba energie“, a nie „Posledná spotreba energie“;
  - Tabuľka A.II.2 a obrázok A.II.2 – miesto „Predpoveď konečného vývoja spotreby elektriky podľa scenáru energetickej politiky SR“ by malo byť „Predpoveď vývoja konečnej spotreby energie podľa scenára energetickej politiky SR“.

# 1 EVALUATION OF THE SELECTED NUCLEAR TECHNOLOGY

The specific boundary conditions given in EIAR (section A.II.8.3.1) for the selection of the nuclear technology for the new NPP planned to be constructed on Bohunice site are the following:

- Generation III+ design;
- Rated power of the unit up to 1,700 MWe;
- Design lifetime – not less than 60 years;
- The design must be licenced in the country of origin, in EU country or other nuclear-developed country (USA, Russia, Japan, the South Korea, China, etc.) at least by the time of contractor selection and should be at least at the advanced stage of construction at another site;
- The construction of the NPP should be based on a turnkey contract or on delivery of technological islands under coordination of the contractor for the nuclear island;
- The supply of technology shall foresee the supply of nuclear fuel with provisions for diversification of fuel supply by different contractors;
- The licensing process shall comply with the legislative regulations of the Slovak Republic and utilizing experience and recommendations of the international institutions;
- The NPP shall work with baseload on the basic part of the daily load diagram and shall be provided with the access to the electricity transmission grid and could participate in the primary, secondary and tertiary active power regulation;
- The unit shall be capable to work on long-term with an output varying from 50 to 100% of the rated power and shall comply with technical requirements towards the connection of electric generation facility;
- The unit capability factor must be higher than 0.9 for a 12-month period.

In addition to these basic requirements, the new NPP unit shall be designed in compliance with the requirements established by the Nuclear Regulatory Authority of the Slovak Republic (UJD SR), IAEA, WENRA and EUR.

The main features of generation III+ NPP, depending on specific design, include the following:

- A standardised design to speed up licensing, reduce capital cost and reduce construction time;
- A simpler and more robust design that is easier to operate and less vulnerable to operational deviations;
- Higher availability factor - typically > 0,9;
- Longer operating life – typically 60 years;
- Reduced probability of core melt accidents – IAEA safety target for future plants is Core Damage Frequency (CDF) of $10^{-5}$, while calculated Large Release Frequency (LRF) is typically about ten times less than CDF, i.e. $10^{-6}$;
- Substantial grace period, so that no intervention of operators is required for (typically) 72 hours;
- Improved resistance to serious damage caused by an aircraft crash;

- Higher burn-up of nuclear fuel and thus reduction of generated RW;
- Extended use of burnable absorbers to extend fuel cycle;
- Possibility to use MOX fuel;
- 18 to 24-month cycle;
- Load-following capabilities;
- Reduced construction time (36-52 months).

According to section A.II.8.3.1.3 of EIAR, the following GEN III+ technologies are considered for the construction of the new unit:

- AP1000;
- EU-APWR;
- MIR-1200;
- EPR;
- ATMEA1; and
- APR-1400.

Some of the most important features of the above mentioned designs are presented in the following subsections.

**AP1000 (Advanced Passive) reactor** designed by Westinghouse Electric LLC represents an innovative line of development of power reactors. It is an advanced reactor with inherent safety features and wide application of passive safety systems using natural circulation, gravity force, spring loads or compressed gas pressure to achieve safety objectives in a manner independent from external energy sources and operator actions. The standard design of AP1000 obtained the certificate of U.S. Nuclear Regulatory Commission in 2006 and the compliance certificate from EUR.

AP1000 is a two-loop design PWR with a rated power of 3,415 MWth and 1,110 MWe net electrical output. Thermal efficiency of the unit is about 35%, and net thermal efficiency is 33%.

The design of AP1000 is based on nearly 20 years of research and development works and experience gained from 50 years operational experience of more than 100 NPP units designed by Westinghouse.

AP1000 emergency core cooling system has no active elements, such as pumps, fans, or emergency diesel generators, and there is no need for supporting systems such as Alternative Current power supply, heat removal by reliable service water system, ventilation system etc. Owing to that, there is no need for redundant safety systems with reliable electric power supply, which eliminates not only emergency diesel generators, but also the need for their auxiliary systems. As the quantity of systems is lower, it is easier to reach higher reliability of the whole plant.

Containment cooling in AP 1000 is completely passive and uses natural circulation of atmospheric air to remove the heat in case of Loss of Cooling Agent (LOCA) and loss of power. Heat transfer from the containment is enhanced by water flow which feeds using gravity force down from the reservoir on top of the containment shield building over the outer surface of the steel containment wall. System of passive reactor core cooling ensure reliable residual heat removal with no need for operator’s intervention even in the case of a severe accident during 72 hours after the accident.

In order to achieve high level of safety AP1000 employs numerous passive safety systems that include:

- Passive Core Cooling System;
- Containment Isolation;
- Passive Containment Cooling System;
- Main Control Room Emergency Habitability System;
- High Pressure Safety Injection with Core Makeup Tanks;
- Medium Pressure Safety Injection with Accumulators;
- Low Pressure Reactor Coolant Make from the IRWST (in-containment refuelling water storage tank);
- Passive Residual Heat Removal;
- Automatic Depressurization System.

For Beyond Design Basis Accidents, the design of AP1000 foresee In-vessel Retention of the molten core using high capacity in-containment refuelling water storage tank (IRWST) to fill in the reactor cavity and in that way preventing reactor vessel failure.

From a construction point of view, the design of the AP1000 has as intrinsic properties a modular design that foresees factory-based manufacturing and assembly of modules, improved quality pre-testing and inspection of modules and thus reduced field manpower and shortened construction time.

The core damage frequency (CDF) of the AP1000 is $5.09 \times 10^{-7}$ and the Large Release Fraction (LRF) is $6 \times 10^{-8}$ that meets the European Utility Requirement (EUR) target values.

**EU-APWR (Advanced Pressurized Water Reactor)** is a GEN 3+ reactor designed by Mitsubishi Heavy Industries, Ltd of Japan. EU-APWR is a four-loop PWR with a rated thermal capacity of 4,451 MW and an electric output of 1,700 MW. The design of the EU-APWR is based on the US-APWR developed for the US market using original APWR design for Japan. The plant possesses economic, safety and reliability features that are based on increased thermal power and use of 4-train safety systems, advanced accumulator tanks and digital instrumentation and control systems.

EU-APWR containment is designed to withstand Loss of Cooling Agent (LOCA) events. The EU-APWR safety-related systems, structures and components are designed to withstand aircraft crash and earthquake. The seismic design response spectra used for the design of the EU-APWR are based on the spectra defined by the modified US RG1.60 that exceeds the EUR Design Basis Earthquake spectra, which are valid for the potential nuclear sites in Europe.

EU-APWR use fuel with maximum of 5wt% U-235 enrichment, 24 months fuel with burn-up of 62GWd/t.

The improved operational and safety characteristics of EU APWR are based on:

- Enhanced safety with simplified and reliable safety systems;
- Mechanical four-train systems with direct vessel injection;
- Elimination of Low Head Safety Injection pump by utilizing advanced accumulators;

- Elimination of recirculation switching by In-containment refuelling water storage pit;
- Enhanced safety by four-train safety electrical systems;
- Enhanced on line maintenance capability.

The engineered safety features of the EU-APWR are based on a four-train configuration with an assumption of a single failure in one train and second train out of service for maintenance.

Passive accumulator system includes 4 advanced accumulators (ACCs) with respective valves and piping injects, in case of LOCA, borated water into primary circuit when the pressure drops below the accumulator operating pressure. The advanced accumulator incorporates an internal passive flow damper. ACCs inject a large flow of water into the reactor vessel at the initial phase of accident to fill in the reactor core and then automatically reduce the flow when the water level in the accumulator drops. Reduced flow injection in combination with safety injection pumps ensures core re-flooding and thus eliminates the need for a low pressure injection system.

EU-APWR unit is equipped with four 50% capacity emergency power supply systems. Use of 4 train design where two of four trains are required to ensure safe shutdown of the plant allows on-line maintenance of the plant's safety systems. Emergency power supply to plant's safety systems is provided by gas turbine generators that are used instead of diesel engines, as they have lower maintenance requirements and have less auxiliary systems.

The design of the EU-APWR foresees that the refuelling water storage pit is located at the lowest part of containment, and four recirculation sumps are installed at the bottom of the pit. Such a configuration simplifies the design and provides safety injection pumps and the containment spray/residual heat removal pumps with source of borated water.

For dealing with Beyond Design Basis Accident, the design of EU-APWR employs In-vessel retention of core debris by external Reactor Pressure Vessel cooling. Such external cooling is an efficient measure that prevents phenomena like steam explosions and Melted Core Concrete Interaction.

The core damage frequency (CDF) of the EU-APWR is $<10^{-5}$ while the Large Release Fraction (LRF) is $<10^{-6}$ that meets the European Utility Requirement (EUR) target values.

**MIR-1200 (Modernised International Reactor**) is a GEN III standardised VVER reactor designed by Gydropress of Russian Federation with participation of Skoda.

The rated thermal power of MIR-1200 is 3,200 MWth and the rated electric output is 1,170-1,200 MWe. The design lifetime of the plant is 60 years. The plant has an efficiency of 34.8% net, fuel cycle of 12-24 months and up to 70 GWd/tU fuel burn-up. The unit can operate in both base and load following modes within the range of power from 50% to 100% of rated capacity. The load factor is expected to be around 90% over 60 years of unit lifetime.

MIR-1200 design includes 4 safety systems channels that are fully and physically separated. The safety systems of this design use a combination of active and passive elements that includes:

- Hydroaccumulators;
- Low-pressure injection system;

- Emergency injection system;
- High pressure injection system;
- High boric acid concentration feed system;
- Spray system.

MIR-1200 is equipped with pre-stressed reinforced concrete double wall containment with hemispherical dome and reinforced concrete foundation plate. The containment is designed to withstand airplane crash.

In addition to safety systems' equipment, MIR-1200 units are equipped with special safety features that include:

- Core Catcher;
- Hydrogen Removal System (with passive recombiners);
- System of primary circuit overpressure protection;
- Passive Heat Removal System via Steam Generators;
- Passive Heat Removal System from Containment.

These safety features are designed to cope with Beyond Design Basis Accidents to prevent core melt, or, if occurred, to ensure long term cooling of the containment aiming to prevent containment failure and therefore, to prevent large uncontrolled radioactive release.

The construction period of a MIR-1200 NPP is expected to be ~54 months.

The Core Damage Frequency (CDF) of MIR-1200 is $5.8 \times 10^{-7}$ while the Large Release Fraction (LRF) is $2 \times 10^{-8}$ that meets the European Utility Requirement (EUR) target values.

**EPR (Evolutionary Power Reactor)** is a PWR reactor designed by AREVA NP (France). The thermal output of this 4-loop design reactor is 4,300 MWth with rated electrical capacity of 1,630 MWe and a fuel cycle length of 12-24 months. The system architecture of EPR is based on redundancy, physical separation and functional diversity. The combination of these 3 components is the basis for a robust and reliable design of an EPR NPP.

The main design features of the EPR include:

- Double wall containment;
- Four independent safety systems;
- Large cooling water inventory;
- Protected and separated reactor fuel pool;
- Flexible monitoring ensured by digital instrumentation and control systems;
- Diversified, separated and protected emergency power supply sources.

The EPR design foresees 4 separate independent and physically separated safety systems trains, where each safety train is designed in a way that any train could perform 100% of the required safety functions. Each safety systems train include:

- Reactor water injection system;
- Steam generator emergency feedwater system;
- Electrical and instrumentation and control systems.

Four trains design enables online maintenance of the plant's safety systems.

The EPR design approach to control severe accidents is based on the following features:

- Containment by-pass is excluded by design (containment integrity, depressurization and heat removal etc.);
- Exclusion of hydrogen phenomena (by use of catalytic recombiners);
- Corium spreading and cooling (by use of core melt retention system);
- Pressure inside the reactor building is maintained by containment heat removal system;
- Containment release filtering.

EPR also possesses specific operational features that increase competitiveness of the design:

- Flexible fuel cycle length (12-24 months);
- Low leakage core;
- Maximum enrichment of 5% of U-235;
- Burn-up of 55 to 65 GWd/tU;
- Manoeuvring capability;
- Capability for plutonium recycling (use of MOX fuel).

The construction period of the EPR is expected to be ~48 months.

The CDF of the EPR is 1.3-1.8 x $10^{-6}$ while the LRF is 1 x $10^{-7}$ that meets the European Utility Requirement (EUR) target values.

**ATMEA1** is a GEN III+ PWR designed by the joint venture of AREVA NP (France) and Mitsubishi Heavy Industries (Japan). The thermal output of this 3-loop design reactor is 3,150 MWth with a rated electrical capacity of 1,125 MWe and a fuel cycle length of 12-24 months. ATMEA1 represents an evolutionary design that use proven solutions used by AREVA and Mitsubishi Heavy Industries.

The reactor building of ATMEA1 is a simple containment type building made of pre-stressed concrete, designed to withstand airplane crash.

The ATMEA1 design foresees a combination of passive and active safety systems. Engineered safety features of the ATMEA1 possess the following characteristics:

- Three 100% capacity safety system trains;
- Additional 100% safety train for support systems with additional diversified heat sink;
- Airplane crash proofed design;
- Physical separation of the safety trains;
- Possibility for on-line maintenance.

Three safety systems trains are identical in design and their safety functions. Each safety system train includes medium head safety injection pump, advanced hydroaccumulator and containment spray/residual heat removal system.

For dealing with Beyond Design Basis Accidents, the design of ATMEA1 includes core catcher designed to accept the melted core in case of severe accidents and transform it into a coolable configuration. The design of the ATMEA1 core catcher is similar to the one of the EPR reactor.

The construction period of the ATMEA1 is expected to be ~48 months.

The CDF of ATMEA1 is $<10^{-6}$ while the LRF is $<10^{-7}$ that meets the European Utility Requirement (EUR) target values.

**APR-1400 (Advanced Power Reactor)** is a GEN III evolutionary design of the advanced light water reactor developed in the Republic of Korea. The design of APR-1400 is based on the design of standard 1,000 MWe OPR1000 PWR plant. The thermal output of this 2-loops design reactor is 4,000 MWth with a rated electrical capacity of 1,400 MWe and a fuel cycle length of 18-24 months.

The safety systems and features of APR-1400 are designed to be a hybrid system in which active and passive systems perform the necessary safety functions. The major safety systems are the safety injection system, safety depressurization and vent system, in-containment refuelling water storage system, shutdown cooling system, auxiliary feedwater supply system, and containment spray system.

The APR-1400 safety injection system has 4 independent trains that include:

- Safety Injection Pump;
- Safety Injection Tank equipped with a Fluidic Device.

According to the design, each train provides 50% of the injection flow rate for large LOCA (the break is larger than the size of a direct vessel injection line) or 100% of the required capacity for small and medium LOCA (the break is smaller than the size of a direct vessel injection line).

APR-1400 features to mitigate severe accidents include:

- Large dry pre-stressed concrete containment;
- Hydrogen Mitigation System;
- Cavity Flooding System;
- Ex-Reactor Vessel Cooling System;
- Safety Depressurization & Vent System;
- Emergency Containment Spray Backup System.

APR-1400 design applied the concept used in AP1000, which foresees external cooling of the reactor pressure vessel and thus preventing reactor vessel failure aiming to maintain the integrity of the third barrier against the release of fission products from the molten core. The cavity flooding system is designed to retain the molten core inside the reactor vessel and, if vessel breaks, to cool the molten core in the reactor cavity.

The construction period of the APR-1400 is expected to be ~48 months.

The CDF of APR-1400 is $2.8\times10^{-6}$ while the LRF is $7.19\times10^{-7}$ that meets the European Utility Requirement (EUR) target values.

In conclusion, it can be stated that:

- All proposed designs are Generation III/III+ reactors;
- All proposed designs are evolutionary PWR reactors;
- All proposed designs are characterized by low CDF and low LRF, thus complying with EUR target values;
- All proposed designs use different combinations of passive and active safety features.

However, none of the proposed design plants has operational experience, and the construction experience for some of the designs shows significant delays. In addition to these, while Fukushima accident is mentioned in the EIAR, the description of the reactor designs/nuclear technologies that are considered for the construction of the new NPP do not mention any post-Fukushima measure introduced by the vendors. It would be interesting to know how the developer plans to access and evaluate the implementation of stress-tests/post-Fukushima measures in the design of the considered reactors.

Another observation relates with the fuel burnup. The EIAR considers a fuel burnup up to 60 GWd/tU, but some of the new designs considered for construction of the new NPP foresee burn-ups up to 70 GWd/tU It would be therefore interesting to see how the developer plans to address this issue, as the fission products pattern for 60 and 70 GWd/tU will substantially differ and this will be reflected in the RW activity level.

# 2 EVALUATION OF COMPLETENESS OF INFORMATION PRESENTED IN EBO3 EIAR

According to the EIA Directive (EUROPEAN COMMISSION 2011b), the developer of any project subject to environmental impact assessment shall supply, in an appropriate form, the following information:

1) A description of the project, including in particular:
   a) A description of the physical characteristics of the whole project and the land-use requirements during the construction and operational phases;
   b) A description of the main characteristics of the production processes, for instance, the nature and quantity of the materials used;
   c) An estimate, by type and quantity, of expected residues and emissions (water, air and soil pollution, noise, vibration, light, heat, radiation, etc.) resulting from the operation of the proposed project.
2) An outline of the main alternatives studied by the developer and an indication of the main reasons for this choice, taking into account the environmental effects.
3) A description of the aspects of the environment likely to be significantly affected by the proposed project, including, in particular, population, fauna, flora, soil, water, air, climatic factors, material assets, including the architectural and archaeological heritage, landscape and the interrelationship between the above factors.
4) A description (covering the direct effects and any indirect, secondary, cumulative, short, medium and long-term, permanent and temporary, positive and negative effects of the project) of the likely significant effects of the proposed project on the environment resulting from:
   a) The existence of the project;
   b) The use of natural resources;
   c) The emission of pollutants, the creation of nuisances and the elimination of waste.
5) The description by the developer of the forecasting methods used to assess the effects on the environment referred to in point 4.
6) A description of the measures envisaged to prevent, reduce and where possible offset any significant adverse effects on the environment.
7) A non-technical summary of the information provided under headings 1 to 6.
8) An indication of any difficulties (technical deficiencies or lack of know-how) encountered by the developer in compiling the required information.

Thus, the completeness of the information provided in EIAR for EBO3 was firstly assessed against these requirements. The findings of this evaluation are presented below following the points as above listed:

1) An adequate description of the project is provided in Chapter A of EIAR, including the characteristics of the plant and the land-use requirements (also described in subchapter C.II.19.), the characteristics of the nuclear power generation process, as well as the nature and the quantities of the nuclear fuel to be used.

Estimates of the expected quantities of material to be used, as well as outputs like conventional waste, radioactive waste, spent fuel, radioactive airborne and liquid emissions and waste water are given in subchapters B.I and B.II, for both the construction and operation phase of the project. Noise and vibration loads, heat load on the Vah River, air pollution, soil pollution, surface and ground water pollution are estimated too (in chapter C).

The findings of the evaluation of chapters A and B of EIAR are provided in the Annex to this report.

2) The alternatives considered for EBO3 construction project are briefly presented in subchapter A.II.9, but only in general terms and mostly in connection with the Energy Policy of SR (2014) (SR 2014a) and the related strategy documents and government resolution. The developer concludes that construction of EBO3 is the only viable solution and furthermore, it is stated that the Ministry of Environment of SR has, on the basis of the developer´s request and evaluation of the facts listed in it, abandoned the requirement for assessment of alternatives. However, the information presented in EIAR are insufficient for a comprehensive evaluation of the alternatives and in particular of the selection made.

   The findings of the evaluation of this aspect are provided in the Annex to this report.

3) A detailed description of the aspects of the environment possibly to be affected by the proposed project is given in subchapters C.I. and C.II. These include the population, fauna, flora, surface and ground water, soil, geology, geomorphology, air, climatic factors, architectural and archaeological heritage, paleontological heritage, landscape, protected territories. However only the population outside the construction site and future operation site was considered; the impact on the EBO3 workers was not addressed, nor the impact of EBO3 operation of the workers of other nuclear facilities at the same site. As such, the interrelationship between these factors was addressed only to a limited extent, during the evaluation performed (when indirect impact was analysed for the purposes of evaluation of the impact on a certain environment element).

   The findings of the evaluation of this aspect are provided in the Annex to this report.

4) The impacts on the environment of the proposed project are described in subchapter C.III. Direct effects are presented in subchapter B.II. For some elements, short, medium and long-term effect are presented. Positive and negative effects are mentioned, whenever the case. Cumulative effect of the simultaneous operation of the existing plant V2 NPP and the proposed new one are also addressed, but only for normal operation. The effects of one plant to the other one in accident conditions are not estimated. The cumulative effect of more than one installation at Bohunice site (V2 NPP, A1 NPP and V1 NPP in decommissioning, RW processing and treatment facility, interim SF storage facility) being simultaneously affected by an accident is not considered at all.

   The findings of the detailed evaluation of these aspects are provided in Section 3 of this report.

5) The methods, the models and the computer codes used to evaluate the effects on the environment of the impact factors considered are described in subchapter C.VII, and also in the technical sections of subchapter C.III.

The findings of the detailed evaluation of these aspects are provided in Section 3 of this report.

6) The measures envisaged for mitigation of the adverse effects on the environment or for prevention of the possible adverse effects are presented in subchapter C.IV, and partially in subchapter C.III.19.

   The findings of the detailed evaluation of these aspects are provided in the Annex and partially in Section 3 of this report.

7) A non-technical comprehensive summary of the information presented in EIAR is provided in subchapter C.X.

   The findings of the evaluation of this aspect are provided in the Annex of this report.

8) No difficulties were encountered by the developer in compiling the required information, as it is stated in subchapter C.VIII.

   The findings of the evaluation of this aspect are provided in the Annex of this report.

Following this analysis, it can be stated that, with the notable exception of presentation of the main alternatives, the EIAR content covers the EIA Directive requirements. However, these requirements are rather general, since they are addressing all types of development projects. Specific content for an EIA report for development of new NPP is given in the IAEA Publication No. NG-T-3.11 (IAEA 2014). According to this, an environmental impact assessment report for a nuclear project development should address all environmental and socioeconomic impacts, with their nature, probability, duration, magnitude and significance, during the entire duration of the project (i.e. from construction to decommissioning of the NPP). A typical content for a NPP EIA report would be:

a) Summary
b) Introduction
c) Environmental impact assessment procedure and communication and participation
d) Description of the project
e) Description of the plant
f) Nuclear safety
g) Description of the environment
h) Environmental impact assessment for the project
i) Cumulative impact
j) Impact of irregular operation and accidents at the nuclear power plant
k) Transboundary impacts (depending on States)
l) Nuclear fuel production chain
m) Prevention and mitigation of adverse impacts
n) Environmental monitoring program.

Apart from the general aspects (a-e) which should be described in a manner similar with the EU general requirements, some specific points require more attention, as presented in the below paragraphs.

*Nuclear safety*

This section should include a review of the nuclear safety aspects of the plant, describing the nuclear safety requirements and principles as well as their implementation in the design, construction and operation of the NPP.

A general description of nuclear power plants technology envisaged for EBO3 with a presentation of general nuclear safety principles and regulatory requirements is given in subchapter A.II.8.2. Additional specific data and nuclear safety aspects and requirements which will be implemented in design, construction and operation of EBO3 are described in details in subchapter A.II.8.3 of EIAR.

The findings of the evaluation of the selected nuclear technology are given in Section 1 of this report.

*Environmental impact assessment for the project*

This section should describe the analyses performed in order to estimate the magnitude and important characteristics of the impact, for each of the construction, (normal) operation and decommissioning stage of the project.

For each development stage, the following impact factors should be addressed:

- Air, soil and water quality due to nuclear and non-nuclear releases;
- Aquatic flora, fauna and ecological values;
- Terrestrial flora, fauna and ecological values;
- Landscape and cultural environment;
- Traffic;
- Noise level;
- People and socioeconomic factors;
- RW and SF management.

While the construction of EBO3 is adequately considered in the EIAR, the analysis of the normal operation of the plant does not address the impact on the workforce due to the operational activities.

The impact during decommissioning of EBO3 is considered only at a level of general description, but this is acceptable (since decommissioning in itself requires a separate EIA).

The findings of the evaluation of the proposed solutions for RW and SF management are given in Section 4 of this report. The evaluation of all other impacts is presented in the Annex.

*Cumulative impact*

This section should include a description of other projects in the area and the combined impacts resulting from the addition of the new NPP, including the cumulative impact (in time) on environmental resources that continue to be affected.

While the latter is adequately analysed and presented in subchapter C.VII of EIAR, the cumulative impact of EBO3 and the other nuclear facilities on Bohunice site is presented only for the population off site and only for normal operation. The impact of other nuclear activities on the site on the workers that will be involved in the construction of EBO3 is not addressed. Nor the cumulative impact of all nuclear facilities on the outside (external) workers during the joint operation.

The findings of the detailed evaluation of the radiological impact assessment are given in Section 3 of this report.

*Impact of irregular operation and accidents at the nuclear power plant*

This section should describe the impacts on people and the environment due to design base accidents, beyond design basis accidents and severe accidents at the NPP, together with the impact area and the measures to address these impacts.

In the EIAR these issues are described in details in subchapter C.III.19. Basically two types of accidents are considered: design basis accidents and accidents with serious damage of nuclear fuel (severe accidents). For both types of accidents, acceptance criteria are presented in subchapter C.III.19.1.5. The methodology of the assessment of accident radiological consequences in presented in subchapter C.III.19.1.6. The results of the assessment are presented and analysed, and also the emergency preparedness arrangements are briefly described.

The findings of the detailed evaluation of the radiological impact assessment in case of accident are given in Section 3 of this report.

*Transboundary impacts*

This section should describe the possible transboundary impacts (e.g. impacts of accident situations, socioeconomic impacts such as employment, and impacts on a shared watercourse).

The EIAR provides a comprehensive description of the analysis of the transboundary impacts for normal operation (C.III.), including socioeconomic impacts (C.III.1.3.). A description of the analysis of the transboundary impacts of accidental situations is given in details in subchapter C.III.19.

The findings of the detailed evaluation of the radiological impact assessment in case of accident are given in Section 3 of this report.

*Nuclear fuel production chain*

This section should include a general description (not an assessment) of the nuclear fuel chain, which requires a separate EIA report.

The EIAR properly addresses this aspect (in subchapter A.II.8.3.4.1.). The findings of the evaluation of the proposed solutions for SF management are given in Section 4 of this report.

*Prevention and mitigation of adverse impacts*

This section should describe the measures envisaged by the project developer to prevent and to diminish significant adverse impacts of the project, such as:

- Engineering and planning alterations;
- Practice alterations for construction and operation;
- Habitat restoration;
- Financial compensation, etc.

The selection criteria for the proposed mitigation measures, in terms of cost, technical feasibility, legal possibility or social acceptability, should also be clarified in this section.

Section C.IV of the EIAR presents the basic design measures for the prevention, mitigation and eventual compensation of negative impacts of the proposed NPP, as well as a number of additional measures proposed for provision of supplementary protection of environment and public health, which are basically requested by the Slovak legislation as conditions for the further administrative proceedings, thus will be implemented during the next stages of NPP development. All the measures proposed are technically-economically feasible according to the developer. The findings of the evaluation of the proposed prevention and mitigation measures are given in the Annex of this report.

*Environmental monitoring programme*

This section should describe the environmental monitoring programme for the construction and operation periods, which should address the environmental elements that might be affected (groundwater, surface water, soil or biota). All these aspects are adequately considered in subchapter C.VI of the EIAR. The findings of the evaluation of the proposed environmental monitoring program are given in the Annex of this report.

Consequently, it can be stated that the content of the EIAR follows the EU requirements (EUROPEAN COMMISSION 2011b) and the IAEA guidelines (IAEA 2014), with the following notable exceptions:

a) The main alternatives to EBO3 are only generally presented, without a justification of the selection made;
b) The cumulative impact should be evaluated for all nuclear installations existing at the site and planned to be built on the site, not only for normal operation, but also for accident conditions; also, the impact of one installation on the other should be properly addressed.

In addition, it is suggested to evaluate also the radiological impact on the workers, although this aspect is not important from a transboundary perspective.

# 3 EVALUATION OF ESTIMATED RADIOLOGICAL TRANSBOUNDARY IMPACT OF EBO3 ON AUSTRIAN TERRITORY

The results of the assessment of radiological impact of EBO3 operation, in both normal and abnormal conditions, are given in section C.III.19.1 of EIAR. In the following paragraphs, the findings of the detailed evaluation of this assessment, focussed on the possible transboundary impact on Austrian territory, are presented, grouped in normal operation and accident conditions. Since the emergency preparedness and response arrangements are also presented in section C.III.19.1 of EIAR, an evaluation of the adequacy of these arrangements is also included.

## 3.1 Transboundary impact during normal operation

SR Government Regulation No. 345/2006 Coll. on Fundamental Safety Requirements for the Protection of Employees and Population against Ionizing Radiation establishes a dose constraint of 250 µSv/year of normal operation of all nuclear facilities situated on a site for any hypothetical individual living in the vicinity of that site.

In addition to this site dose constraint, authorized discharge limits were established by the Chief Hygiene Officer of SR, for each nuclear installation on Bohunice site. The operators of these nuclear installations shall ensure that the effective dose received by a representative person due to radioactive substances discharged into the air and surface water by each nuclear facility will not exceed the following dose constraints:

- 50 µSv/year for V2 NPP (in operation);
- 20 µSv/year for V1 NPP (under decommissioning);
- 12 µSv/year for all the other JAVYS nuclear facilities (A1 NPP under decommissioning, RW treatment and SF storage facilities in operation).

These result in a total dose constraint for the nuclear facilities currently existing on Bohunice site of 82 µSv/year. In order to comply with the site dose constraint, the radioactive effluents from the new NPP to be built on Bohunice site shall therefore be limited to 168 µSv/year in normal operation condition. This value is with one order of magnitude lower than the dose limit for population and it is line with the international standards and EU legislation and good practices.

According to the information presented in the EIAR, the radioactive effluents will be discharged from EBO3 into the atmosphere and the Váh River, in a controlled manner.

Airborne effluents will be discharged from the new NPP through the ventilation stacks of the units and auxiliary plants. The source term of airborne effluents was calculated in the EIAR as the envelope (maximum) annual activities of the emissions of each main group of radionuclides discharged into the air during the normal operation of the reference types of reactors, based on the publicly accessible data of the possible suppliers. As such, the maximum radioactivity expected to be discharged into the atmosphere by EBO3 in normal operation is:

- Noble gases: up to 6.2E+13 Bq/year;
- Tritium: up to 6.7E+12 Bq/year;
- C-14: up to 1.0E+12 Bq/year;
- Iodine: up to 2.5E+09 Bq/year;
- Aerosols: up to 1.9E+09 Bq/year;
- Ar-41: up to 1.3E+12 Bq/year.

These values are further divided (in Table B.II.8) per specific radionuclides. Comparing these values with the source term of a MIR-1200 reactor given in the EIAR for Paks II NPP, it was noticed that the activity of H-3 is slightly lower (6.7 E+12 for EBO3 compared with 7.8E+12 for MIR-1200), and also the activities of Xe-135 and Xe-138 are lower by 3 orders of magnitude, respectively by one order of magnitude. Therefore, it should be clarified how the source term for airborne discharges in normal operation of EBO3 was calculated.

Liquid effluents will be discharged from the new NPP into the Váh River through a new waste water collector channel. The source term of liquid effluents was estimated in the EIAR in similar manner as for airborne effluents. The maximum radioactivity expected to be discharged into the Váh River by EBO3 in normal operation is:

- Tritium: up to 7.5E+13 Bq/year;
- Corrosion and fission products: up to 1.0E+10 Bq/year.

In addition to these estimated source terms of radioactive discharges, for the assessment of the radiological impact of EBO3 in normal operation, the radioactive discharges from all other units existing on the site were considered, in terms of the maximum values measured by the operators of these facilities. As such, to the airborne discharges' source term estimated for EBO3 the following activities discharged into the atmosphere by the existing facilities were added:

- Noble gases (including Ar-41): up to 1.4E+13 Bq/year;
- Tritium: up to 8.0E+11 Bq/year;
- C-14: up to 4.5E+11 Bq/year;
- Iodine: up to 4.6E+05 Bq/year;
- Aerosols: up to 7.1E+07 Bq/year.

These values were calculated in the EIAR by summing up the maximum measured values of each particular radionuclide emitted by V2 NPP between 2003 and 2013 and the maximum measured values of each particular radionuclide emitted by V1 NPP, A1 NPP, RW treatment and SF storage facilities between 2009 and 2013.

In a similar manner, to the liquid discharges' source term estimated for EBO3 the following activities discharged into the surface waters at Bohunice site by the existing facilities were added:

- Tritium: up to 1.2E+13 Bq/year;
- Corrosion and fission products: up to 2.2E+08 Bq/year.

The assessment of the radiological impact of normal operation of EBO3 was performed with both source terms: for the case of single operation of the new NPP, as well as for the case of simultaneous operation of all nuclear facilities on the site. The calculation of doses was performed using a computer code (RDEBO) which, according to the developer, is accepted by the Nuclear Regulatory Authority of SR (UJD SR), as well as by the State Nuclear Safety Authority of the Czech Republic (SÚJB). However, no information about the validation of this code is given in the EIAR.

With this computer code, the individual effective doses as well as the equivalent doses (to gonads, bone marrow, lungs, thyroid, digestive tract and skin) were calculated for six age groups of the population (infants up to 1 year, children between 1-2 years, 2-7 years, 7-12 years, young between 12-17 years and adults).

The following exposure paths are considered:

- External exposure – through immersion in the plume and exposure to deposited radionuclides;
- Internal exposure to airborne radioactivity – through inhalation and ingestion of radionuclides entering the food chains via atmospheric fallout;
- Internal and external exposure to radionuclides dispersed in water – through bathing in surface waters receiving liquid effluents, boating on such water, direct exposure to contaminated banks, soil irrigated by contaminated water, ingestion of drinking water, fish from surface waters receiving liquid effluents, meat and milk from animals fed by such waters and agricultural products irrigated by such water.

The contribution of ingestion to the annual individual effective doses was calculated as a lifetime committed dose (50 years for adults and 70 years for children) due to ingestion of contaminated food, using the conservative assumption that all the food is produced in the impact area. As consumption rates, statistical data for SR were used, as well as the "farmer consumption rates" for Austria (as defined by the Austrian side during the "Melk process" for Temelín NPP assessment) were used. Since calculation with the Austrian consumption rates led to slightly higher values for the committed dose these values were used for the conservative estimation of doses for the whole impact area.

In addition, other conservative assumptions were used for calculation of doses, such as the minimum height of the ventilation stack (which results in slightly higher doses), no buildings' shading effect, no indoor attenuation, and real ground surface roughness (according to the local conditions around Bohunice site).

Real meteorological data from the Bohunice meteorological station were used for the calculations, i.e. hourly data (wind speed and direction, atmosphere stability category and atmospheric precipitation intensity) recorded in 2010. The reason of selecting this year as a reference year given in EIAR is that the meteorological data for this year are complete. However, for comparison purposes, calculations were also performed with the average values of probabilities of simultaneous occurrences of atmosphere stability category and wind speed and direction for the period 1999-2010. The differences between the results obtained with the 2010 data and with the 1999-2010 averages are very small (below 5%). According to the meteorological data reported in EIAR, the predominant wind direction in 2010 was from North, while in 1999-2010 it was from the North-West.

The calculations were performed for the whole area surrounding the Bohunice site, up to 110 km (in order to provide data for the radiological impact on territories of the Czech Republic, Hungary and Austria). The area was divided into 192 zones delimited by circular sectors of 22.5° (i. e., into 16 directions) and annuli with radii starting from 1 km to 110 km.

The results of the calculations shows that the maximum annual effective dose (1.76 μSv/year) due to all radioactive discharges (from all existing nuclear facilities at the site plus the new NPP) will be received by an infant living at the distance of 7-10 km from the site in the South-East direction. For the territory of Austria, the calculated doses are two orders of magnitude lower than this value (namely 0.01 μSv/year), so it can be concluded that the radiological impact on Austrian territory during both the normal operation of the new NPP as well as during the joint operation of all nuclear facilities in normal conditions will be insignificant.

The assessment performed by the proponent, the type of the input data used for calculations, the assumptions made in this respect, as well as the quantities calculated are found adequate, in line with the international standards and good practices.

## 3.2 Transboundary impact during accident conditions

The radiological consequences of accident conditions at EBO3 were assessed up to a distance of 110 km from the reactor, so as to include foreign territories too. The results of the assessment are presented together with the selection of the reference accidents, the acceptance criteria defined by the Slovak legislation, as well as WENRA, EUR and IAEA, and the intervention criteria established by Slovak legislation.

The safety characteristics of reactors of the generation III+ are correctly presented as significantly lower than the risks which are typical to II generation. The division of accidents into:

- Abnormal operation;
- Emergency conditions:
  - Design basis accidents;
  - Accidents in design extension conditions:
    - Accidents during which is prevented serious damage of nuclear fuel (mainly multiple failures);
    - Accidents with serious damage of nuclear fuel (severe accidents).
- Conditions during which could occur early or large leakages of radioactive substances into the environment shall be practically eliminated (practically eliminated conditions);

is correct and the description of acceptance criteria set by various organisations for each class of accidents is right. The reference accidents are correctly characterized. The intervention levels are in line with the international ones (IAEA 2002).

In discussion of source terms for accidents the division of fission products into 9 radionuclide groups is correct, their characteristics are right, in particular the specification of iodine species is in agreement with the actual results of experimental studies and with the EUR guidance. The only radionuclide for which the assumed release value is slightly below the value used in VVER estimates is Ru-103, but this can be expected, because Russian estimates of Ru-103 releases are two orders of magnitude higher than the releases estimated in US literature and this difference has been observed also in previous Russian and US reports. The value of Ru-103 release chosen for EBO3 is 2.5 times lower than in VVERs, but 80 times higher than in US accident source terms. Since this radionuclide plays only secondary role in overall radiological hazards, this possible discrepancy does not change the overall strongly conservative estimate of accident source terms.

However, it is not clear why it was necessary the determination of the accident source terms, as long as the safety analysis documentation was available. Moreover, EIAR recognizes that the accident source terms were calculated using conservative assumptions, overly conservative in our opinion, "*while actually available projects provide significantly more optimistic and even several times lower source terms*". Indeed, the accident source terms for MIR-1200 (as given in Paks II NPP EIS) are 2-3 orders of magnitude lower. Therefore, it can be already assumed that the real radiological consequences would be significantly smaller than those presented in the EIAR.

The estimation of the radiological consequences of the design basis accidents was performed using the computer codes RTARC and RDEBO. The RTARC software is accepted by UJD SR and it is a validated computer code; details about its verification and validation are included in EIAR. The code calculates individual effective doses and equivalent doses to selected organs, for 6 age groups of population, based on local, time dependent concentrations of radionuclides in the air and on the ground. The exposure pathways considered for calculations were:

- external exposure through immersion into the radioactive cloud,
- external exposure to radionuclides deposited on the ground,
- internal exposure through inhalation of radionuclides during the passage of the cloud and inhalation of radionuclides resuspended from the ground.

The program models the local geographical conditions, terrain roughness and different meteorological situations, and it also includes a module for evaluation of radiological consequences on long distances (higher than 40 km). Since RTARC does not calculate the contribution of ingestion of contaminated food to the individual effective doses, the RDEBO code was used.

A number of conservative assumptions were used for the calculations of doses, such as a person siting 24 h/d under the centre line of the radioactive cloud, no shelter inside buildings, consumption of food only from the contaminated area, no attenuation by the Carpathian Mountains. For the determination of the contribution of ingestion, the Slovak consumption rates were used within 40 km distance from the NPP, while at higher distances the Austrian consumption rates were used.

The doses to population were calculated at various distances from the plant, starting from 0.5 km up to 110 km, in circular rings of 20 km width. The calculations were performed for 3 different meteorological situations:

- Atmospheric stability F without precipitation (the most stable atmosphere, characterized by the lowest dispersion on both horizontal and vertical direction, thus leading to maximum concentration of radionuclides and maximum doses around the NPP);
- Atmospheric stability D with 5 mm/h precipitation on all areas around EBO3; and
- Atmospheric stability D with 5 mm/h precipitation on the areas starting 40 km away from the plant (representing the conservative case for estimation of transboundary impacts, since in this situation the radioactive deposition will be maximum due to rain washout).

The results of the calculations of doses to population in case of the selected design basis accidents in each of the above mentioned situations show, for the territories situated further than 40 km from the plant (including Austria), the following:

- In case of a design basis accident initiated in reactor cooling system (ground release from the containment), the maximum effective doses at distances higher than 40 km will reach 0.380 mSv/year (without ingestion) and respectively, 0.640 mSv/year (with ingestion). The critical group is represented by children (2-7 years age) located in the annular area 50-70 km from EBO3 (in atmospheric stability class F);
- In case of a design basis accident followed by a release through the ventilation stack (fall of a fuel assembly in the spent fuel storage pool during refuelling,) the maximum effective doses at distances higher than 40 km will reach 0.220 mSv/year (without ingestion) and respectively, 0.221 mSv/year (with ingestion), in the annular area 50-70 km from EBO3 (in atmospheric stability class F). The EIAR states that the critical group is represented by 2-7 years old children, but this can’t be checked since other results (for other age groups) are not presented.

All these results are lower than the intervention levels, and even than the 1 mSv/year dose limit for population (which is applicable in normal operation of the plant). Therefore, based on this, it can be stated that the considered design-basis accidents will not affect Austria. Moreover, all the other results presented in EIAR show that Slovak requirements, EUR requirements, WENRA requirements and IAEA requirements will be observed (no urgent protective measures necessary to be implemented off site).

The evaluation of radiological consequences of severe accident was performed with the probabilistic computer code COSYMA, which is accepted by ÚJD SR for the evaluation of radiation effects of severe accidents, as well as by EC. The results of this software are given in terms of statistical characteristics of the calculated doses on all exposure pathways (including ingestion of contaminated food): average values and standard deviations. Similar conservative assumptions were used in this case too, as in the case of modelling design-basis accidents. The calculations were performed without consideration of protection measures (e.g. sheltering, iodine prophylaxis, etc.) and then also with consideration of protection measures, in order to enable the calculation of avertable doses. However, there is no explanation given in EIAR on why for modelling the radiological consequences of severe accidents another computer code was used than in case of design-basis accidents, or why PC COSYMA (which is a validated code accepted by EC) was not used also for modelling the design basis accidents consequences.

The EIAR presents the average values and the values corresponding to 95 % of the quantile of the projected individual effective doses (to be incurred in 2 days, 7 days, 1 year and lifelong), lifelong equivalent doses and avertable doses to thyroid, as well as lifelong individual effective doses (including ingestion of contaminated food). It is not clear why average values and values corresponding to 95% quantile were selected for presentation; maximum values or at least values corresponding to 99% quantile would have been more appropriate.

Based on the average values, EIAR concludes that at distances higher than 800 m from EBO3 it will not be necessary to implement urgent protective measures. At distances higher than 40 km, the individual effective doses (projected for 2 days, 7 days and one year) are in the range of few µSv, while the avertable committed doses to thyroid are in the range of few tens of µSv (maximum 50 µSv at the Austrian border), thus lower than the intervention levels.

Based on the values corresponding to 95% quantile, urgent protective measures will have to be implemented up to 1 km from the plant. The EIAR mentions that the real doses are expected to be lower than the values calculated, due to the fact that the source term for severe accident is sufficiently conservative and thus, the EUR requirement (no need for urgent protective measures at distances higher than 800 m) will most probably be fulfilled. At distances higher than 40 km, the individual effective doses (for 2 days, 7 days and annual) are in the range of few tens of µSv, while the avertable committed doses to thyroid are in the range of few hundreds of µSv (maximum 285 µSv at the Austrian border), also below the intervention levels.

All calculated doses that are applicable to Austrian territory are below the intervention levels (BMLFUW, 2007). However, the time integrated concentrations in the air and maximum levels of surface contamination presented in table C.III.64 show rather high values, up to 9.33E+08 Bq.s/m$^3$ and respectively, 20,000 Bq/m$^2$ at 60 km from the plant, decreasing at higher distances. Using the contribution to ingestion doses of the radionuclides specified in EIAR (Cs-137 20%), which is not necessarily correct, it results a value of 4,000 Bq/m$^2$ of Cs-137 for the ground deposition. This value is 6 times higher than the threshold value for selection of the sampling strategy in case of emergencies in Austria (650 Bq/m$^2$ according to (SKKM 2010)). Therefore, it is necessary to clarify what is the exact contribution of each radionuclide (I-131 and Cs-137 in particular) to the time-integrated concentration in air and ground deposition in case of severe accident, as well as for the considered design basis accidents, in order to allow a direct comparison with the Austrian threshold values above mentioned. In addition, it would be necessary to see the effective doses projected for 2 days and 7 days, as well as the avertable committed doses to thyroid for design basis accident too, in order to allow a direct comparison with the intervention levels.

The radiological consequences of a severe accident are also estimated in EIAR in the case of maximized fallout of radionuclides on the water reservoir near Váh River, which may happened in case of heavy precipitation after the passage of the radioactive cloud over the water reservoir with consequent contamination of Váh River and then Danube River (downstream Austria). The results of the calculations performed show that the intervention levels for urgent protective measures will not be exceeded, the doses being in fact lower than 1 mSv/y. Due to subsequent transport of the radionuclides entered into the water, from Sĺňava water reservoir in the direction of the flow of Váh River into Danube River in Hungary, the EIAR states that there is a risk for groundwater contamination. Therefore, doses due to ingestion of contaminated drinking water pumped out from underground in the vicinity of Sĺňava and the confluence of Váh and Danube. The maximum calculated values will reach 18 µSv/year (in case of high waters).

## 3.3 Other risks

In additions to the design-basis accidents and severe accident affecting EBO3, other risks are presented in EIAR, including: aircraft crash, explosion connected with shock wave, clouds of combustible vapours, toxic chemical substances, fires, violation of water intake structure, contamination by noxious liquids, as well as terroristic attack.

The preliminary (qualitative) assessment performed for the purposes of EIA shows that the new NPP will not be significantly endangered by any of the risks resulting from human activities in the locality. The main buildings of EBO3 will be designed so as to resist against shock waves, aircraft falls, fires, flooding, loss of power supply by external sources, water and other external impacts. In this respect, the plant will be equipped with technical means to prevent penetration of radioactive, toxic or explosive substances into the control room, even in case of severe accident on the other nuclear facilities on the site. According to EIAR, the confirmation of these conclusions will be proved in the safety documentation that will be prepared for the next stages of permitting. One important mention here is that the possible accidents affecting the other nuclear facilities on the site leading to radioactive releases into the environment are recognized as a “specific source of threat”, but these sources will also be assessed in further stages of permission process. However, as along as the EIA Directive and IAEA guidelines require the assessment of cumulative impact, the assessment of the radiological consequences for accident conditions should have been done also for the parallel operation of all nuclear facilities on the site, exactly like it was done for normal operation, especially because an accident due to an external event affecting more than one installation can lead to more serious consequences than in case of only one installation.

Regarding the aircraft crash, EIAR specifies that the assessment performed in 2011 for V2 NPP shows a probability of 5.24E-08/year. Using this value and the comparison of the V2 impact area with the impact area of the biggest containment (of the 6 reactor models envisaged for EBO3) results a probability of accidental hitting of EBO3 containment by a falling aircraft at the level of 1E-08/year. Following the IAEA specific guidelines, if the probability is lower than 1E-07/year, there is no need for further (detailed) assessment.

For a terroristic attack, EIAR specifies that a malevolent targeted impact of a big transport or military plane can be considered as an envelope case. All suppliers of the 6 reactor models envisaged for EBO3 confirmed the resistance of their units against aircraft crashes, including a big transport plane. This declared resistance shall be proved in the further phases of the permitting process. However, due to national security purposes, the detailed analysis of the impact of aircraft crashes, sabotage, or terroristic attack can't be presented in a public document (such as an EIAR), according to the national legislation of the SR.

## 3.4 Emergency preparedness and response

Emergency preparedness and response arrangements are described in section C.III.19.1.11 of EIAR, where the internal and external emergency response plans are described, in very general lines though.

For instance, it is stated that "*internal emergency plans of the operator and related documents are developed to assure the protection and the preparation of employees for the case when important release of radioactive substances into working environment or the surrounding environment occurs* […]". Since on Bohunice site there are several nuclear installations, in different stages of operation, it would be interesting to know if the future operator of EBO3 will develop a stand-alone response plan (in which case it should be made a correlation with the other nuclear installations' response plans) or the necessary response arrangements for EBO3 will be integrated into an on site response plan (of the whole site, if such a plan exists). In the later case, it would be also interesting to know who is developing the on site response plan, since the nuclear installations located on Bohunice are operated by different operators. Important aspects are also the approval of the plan(s), and how it is verified the correlation of the plans (if case).

According to EIAR, the operator has to submit the "support documentation" (presumably, the internal response plan) to the local authorities, who are in charge with the establishment and implementation of a population protection plan. In case of an emergency, the operator has to asses the evolution of the technical situation inside the affected installation, determine the source term, collect and analyse the values measured by the teledosimetry system, the first measurements of radiation situation around the facility and the meteorological data, and has to notify accordingly the competent authorities and organizations in the "area of threat" in case of a 2nd level event (emergency on the nuclear facility site) and has also to warn the population in case of a 3rd level event (emergency in the nuclear facility surroundings). According to the Slovak legislation, the "area of threat" is defined as "*the area in the surrounding of nuclear facility, where the need to perform the activities for population protection is supposed, during the accidents of nuclear facility*". For the operating V2 NPP, this area was established at 21 km around the plant, centred on the ventilation stack of the plant. For the future NPP, the size of the area will be established during the permitting process.

The protection measures will then be taken on the territories affected or potentially affected by the radioactive releases by the authorities of state administration, local administration and municipalities. For the notification of population in the area of threat of V2 NPP a warning system was developed by the operator. This system receives data from the radiation monitoring system of V2 NPP and it is planned that the output from radiation monitoring system of EBO3 will be integrated into the system.

At international level, the notification of IAEA, EC and neighbouring countries (Austria, Hungary, Czech Republic, Poland and Ukraine) will be performed by UJD SR, using the USIE system, ECURIE system and respectively, the communications lines established with the contact authorities of each country with which SR has signed a bilateral agreement for early notification of nuclear accidents and information exchange in the area of nuclear safety.

## 3.5 Conclusions

Based on all of the above, it is concluded that a detailed assessment of the radiological impact of EBO3 operation was performed and that the assessment methods follow the international standards and recommendations, showing in most of the cases compliance with the acceptance criteria established by international organisations. All doses calculated for distances higher than 40 km (which are relevant for Austria) are below the intervention levels (BMLFUW 2007). However, some aspects need further clarification.

First, it would be necessary to understand what sources (publicly available or provided by the possible suppliers) were used by the developer in order to determine the "envelope" source term for normal operation (which for some radionuclides shows lower values than the source term of one the reactor models envisaged for EBO3 – MIR1200).

Same question for the accident source terms, where it is necessary to clarify why a calculation of the source terms was performed, as long as in some parts of EIAR it is mentioned that the safety documentation was made available by the possible providers to the developer.

It is also advisable to get more information about the validation of the RDEBO computer code. Related to this, it would be necessary to know why 2 different codes were used for estimation of radiological consequences of DBA and severe accidents, and in particular why PC COSYMA (which is a validated code, accepted by EC) was used only for sever accidents.

If possible, maximum values or at least values corresponding to the 99% quantile provided by PC COSYMA for the doses calculated in case of severe accidents should be presented.

In addition to these, the contribution of Cs-137 and I-131 to the time-integrated concentration in air and ground deposition in case of design basis accidents and severe accidents need to be presented, in order to allow a direct comparison with the Austrian threshold values.

The effective doses projected for 2 days and 7 days, as well as the avertable committed doses to thyroid should be presented for design basis accidents too, in order to allow a direct comparison with the intervention criteria.

The cumulative impact of the nuclear installations on Bohunice site (EBO3 plus the existing ones) should be assessed not only in case of normal operation of all facilities, but also for accident conditions affecting all facilities

Regarding the emergency preparedness, it is necessary to specify the following:

- If the future operator of EBO3 will develop a stand-alone response plan (in which case it is necessary to describe how this plan will be correlated with the other installations' plans) or the necessary response arrangements for EBO3 will be integrated into an on site response plan (if such a plan exists);
- In case an on site response plan exists:
  - Who is in charge with its development;
  - Who is in charge with its approval; and
  - How its correlation with the off site response plan is verified.

# 4 EVALUATION OF PROPOSED RW AND SF MANAGEMENT SOLUTIONS FOR EBO3

## 4.1 Legal framework

According to the information given in the EIAR (sections A.II.6.3) which were verified against the National Report of SR to the Joint Convention (UJD 2014), the basic concept of RW and SF management in SR is given in the updated "Strategy for the back-end of the peaceful use of nuclear energy", approved by the Resolution of the SR Government No. 26/2014 of January 2014. This strategy was updated in October 2013 by the National Nuclear Fund for Decommissioning of Nuclear Installation and for Management of Spent Nuclear Fuel and Radioactive Waste (an independent legal entity under the Ministry of Economy, in charge with collecting and administration of the financial resources determined for the back-end of nuclear energy). The updated strategy set up the direction of development in the areas connected with the back-end of nuclear energy use, decommissioning of NPP, RW and SF management, as well as the funding mechanisms of the related individual projects and activities. Details on the method of collection and payment of mandatory contributions, including their calculation are specified by the SR Government Regulation No. 312/2007 Coll.

At the time of developing the EIAR, the Strategy for the back-end of the peaceful use of nuclear energy was under the legislative procedure for approval of a new update, in the form of a National Policy and National Program of the Spent Fuel and Radioactive Waste Management in SR. Since then, the Government of SR approved the National Policy and the National Programme by the Resolution No. 387/2015 on 8 July 2015. Also, in order to fulfil the obligations of SR pursuant to Art. 14 (1) of the Waste Directive (2011/70/Euratom), a national report has been issued (UJD 2015) describing the implementation of the Directive. According to this report, the Waste Directive was transposed in SR by the Act No. 143/2013 Coll. amending the Act No. 541/2004 Coll. on the peaceful uses of nuclear energy (Atomic Act), and the Act No. 238/2006 Coll. on the National Nuclear Fund for Decommissioning of Nuclear Installations and for the Management of Spent Nuclear Fuel and Radioactive Waste (Act on Nuclear Fund). The general requirements for management of RW and SF are defined in the Atomic Act, while the Order of UJD SR No. 30/2012 Coll. provides the detailed requirements for management of nuclear material, radioactive waste and spent nuclear fuel.

Based on the EIAR, the National Program of SR defines the necessary steps to achieve the usual goals for a safe management of RW and SF (safe and reliable decommissioning of nuclear facilities, minimization of RW generation, provision of appropriate fuel cycle selection, safe storage of RW and SF, assurance of nuclear safety, application of graded approach, application of "polluter pays" principle, etc.) and it also includes a detailed balance of production of RW and SF from all nuclear power facilities in Slovakia including the ones under decommissioning and the Mochovce 3 and 4 units under construction, but not the new EBO3. As long as the National Program includes also the balance of RW storage capacity and the needs to expand it, it would be interesting to know why the RW and SF to be generated by the new NPP were not taken into consideration and in particular if the proposed extensions considered the RW and SF amounts to be generated by EBO3 too.

## 4.2 Estimates of RW and SF quantities to be generated by EBO3

The EIAR estimates up to 35.0 t $UO_2$/year to be generated by EBO3, which means 53 fuel assemblies per year. The current production of SF from V2 NPP, which is currently the only plant on Bohunice site generating SF, is up to 20.0 t of $UO_2$/year. The overall production of SF (during simultaneous operation of EBO3 and V2 NPP) will then reach about 55.0 t of $UO_2$/year.

The overall volume of RW estimated for EBO3 is up to 125 $m^3$/year. According to EIAR, this value represents a conservative envelope value, based on the production per unit of about 50-70 $m^3$/1,000 MWe of the installed capacity per year and the envelope data provided by the suppliers of the reference units. The RW that will be generated by the new NPP will mainly consists in concentrates from the vaporising station, spent ion exchangers and sludge, filters of active air systems, used measuring probes and sample cartridges, further contaminated unusable parts, protection equipment and clothes, selected materials from the monitored zone, etc. Based on the Slovak classification of RW (which is in line with the IAEA classification), only VLLW, LLW and ILW will be produced. The great majority of the waste will be VLLW and LLW, which will be, after treatment, disposed of in a near surface repository. V2 NPP generates up to 25 $m^3$/year of liquid RW, including up to 20 $m^3$ of radioactive concentrates, 5 $m^3$ of spent sorbents and an insignificant amount of radioactive oil; in addition to this, V2 generates up to 15 ton of solid RW, showing a decrease trend.

## 4.3 SF management solution for EBO3

According to (UJD 2014), the current concept of SF management in SR can be summarized as follows:

- Nuclear reactors operated in SR apply open fuel cycle;
- Export of SF for reprocessing abroad with return of RW to SR is not considered;
- Short-term storage (for 3-7 years after being removed from the reactor) in the SF pools next to the reactors, which are located at each reactor unit;
- Long-term storage (for 40-50 years after its utilization in the reactor) in a separate storage facility at Bohunice site, operated by JAVYS (Interim Spent Fuel Storage);
- Building an interim storage facility (for storage for 60-70 years) and a deep geological repository in SR, as long-term goals;
- Possibilities are verified to export SF for permanent storage abroad, or for reprocessing abroad without returning the reprocessing RW back to SR;
- Possibilities are verified for international or regional solution for final disposal of SF.

Following this concept, the SF management solution for EBO3, as described in section A.II.8.3.4.1 of the EIAR include:

- Purchase of fresh fuel assemblies on the world market which can offer sufficient supplies for the planned EBO3 lifetime;

- Transport of fresh fuel to the NPP by rail or by road, in transport overpacks;
- Storage of fresh fuel in the power plant stores, either in dry storage bins in a fresh fuel store or in storage positions below water in a separate part of the spent fuel pool;
- The exchange of the used fuel assemblies in the reactor will be carried out periodically, during the operational shutdown (once in 12, 18 or 24 months); when exchanging the fuel only a part of it will be removed, while the rest of fuel assemblies will change the position within the core; the entire exchange will be carried out gradually, in the course of several years (usually 4 to 6);
- After being taken out of the reactor, the SF is transferred to the spent fuel pool, located either next to the reactor in the reactor hall or in the fuel storage auxiliary building connected to the reactor hall by a transport corridor; the SF pool size has to be sufficient to accommodate the SF produced in the course of at least 10 years and it should always provide sufficient free space for storage of all fuel extracted from the reactor core in case of need; the SF should be stored in the pool below sufficient water containing boric acid and in a compact storage grid containing neutron absorption materials;
- From the pool and only after meeting the requirements for safe transport and storage, the SF will be handed over to JAVYS (a legal body authorized to store RW and SF) for interim storage in a dedicated facility – the Interim SF Storage Facility (ISFS), in operation at Bohunice site since 1987, originally design as a wet storage; the storage capacity of ISFS will be expanded, most probably by connecting a modular dry storage facility; currently, the extension of ISFS is under the EIA process;
- For the back-end of the fuel cycle, the strategy documents of SR seems to be in the favour of direct disposal in a deep geological repository, to be built either in SR either as an international facility.

Based on (UJD 2014), the systematic development of a deep geological repository for disposal of SF and HLW started in SR since 1996. Till 2001, a number of activities were performed in this respect, including design and implementation activities, development of source term, assessment of near and far interactions, siting studies, safety analyses, public involvement. Five candidate sites were selected, where basic field research was performed. In addition to that, partial reports summarized international experience in the deep geological repository development, directions and plans in all areas were set, expert teams for solution of individual issues were established, and co-operation started with organizations dealing with deep geological disposal in Belgium, Switzerland, the Czech Republic and Hungary. For continuation of these activities, the Strategy for the back-end of the peaceful use of nuclear energy of SR provides in principle for the evaluation, by 2020, of developments in the area of international repository and, depending on these, to take a decision to continue following this direction or abandon the idea of deep geological repository shared with another country (countries). A final decision on siting of a deep geological repository is expected to be taken around 2030, being followed by an application for siting a deep geological repository, which will be preceded by the EIA process; the procedure for issuing a building permit will take place about ten years after issuing the decision on siting, and the deep geological repository will be put into operation only after 2065.

## 4.4 RW management solution for EBO3

According to (UJD 2014), the current concept of RW management in SR can be summarized as follows:

- Maximal utilization of the current technological equipment for treatment and conditioning of radioactive waste existing at Jaslovské Bohunice (Technology for Treatment and Conditioning of Radioactive Waste) and Mochovce (Facility for Final Treatment and Conditioning of Liquid Radioactive Waste);
- The basic methods for solidification of liquid RW, radioactive sludge and spent ion exchange resins into a suitable form for final disposal are: cementation, bituminization and solidification in a geopolymer matrix and incineration;
- The volume of solid RW is minimized by compacting, incineration and preventive measures;
- Treated liquid or solid RW is placed in fibre concrete containers filled with cement mixed with concentrates, suitable for transport, storage and also disposal of RW;
- For treatment of ILW or RW with high trans-uranium content, vitrification technology is available;
- VLLW will be disposed at the repository, which will be built at the Mochovce site in the premises of the National RW Repository;
- For processing and treatment of metallic RW, the available technology is used (high pressure compacting, cementation, etc.); in case of an increase in metallic RW, a melting unit for its treatment and further recovery will be built; low activity metallic waste shall be treated by fragmentation and decontamination with subsequent clearance;
- Separation of materials before clearance (in particular building material);
- Long-term storage of RW possible only in specially adapted premises approved by the regulatory authorities; RW designed for long-term storage shall be stored in solid form in suitable containers;
- Conditioned RW from the operation and decommissioning of NPP, as well as conditioned institutional RW that meet the acceptance criteria shall be disposed at the National RW Repository in Mochovce;
- RW not acceptable for disposal at the National RW Repository in Mochovce shall be stored on long-term at the site of NPP; an integral storage shall be installed at Jaslovské Bohunice site for storage of RW that cannot be disposed at National RW Repository in Mochovce;
- RW not meeting the criteria for disposal in a near surface repository shall be disposed of in a deep geological repository to be developed;
- The costs of RW management from operation of NPPs shall be covered from the operating costs of RW producers.

Following this concept, the RW management solution for EBO3, as described in section A.II.8.3.4.2 of the EIAR includes in principle segregation of RW in accordance with the national classification scheme and suitable processing of gaseous, liquid and solid RW in dedicated plant systems.

The gaseous RW will be treated for reduction of activity in the gas treatment system through high efficiency aerosol and iodine filters. Prior to the discharge through the ventilation stack (that will be performed in a controlled manner in order to ensure the observance of the authorized discharge limits) the radioactive gases will be kept for a suitable period in the so-called “decay tanks” where their activity will decrease by natural decay.

The liquid RW will be collected in collecting vessels from where they will be taken for further treatment, which will mainly consist in ion exchange filtering and evaporation. The processing of liquid RW includes the reuse of coolant and a part of chemicals in the primary circuit, the discharge of liquid effluents (in a controlled manner so as to ensure the observance of the authorized discharge limits) and storage of radioactive concentrates and suspensions of the saturated ion exchangers.

The solid RW will be collected in dedicated points inside the NPP, and then separated for further processing (in combustible/non-combustible, compactable/non-compactable) and further activities (RW to be further divided in LLW and potentially VLLW following its characterization, and materials potentially clearable). The solid RW is usually placed in barrels and/or in shielded storage chambers before it is further processed.

After these steps, the RW will be handed over, within 12 months from its production, to JAVYS, for further conditioning for disposal. At present, the temporary storage of the conditioned RW, waiting for disposal in the National RW Repository or for clearance is ensured in the predominantly vacant and rebuilt areas of A1 NPP. According to EIAR, a decision was made to build a modular integrated storage facility on Bohunice site; the construction of this facility is expected to start in 2018.

The disposal of conditioned LILW generated by the operation and decommissioning of Slovak NPP is currently ensured in the National RW Repository in Mochovce. This facility, situated 1.5 km away from Mochovce NPP, is a multi barrier surface disposal facility in operation since 1999. The storage structures are represented by two double rows of concrete boxes. The capacity of the existing storage structures is 22,320 $m^3$ of conditioned RW. At present, the first double row is filled and disposal in the second row has already started. In order to accommodate the future amounts of RW to be disposed of, an extension of the National Repository for storage of LLW and the construction of a storage facility for VLLW were envisaged. According to EIAR, a final statement of the EIA for these extensions was issued by the Ministry of Environment of SR in 2013, which would result in:

- Efficiency improvement of the storage system by construction of a storage facility for VLLW in the premise of the existing repository,
- Capacity extension for disposal of LLW by gradual building of other storage structures in accordance with the current approach in a form of double rows parallel to the existing ones.

The disposal of HLW will be ensured in a deep geological repository, according to the actual strategy of SR (see the previous section for national planning).

## 4.5 Conclusion

Following the evaluation, it was found that the activities foreseen for the management of RW and SF at EBO3 are in line with the international standards, the EU Waste Directive (EUROPEAN COMMISSION 2011a) and the current practices in other NPP.

However, it should be clarified why the RW and SF to be generated by the new NPP were not taken into consideration in the National Program, and in particular if the planned extension of the storage capacities for both RW and SF at Bohunice site as well as of the LILW disposal capacity at Mochovce Repository will be sufficient to accommodate these additional amounts of RW and SF.

It should also be mentioned that in the EIAR (mainly in section A.II.8.3.4.2) there is a constant confusion between "storage" and "disposal" and "treatment" and "management" which makes difficult to evaluate the RW management solutions proposed for EBO3. It is therefore suggested to correct the wrong terms. A confusing statement appears also in the non-technical summary (section C.X.2.2 of EIAR) – "*Crucial minority of wastes will be very low active and low active wastes*" – which is in contradiction with the statement in section B.II.5 of the EIAR. In this sentence the "*minority"* should be replaced by "*majority"*.

# 5 EVALUATION OF ANSWERS PROVIDED TO AUSTRIAN EXPERT OPINION ON SCOPING DOCUMENTATION

Under the preliminary consultation part of the environmental licensing process for EBO3, an expert opinion related to the Preliminary Scoping Document (JESS 2014) was submitted by Austria to the Slovak Espoo contact (UMWELTBUNDESAMT 2014). As such, under the evaluation performed by the Consultant in this stage, the EIAR was also checked for inclusion of answers to Austrian questions and the adequacy of such answers, if any. The findings of this evaluation are listed below, grouped in accordance with points 2.3.29 and 2.3.30 of the letter of the Ministry of the Environment of SR No. 3282/2014-3.4/hp from 26.05.2014 (SR 2014b).

## 5.1 Nuclear safety aspects

- The EIS should describe in detail which international documents (IAEA, WENRA, EUR) with regard to safety requirements for new NPP will be used and to what extent this will be done in a binding manner.

Findings: provided (general safety requirements in sections A.II.8.2.2 and A.II.8.2.5 and specific safety requirements in each technical section)

- Relevant technical description for each of the tested types has to be presented.

Findings: general description of the 6 reactor models envisaged for the new NPP is given in section A.II.8.3.1.3 of EIAR.

- Achieved level of development: plants under construction/in operation, licensing, etc.

Findings: not provided.

- Detailed description of the safety systems, including requirements for important safety systems and components.

Findings: general description of the safety features of the 6 reactor models envisaged for the new NPP is given in section A.II.8.3.1.3 of EIAR. Detailed safety requirements for the new NPP planned to be constructed at Bohunice are given in section A.II.8.3.1.2.

- Presentation of the PSA results for each of the tested reactors.

Findings: not provided; in this stage of the project, only the requirements for probabilistic safety characteristics were established (in section A.II.8.3.1.2.2).

- Basic data on the operation of the plant: life time, fuel cycle, expected availability, burn-up, expected share of MOX.

Findings: the requirements for the new NPP are given in section A.II.8.3.1.1; technical data about the 6 reactor models envisaged for the new NPP are presented in section A.II.8.3.1.3; the use of MOX fuel is not envisaged anymore.

- Description in which stage of the project the basics for "Plant Life Management" and "Ageing Management" should be established.

Findings: provided (in section A.II.8.2.3.4.2).

- Detailed description of the measures for the control of design basis accidents and severe accidents and/or to mitigate their consequences for each of the tested reactors.

Findings: general data about the safety systems of the 6 reactor models envisaged for the new NPP design to control the development of accident conditions are given in section A.II.8.3.1.3; the emergency response arrangements are described in section C.III.19.1.11.

- Detailed information regarding the design basis requirements against an intentional crash of an airplane and a description showing whether the considered reactor types meet those.

Findings: the requirements are given in sections A.II.8.2.4 (table A.II.6) and A.II.8.3.1.2.3; the capability of the 6 reactor models envisaged for the new NPP to withstand airplane crash is described in sections A.II.8.3.1.2.6 and A.II.8.3.1.3.

- Information on amount, type and classification of radioactive waste arising from the operation.

Findings: provided (in section B.II.5)

- Information about the amount of spent nuclear fuel.

Findings: provided (in section B.II.5)

- Description of the method of disposal of RW (particularly the high level waste) and the SF (location and duration of storage, data on the current state of the search for a final waste repository, description of waste strategy).

Findings: provided (in sections A.II.8.3.4.2 and A.II.8.3.4.1)

- Presentation of the results of current studies on earthquakes, floods and extreme weather conditions for the site.

Findings: provided (in section A.II.8.2.4, table A.II.5)

- Data for the safety limits for the new NPP taking into account the characteristics of the site.

Findings: not provided, but in this stage of the project, safety limits couldn't be established (safety limits and conditions are usually established during the operation licensing process).

- Data on the potential interactions with existing nuclear facilities at the site and the possible consequences.

Findings: not provided; the cumulative impact is presented only for normal operation conditions.

- Source terms for the most important release categories including releases from the spent fuel pool.

Findings: provided (in section C.III.19).

- Comprehensive description of the distribution calculations of radionuclides for normal operation, as well as in case of accidents and disasters (source term, amount and duration of the release, meteorological data) and the reasons therefor; in the calculations the border areas of neighbouring countries must be considered as well).

Findings: provided (in section C.III.19).

## 5.2 Energy economics aspects

- Examination of technically and economically feasible alternatives to the present project of NPP using a balanced ratio of energy sources. In addition to fossil fuels, renewables, modern cogeneration and biomass power plants are also to be considered.

Findings: some information is included in sections A.II.6.5.4 and A.II.9 of EIAR, where limited energy data about alternative solutions are given. No assessment of technically and economically feasible alternatives to the EBO3 project is indicated, but only references to the Energy Policy of SR (2014) (SR 2014a) and other relevant strategy documents and SR Government resolutions. In section C.V of EIAR it is clearly stated that the construction of EBO3 is not proposed in several variants. The conclusion of the proponent is that "*there is not available any other variant solution than the one proposed*". Moreover, the Ministry of Environment of SR has abandoned the requirement of an alternative, requiring the assessment of the alternative with one PWR unit of III+ generation with the maximum net installed capacity up to 1,700 MWe.

- For this, forecasting data should be used, taking into account the latest developments in the Slovak Republic and in the EU in terms of economic development and changes in the legal framework (e.g. implementation of the EU Energy Efficiency Directive).

Findings: forecasting data taken from the Energy Policy of SR (SR 2014a), which considered the impact of Directive 2012/27/EU on energy efficiency, are given in section A.II.6.5.2 of EIAR.

- The EIS should contain a detailed presentation stating the probable development of the Slovak power plant capacities (decommissioning and new build) to 2030. This could clarify how the new NPP at the Bohunice site would fit in the whole Slovak power generation system (both in terms of installed capacity as well as the annual production).

Findings: not provided; only references to Energy Policy of SR.

- Data on the economic aspects of this project.

Findings: not provided; according to EIAR, such data were included into the Feasibility Study developed for EBO3, and that this study is currently under a detailed analysis conducted by the experts of both shareholders of JESS.

- The production costs of the new NPP at the Bohunice site over the entire life cycle – from project planning to the construction and operation of the plant to decommissioning and the storage and disposal of radioactive waste – should be considered and presented in the EIS. The production costs of the new NPP at the Bohunice site should be compared to those of concrete alternative variants.

Findings: provided only as overall costs (in section A.II.10).

- It should therefore be presented in the EIS how the project applicant can guarantee the lasting achievement of a high level of safety with rising investment needs and permanently low electricity market prices.

Findings: not provided.

- In an economic examination the follow-up costs of major accidents should also be included. Those should be compared with the existing Slovak provisions on nuclear liability.

Findings: provided (in section C.III.19.1.12).

# 6 COMPILATION OF QUESTIONS

## 6.1 Environmental Impact Assessment Report

- Would it be possible to clarify how the selection of the proposed NPP was done and in particular if the environmental impact aspects were considered?
- Was any detailed analysis on the alternatives enumerated in section A.II.6.5.4 of EIAR performed?
- If yes, would it be possible to present the selection criteria and the rationale for the decision?

## 6.2 Consideration of Austrian comments to EIA Scoping Document

- Would it be possible to provide information about the achieved level of development: plants under construction/in operation, licensing, etc., for the 6 reactor models envisaged for the new NPP?
- Would it be possible to provide the results of the examination of technically and economically feasible alternatives to the present project, including renewables, modern cogeneration and biomass power plants?
- Would it be possible to provide a detailed presentation stating the probable development of the Slovak power plant capacities (decommissioning and new build) to 2030, clarifying how EBO3 would fit in the whole Slovak power generation system (both in terms of installed capacity as well as the annual production)?
- Would it be possible to indicate how the project developer will guarantee the achievement of a high level of safety with rising investment needs and permanently low electricity market prices?

## 6.3 Nuclear safety aspects

- Since the description of the reactor designs/nuclear technologies considered for the construction of the new NPP do not mention any post-Fukushima measure introduced by the vendors, would it be possible to know how the developer plans to access and evaluate the implementation of stress-tests/post-Fukushima measures in the design of the considered reactors?
- The EIAR considers a fuel burn-up up to 60 GWd/tU, but some of the new designs considered for construction of the new NPP foresee burn-ups up to 70 GWd/tU; it would be possible to explain how the developer plans to address this issue, as the fission products pattern for 60 and 70 GWd/tU will substantially differs and this will be reflected in the RW activity level?
- Would it be possible to provide data about the cumulative impact of EBO3 and the existing nuclear installations on Bohunice site, in accident conditions too? This should include an estimation of the impact of one nuclear installa-

tion affected by accident conditions on the others, as well as the impact of all nuclear installations on the site affected in the same time by accident conditions.

- What sources (publicly available or provided by the possible suppliers) were used by the developed in order to determine the "envelope" source term for normal operation (which for some radionuclides shows lower values than the source term of one the reactor models envisaged for EBO3 – MIR1200)?
- Why a calculation of the accident source terms was performed, as long as in some parts of EIAR it is mentioned that the safety documentation was made available by the possible providers to the developer?
- Would it be possible to get more information about the validation of the RDEBO computer code?
- Why 2 different codes were used for estimation of radiological consequences of design basis accident and severe accident, and in particular why PC COSYMA (which is a validated code, accepted by EC) was used only for severe accidents?
- Would it be possible to provide the maximum values (or at least values corresponding to the 99% quantile) provided by PC COSYMA for the doses calculated in case of severe accidents?
- Would it be possible to provide data on the contribution of Cs-137 and I-131 to the time-integrated concentration in air and ground deposition in case of design basis accidents and severe accident?
- Would it be possible to provide the effective doses projected for 2 days and 7 days, as well as the avertable committed doses to thyroid calculated for design basis accidents?
- Regarding the emergency preparedness, would it be possible to clarify the following aspects:
  - If the future operator of EBO3 will develop a stand-alone response plan (in which case it is necessary to describe how this plan will be correlated with the other installations' plans) or the necessary response arrangements for EBO3 will be integrated into an on site response plan (if such a plan exists);
  - In case an on site response plan exists:
    - who is in charge with its development;
    - who is in charge with its approval; and
    - how its correlation with the off site response plan is verified.

## 6.4 Radioactive waste and spent fuel

- Would it be possible to clarify why the RW and SF to be generated by the new NPP were not taken into consideration in the National Program, and in particular if the planned extension of the storage capacities for both RW and SF at Bohunice site as well as of the LILW disposal capacity at Mochovce Repository will be sufficient to accommodate these additional amounts of RW and SF?

- Also, in section C.IV of EIAR, it is mentioned, as “other measures” for the impacts mitigation, the inclusion of RW and SF that will be generated by EBO3 into the balances of necessary capacities for storage and disposal in the future update of the National Program for RW and SF Management; would it be possible to provide a deadline for this measure?
- In the EIAR (mainly in section A.II.8.3.4.2) there is a constant confusion between “storage” and “disposal” and “treatment” and “management” which makes difficult to evaluate the RW management solutions proposed for EBO3; it is therefore suggested to correct the wrong terms.
- A confusing statement appears in the non-technical summary (section C.X.2.2 of EIAR): “Crucial minority of wastes will be very low active and low active wastes”, which is in contradiction with the statement in section B.II.5 of the EIAR. In this sentence, “minority” should be replaced by “majority”.

## 6.5 Energy economics aspects

- In today’s global energy environment, NPP investors need to consider many dimensions of risk in addition to the basic nuclear safety-related risk. Therefore, would it be possible to indicate what is the risk management strategy for EBO3 project?
- It is also suggested to correct the titles of:
  - Table A.II.1 and Figure A.II.1 – instead of “Forecast of the gross electricity consumption development pursuant to scenarios of Energy Policy of SR” it should be “Forecast of the gross domestic energy consumption development pursuant to scenarios of Energy Policy of SR”;
  - Section A.II.6.5.2. should be “Final Energy Consumption” and not “Final Power Consumption”;
  - Table A.II.2 and Figure A.II.2 – instead of “Forecast of the final power consumption development pursuant to the scenarios of Energy Policy of SR” it should be “Forecast of the final energy consumption development pursuant to the scenarios of Energy Policy of SR”.

# 7 ANNEX

**Detailed evaluation of EBO3 EIAR**

**A. Basic data**

Under the first chapter of the EIAR, the data on the project developer and on the proposed activity are presented. The subchapter describing the activity includes information about the siting, siting situation overview, justification for siting in the particular area (including justification of the need in relation to the Energy Policy of SR, as well as justification of the need in relation to the electricity generation and consumption), deadlines for commissioning and termination of construction and operation, brief description of the technical and technological solution, short description of proposed activity alternatives, estimation of the overall costs, short presentations of concerned community, concerned self-governing region, concerned authorities, approving authority, departmental authority, type of required approvals under the special regulations and finally an opinion on the cross-border impacts of the project. A detailed review of the relevant sections of this chapter is given below.

*SITING*

At the beginning of this chapter, after general and basic data of the EBO3 project, the siting of EBO3 in the western region of SR in the Trnava Self-Governing Region is presented. The site is located in the cadastre of the communes Radošovce and Jaslovské Bohunice, in the immediate vicinity of the existing site of nuclear facilities at Jaslovské Bohunice (the EBO site). The site was selected in compliance with the strategic documents of SR as well as the land use plan of the Trnava Self-Governing Region (2012).

The site is used for electricity production with nuclear power plants and for the construction and the operation of other nuclear facilities (e.g. RW and SF management facilities). Thus, all the necessary areas and infrastructure including the water source for cooling (the Váh River), networks of the Slovak Electricity Transmission System and systems of waste management, including RW, are available.

On the Bohunice site, the following five nuclear facilities in various phases of their life cycle presently exist:

- V2 nuclear power plant (authorization holder – SE);
- Intermediate storage facility of spent nuclear fuel (authorization holder – JAVYS);
- Processing and radioactive waste treatment technologies (authorization holder – JAVYS);
- Nuclear power plant A1 under decommission (authorization holder – JAVYS);
- Nuclear power plant V1 under decommission (authorization holder – JAVYS).

A comprehensive justification for selecting the Jaslovské Bohunice site is given, in relation with the international commitments of SR, the Energy Policy of SR, the circumstances at the Jaslovské Bohunice site and the electricity generation and consumption in the Slovak Republic. The main justification arguments are the following:

- The necessity of replacement of basic production capacity of power plants with ending operational life in Slovakia by more modern sources;
- The assumed increase of electricity consumption related to the economic growth, even despite the fact of the current implementation of austerity measures in energy consumption and decreasing energy demands;
- The need of stable, reliable and low carbon sources in the power mix production;
- The assumed depression in the utilization of the power plants for fossil fuel due to non-being ecological and decreasing domestic coal resources;
- The unreality of the assurance of sufficient and reliable power supply from renewable sources; and
- The need of overall increase of power safety in the Slovak Republic.

The distance from the nearest inhabited areas of the surrounding communities is a few kilometres at the most. The distance of the proposed NPP from the borders of the nearest countries ranges from tens to hundreds of kilometres, as follows:

- Czech Republic 37 km;
- **Austria 54 km**;
- Hungary 61 km;
- Poland 139 km;
- Ukraine 330 km.

*ECONOMIC JUSTIFICATION*

Section A.II.6.5 of EIAR provides the justification of the need in relation to the electricity generation and consumption in SR. However, there is no special analysis in EIAR in relation to the Electricity Generation and Consumption of SR and for the justification of future electricity consumption a reference to the Energy Policy of SR (2014) (SR 2014a) is given. In the Energy Policy of SR it is concluded that, even satisfying the Directive 2012/27/EU on energy efficiency, an increase in electricity consumption will appear in all analysed scenarios, within the entire period until 2035.

In the Energy Policy of SR (2014) Gross Domestic Consumption is based on anticipations of total economic development in Slovakia and Europe. Forecast of the Gross Domestic Consumption development in three different scenarios predict annual rates of change until 2035 as follows: +0.62% (Growth), +0.25% (Referential) and -0.19% (Economy). Table A.II.1 in EIAR presents these data, but the title of the table (as well as the title of figure A.II.1) – “Forecast of the gross electricity consumption development pursuant to scenarios of Energy Policy of SR” – is wrong and it should be corrected. In section A.II.6.5.1 of the EIAR it is concluded that, in case of the reference scenario, the energetic mix of the SR would be significantly different from the current one (2012). Nuclear fuel will have the most substantial share (increase from 24% to 31% of gross domestic consumption), while the share of renewable energy sources will be double (increase from 9% to 18%), whereas solid fuels are expected to decrease (from 21%to 10%), as well as natural gas (from 26% to 23%) and oil and oil products (from 20% to 17%).

Forecast of the expected final energy consumption development are given in section A.II.6.5.2 "Final Power Consumption", which again has a wrong title, as well as Table A.II.2 and Figure A.II.5 (it should be "final *energy* consumption" instead of "final *power* consumption"). For the 3 scenarios included in the Energy Policy of SR, the predicted annual rates of change from 2012 until 2035 are: +0.49% (Growth); +0.13% (Referential) and -0.26% (Economy). Within the scenarios, the expected increases are smaller than for the Gross Domestic Consumption because of the envisaged implementation of energy efficiency and in the scenario with decrease of consumption this decrease is bigger than that for the Gross Domestic Consumption for the same reason. This shows that in the Energy Policy of SR the obligations deriving from the Energy Efficiency Directive (2012/27/EU) were taken into account in the forecast of the demand. Section A.II.6.5.2 of EIAR concludes that in future it is anticipated that energy conversion efficiency will grow, due to improvement of efficiency of facilities generating electricity and heat, which practically means that it would be possible to obtain a higher amount of energy from the same amount of primary sources.

Data about the electricity consumption in SR are given in section A.II.6.5.3 of EIAR. While the Energy Policy (2014) is again cited, the values on the available electricity generation capacity and demand given in EIAR only show the situation until the year 2013 (historical data). More explanations are given in the Energy Policy of SR (SR 2014a), where it is stated that Slovakia became self-sufficient for electricity supply with the completion Mochovce NPP in 1998 and 2000 and until 2006 the country exported electricity. After the shutdown of V1 NPP and other thermal power plants, Slovakia became again dependent upon imports. The total installed capacity of power plants in Slovakia in 2013 was 8,074.3 MW. The forecast development of electricity consumption in Slovakia by 2035 is analysed in the Energy Policy for 3 scenarios:

- Low scenario – anticipates a significant slowdown in economic development and GDP growth and low year on year growth in electricity consumption of 0.6% ;
- Reference scenario – anticipates a slight increase in economic performance and year on year growth in electricity consumption of 1.2%;
- High scenario – anticipates accelerated economic development and GDP growth and year on year growth in electricity consumption of 1.4 %.

The forecast development of available electricity generation capacity in Slovakia by 2035 provides for a capacity increase by 2020, which involves the construction of Unit 3 and Unit 4 at Mochovce NPP, the construction of a new NPP at Jaslovské Bohunice (EBO3) with an expected installed capacity of 1,200 MW (or 1,700 MW or 2,400 MW), as well as the possibility of extension of operation of V2 NPP until 2045. If the operation of V2 NPP will be extended beyond its design lifespan, it will be necessary to consider the concurrent operation of both plant and therefore it will be necessary to analyse and create conditions in the Slovak electricity grid to increase transmission capacity for the duration of the parallel operation. The magnitude of the balance will depend on the extent of construction of other power plants in Slovakia and also on the decommissioning of existing power plants. Restrictions on the construction of fossil fuel power plants are considered, which is why the balance only includes smaller natural gas-based cogeneration power plants resulting in particular from reconstruction works as replacements for obsolete units that do not comply with new emissions regulations. The construction of large combined cycle power plants is not anticipated as a result of air protection measures. One variant in the forecast for covering energy consumption also counts on the extended operation of V2 NPP after 2028 and the operation of the new NPP. In this case, a significant surplus of possible generation production will appear by 2035 (+33.7%), that is predicted to be solved primarily through exports. The exports strongly depend on competitiveness of the NPP but this is impossible to be predicted at this moment (now and in the next 5-10 years the price of electricity on the EU electricity market will be very low, probably between 30-40 €/MWh). In case the operation of V2 NPP will not be extended, the surplus of possible generation production by 2035 will be lower (+11.9%), just at the level of a reasonable reserve margin.

In section A.II.6.5.4 of EIAR, it is concluded that according to the Energy Policy of SR, the new NPP is only one part of the diversified fuel mix, being an alternative not excluding other resources. The following options are presented in EIAR as alternatives:

- Without a new NPP;
- Coal power plants;
- Natural gas power plants;
- Hydroelectric power plants;
- Solar power plants;
- Wind power plants;
- Geothermal power plants;
- Biomass power plants.

These alternatives are described in very general terms; no economic or financial data and analysis are presented. In fact, in section A.II.9 of EIAR it is clearly stated that "*The proposed activity is implemented in one alternative, which consists of the construction of a new NPP at the Jaslovské Bohunice site*". The selection of this alternative was based "*on the factoring of the following options of the alternative solution":*

- Alternatives of the new NPP siting within the Slovak Republic;
- Alternatives of the new NPP siting within the Jaslovské Bohunice site;
- Alternatives of the new NPP capacity (net installed capacity);
- Alternatives of the new NPP technological solution;
- Reference alternatives (other ways of electric power generation and/or electric power saving);
- Alternatives of the new NPP networks (connection to the local infrastructure);
- Zero alternative (non-execution of the new NPP).

These alternatives are only briefly described, without any analysis of technical and economic characteristics and basically in relation with the Energy Policy of SR (2014) and some other strategy documents (especially Government Resolution No. 948/2008, Urban Development Conception of the Slovak Republic, and Land Use Plan of the Trnava Self-Governing Region). Based on these, the EIAR concludes that "*there is no other realistic alternative available for the pro-*

*posed activity than the one being proposed, that is, neither a different site nor a different technology*" and further states that, on this basis, the Ministry of Environment of SR has abandoned the requirement of an alternative, asking (besides the zero alternative) the assessment of the alternative with one PWR reactor unit of III+ generation with the maximum net installed capacity up to 1,700 MWe.

The overall costs of this alternative are given very approximately in section A.II.10 of EIAR: € 4 to 6 billion.

Apart from the fact that no other alternative are presented in the EIAR, so as to allow a thorough comparison, there are other important aspects which have to be mentioned. In today's global energy environment, NPP investors need to consider many dimensions of risk in addition to the basic nuclear safety-related risk. Therefore, it would be interesting to know if a risk management strategy for EBO3 project was elaborated to cope with such risks.

*TECHNICAL DATA*

Further in this chapter a brief description of the technical and technological solutions envisaged for EBO3 is given.

From a technical point of view, the plant planned to be built at Bohunice is requested to be a power plant with a pressurized water reactor (PWR) of the generation III+, designed in a one unit arrangement. The net installed power should be maximum 1,700 MWe. The design operational life of the plant should be 60 years. The assumed year of commencement of EBO3 construction is 2021, while the commissioning is assumed to start in 2029.

The supplier of the power plant will be selected subsequently in the further stages of the project preparation; as stated in the EIAR, the supplier selection is not the subject of the environmental impacts assessment.

There will be used commercially available units of reputable suppliers. As reference solutions, the following reactor models are considered:

- AP1000 (Westinghouse Electric Company LLC, USA);
- EU-APWR (Mitsubishi Heavy Industries (MHI), Japan);
- MIR-1200 (Consortium Škoda JS/JSC Atomstroyexport/JSC OKB Gidropress, Czech Republic/Russia);
- EPR (AREVA NP, France);
- ATMEA1 (AREVA NP/Mitsubishi Heavy Industries, France/Japan);
- APR-1400 (Korea Hydro&Nuclear Power (KHNP), South Korea).

Detailed analysis of the state-of-the-art envisaged technology is given in Section 1 of this report.

The power output of the new units will be brought by 400 kV overhead power lines into the new power plant at Jaslovské Bohunice. This plant will be a part of the Slovak Electricity Transmission System. Standby power supply of the station internal power consumption will be solved by a new 110 kV overhead line from the same power plant and backup standby power supply from the substation JE V1.

The power plant will operate in the basic part of the daily load diagram. The unit should be capable to operate for long-time on power output in the range from 50 to 100% of the rated power. The coefficient of unit readiness for the period of 12 months should be bigger than 0.9.

Approximately 650 persons are estimated to be needed for the operation and maintenance of EBO3.

The raw water supply is planned to be ensured by a new underground pipeline from the water reservoir Slnava on the Váh River. Drinking water supply will be ensured by the connection to the existing infrastructure at the locality. Waste water discharge will be ensured by a new underground pipeline collector of waste waters into the Drahovsky channel on the Váh River. Rain water discharge will be implemented by a new underground pipeline collector of rain water to the Dudvah River. All pipeline routes are planned to be constructed near the existing infrastructure networks of V2 NPP and other installations on the site, but they will be independent.

The solutions envisaged for management of RW and SF that will be generated by EBO3 are described and commented in Section 4 of the report.

**B. Data on the direct impacts**

In this chapter data on direct impacts of EBO3 during construction and normal operation are presented.

*INPUTS*

Regarding required inputs during normal operation, occupation of the land, annual quantities of raw and drinking water extraction, nuclear fuel and other materials are given.

*OUTPUTS*

A quantitative inventory of all possible outputs which can occur during construction and normal operation of the plant is given in this section, including emissions into air, waste heat, industrial, sewage and rainfall waste water, non-active and radioactive waste, spent nuclear fuel, noise, vibrations, and radioactive effluents. Estimated quantities are given, together with explanations about the methods used to estimate these quantities. A discussion on the estimated radioactive discharges in normal operation is given in Section 3 of this report, while the estimated quantities of RW and SF are presented in Section 4 of this report.

**C. Complex characteristics and impact assessment**

This chapter represent the main chapter of the EIAR, where the results of the assessments performed are presented and analysed. It includes the definitions of the areas of concern, the characteristics of the current state of the local environment (in terms of geomorphological, geological and hydrological conditions, soil, air, climate, flora and fauna, landscape, protected territories, population, ecological systems, cultural and historical monuments, archaeological, paleontological and geological sites, and environment pollution sources), as well as the results of the assessment of impacts on all the environmental factors above mentioned. In addition, the impact of noise, vibration, ionising and non-ionising radiation is presented. The radiological impacts are described in the "Operational risks" subchapter. The measures for impact mitigations, the comparison of variants, the proposals for monitoring and inspection of conditions observance, the assessment methods, the shortcoming and uncertainties in knowledge are also included in this chapter.

### C.I. Delimitation of the borders of the area concerned

In the EIAR two terms are used to define the areas where the status of the environment should be analysed or might be modified.

The first term is the AREA CONCERNED which is defined as an area that might be significantly impacted by the influences of the proposed activity. From the evidences provided in the subsequent chapters, it can be concluded that the extent of the significant influences will not exceed the area of the cadaster territories of the communities concerned.

The second term is AREA OF INTEREST which is defined as the area in which the characterization of the status of the environment and the impact analyses were carried out. This area of interest is not cohesively delimited, but its expanse depends on the range of the potential influences on one or another part of the environment.

### C.II. Characteristics of the current status of the environment

In this subchapter the results of the detailed investigation of the characteristic and conditions of the site are reported (geomorphological, geological, soil, climatic and hydrological condition, air quality, flora and fauna, protected areas, landscape issues, population, cultural and historical heritage, as well as environment pollution sources).

Among the entire set of the site characteristics, which are given in this subchapter, it is worth mentioning the analysis of a seismic threat for the site, which was carried out in the years 1996-1997 in compliance with the IAEA Safety Guide 50-SG-S1 (Rev. 1), 1991 (IAEA1991). The results are still valid and accepted by the supervision body (UJD SR) and verified within the 1998 IAEA review mission. They are also accepted in the Extraordinary National Report of the Slovak Republic, processed in compliance with the Convention on Nuclear Safety (April 2012) (UJD 2012) within the process of complex risk evaluation and safety of the nuclear plants ("stress tests") after the breakdown which occurred following the earthquake and tsunami on 11 March 2011 in the Fukushima-Daiichi nuclear power plant.

The values of Peak Ground Acceleration were calculated for the return period of 10,000 years. However, it is stated in EIAR that for the stage of the approval of the new NPP location, a new study of the seismic risk at the Jaslovské Bohunice site will be submitted. This study should include the probabilistic calculation based on the current IAEA Safety Guides (especially the document № SSG-9 Seismic Hazards in Site Evaluation for Nuclear facilities (IAEA 2010)), as well as the validation of all the basic sets of inputs, such as the new seismologic database and earthquake catalogue, geological database, seismotectonic model and selection of the ground motion prediction equations.

An important characteristic of Bohunice site is reported in section C.II.2.4.2 of EIAR, where it is stated that South East from the site two fault lines classified, due to their age, as Quaternary, are crossing each other. The activity of the faults in the Quaternary period is not supported by the available evidences, and it is not possible to derive the activity of the faults based on the interpretation of the results of drill works. In this sense, it is further stated that the fault lines running in the proximity of the Bohunice site could not have been active in the period following the Middle Pleistocene, which represents a period of about 780,000 years. New results of the geological works from the locality confirm that statement. The minimum age of the sediments of the alluvial complex is about 830,000 years. All the data point to a tectonic peace in the Bohunice site area, at least from the period of 780-830,000 years ago. Nevertheless, EIAR mentions that such a conclusion will be validated and updated based on the detailed research which has to be undertaken in the following stages of the licensing and the design documentation development.

Out of possible geodynamic phenomena which may occur at the site, it is reported in EIAR that an occurrence of volume-changing soils (a sudden reduction of the volume due to the influence of excessive moistness or supplementary burdening) is not ruled out in the given area. As the possible change of volume is a potential risk for stability of the foundations of buildings, this property has been researched and it will be taken into account during the construction of the foundations of the EBO3 buildings.

### C.III. Environmental impact assessment including health

In this subchapter, a thorough assessment of the assumed impacts of EBO3 on the different segments of the environment including health and the estimation of their significance (assumed direct, indirect, secondary, cumulative, synergic impacts and impacts initiated during the construction and operation) are presented.

Following the evaluation of this subchapter, it can be concluded that the impacts on rock environment, climate, soil, flora and fauna, landscape, protected areas, urban complex, land use, water, cultural and historical monuments, archaeology, palaeontology and geological sites, or cultural values of intangible nature can't reach Austrian territory. Therefore, in the following paragraphs, the findings of the evaluation of the assessment of impacts on air and population, impacts of ionising radiation and the operational risks will be presented.

#### C.III.1. Impacts to the population

Out of all impacts on the population arising from the EBO3 operation (social, economic, psychological, infrastructure impacts) only the radiation impact could be relevant for Austria.

From the results of calculations presented in EIAR, it appears that the health detriment risk from radioactive effluents discharged from EBO3 and other nuclear facilities on the site will be on the order of E-06 (i.e., 1 case per 1 million exposed people) and lower at any distance from EBO3.

The highest risk, in the order of E-06, is in the geographical direction South-East, at a distance of 7 to 10 km from the plant.

The highest risk abroad is at the Váh River estuary into the Danube River (on the territory of Hungary), in the geographical direction South-Southeast, at distances of 90 to 110 km, where values of the order of E-07 were calculated. In the other area abroad, the risk is with 1 to 2 orders of magnitude lower.

Therefore, it can be concluded that, for the Austrian territory, the risk of health damage will be insignificant.

### C.III.4. Impacts on air

EBO3, like any other nuclear power plant, will not be a significant source of emissions of non-radioactive substances polluting the atmosphere. In terms of power plant operation, nuclear energy belongs to nearly zero producers of greenhouse gases.

Taking into account the level of immission load in the locality, it can be concluded that stationary sources of atmosphere pollution from EBO3 and even automobile traffic caused by the construction and operation of EBO3 will not change the load of the locality significantly.

### C.III.16.3. Impacts of ionizing radiation

This subchapter of EIAR presents the radiological impact of radioactive discharges from normal operation of EBO3. A detailed evaluation of it is included in Section 3.1 of this report.

### C.III.19. Operational risks

This subchapter of EIAR presents the radiological impact of radioactive discharges from EBO3 in accident conditions, as well as the envisaged emergency preparedness arrangements, the preliminary assessment of other risks, and it also describes the legal and regulatory requirements in SR for nuclear liability. Detailed evaluation of the radiological impact assessment in accident conditions, the emergency preparedness arrangements and the assessment of other risks is presented in Sections 3.2, 3.4 and respectively 3.3 of this report, and therefore it will not be repeated here.

*Liability for nuclear damages*

The liability of a nuclear facility operator for nuclear damages is specified by the Atomic Act (No. 541/2004 Coll., as amended), by which it is fulfilled the commitment of SR to the Vienna convention on civil liability for damages caused by nuclear events.

The amendment to Atomic Act No. 143/2013 Coll. introduced, with effect from January 1st, 2014, the increase of the limits of operator's liability for nuclear damage caused by each individual nuclear event.

For the future operator of EBO3, the Atomic Act imposes the obligation to submit a document on the assurance of financial covering of the liability for nuclear damages as a part of the application on the permission for nuclear facility commissioning.

The limit of operator liability for nuclear damages is determined by the Atomic Act to € 300 million.

A new Act on civil liability for nuclear damage and its financial covering No. 54/2015 Coll. was approved on March 2015. This new act adopted the principles and rules of the solution of the liability for nuclear damage established by the Vienna Convention and it replaces and supplements relevant paragraphs in the Atomic Act. The new act explicitly prohibits the commissioning, operation and decommissioning of a nuclear facility without the required financial amount and the method of the assurance of liability covering for nuclear damage.

All these provisions are found in line in the international standards.

### C.IV. Measures for the impacts mitigation

This section of the EIAR presents the basic design measures for the prevention, mitigation and eventual compensation of negative impacts of the proposed NPP, as well as a number of additional measures proposed for provision of supplementary protection of environment and public health. According to the proponent, these additional measures are basically requested by the Slovak legislation as conditions for the further administrative proceedings and they will be implemented during the next stages of NPP development.

The basic design measures listed by the developer (utilization of best available technologies of III+ generation of nuclear power reactors, assurance of nuclear safety, radiation protection, physical protection and emergency preparedness in compliance with the national legal requirements, IAEA standards and WENRA requirements, minimizing of radiation impacts to workers and public in compliance with ALARA principle, minimization of demands for environmental sources and of outputs into the environment, compliance with all procedures and standards of environmental and public health protection) are adequate and correspond to the principles of environmental protection and nuclear safety.

The additional measures proposed by the proponent are grouped under different categories, including:

- Territorial planning measures, like extension of the flights restriction area over the Bohunice site to include the new NPP;
- Basic technical measures, to be applied during the design of EBO3, such as: technical solution will assure that the envelope parameters specified in EIAR and the source terms for the individual types of accidents considered in EIAR will not be exceeded;
- Basic technological measures, to be applied during the design of EBO3, such as: ventilation systems allowing the circulation of air from spaces with lower activity to the spaces with higher activity, the passage of exhausted air through iodine and aerosol filters before the inlet to ventilation stack, monitoring of noble gases, iodine and aerosols in gaseous effluents inside the ventilation stack, in such a manner so as atmospheric discharges exceeding the authorized discharge limits will not occur in normal operation, monitoring of liquid effluents in such a manner so as discharges exceeding the authorized discharge limits will not occur in normal operation, etc.;
- Organizational and operational measures, that will be later on approved by the Nuclear Regulatory Authority of SR as limits and conditions for the safe operation of the plant, such as: start up of the discharge monitoring systems and environmental monitoring system before the commissioning of the plant, functionality testing of the monitoring systems during commissioning and trial operation of the new plant, verification and confirmation of the assumptions

and results of EIA by the end of trial operation, regular information of the public about the impact of EBO3 operation, evaluation of health state of the population before commissioning and subsequently every 10 years, etc.;

- Other measures, such as anticipated caused investments (for e.g. inclusion of the RW and SF that will be generated by EBO3 into the balances of necessary capacities for storage and disposal in the future update of the National RW Program, determination of the size of the new protection area around EBO3, integration of the output from the EBO3 radiation monitoring system into the existing warning and notification system of the operating plant, etc.).

All the measures specified in this section are found adequate, and in line with good practices elsewhere. However, the hierarchy of the possible approaches for mitigation of environmental impacts is not presented, nor the selection criteria for the proposed measures. The proponent only specifies at the end of this section that all the measures proposed are technically-economically feasible and that it considers them as an integral part of the project.

However, one question has to be raised, since it is in connection with the proposed solutions for RW and SF management at EBO3; this is related with the deadline of the inclusion of the RW and SF that will be generated by EBO3 into the balances of necessary capacities for storage and disposal in the future update of the National RW Program.

### C.V. Comparison of variants

The construction of EBO3 is not proposed in several variants. The EIAR clearly states in this section that: “Proposed activity is not solved in several variants”. Some justification of this fact is presented in section A.II.9 of the EIAR, but only in general lines and mostly referring to the Energy Policy of SR and some other strategic documents. The conclusion of the proponent is that “there is not available any other variant solution than the one proposed”. At his requests and following its own assessment, the Ministry of Environment of SR has abandoned the requirement of an alternative. However, this contradicts the provisions of the EIA Directive (2011/92/EU) (EUROPEAN COMMISSION 2011b) which asks for an outline of the main alternatives studied by the developer and an indication of the main reasons for this choice, taking into account the environmental effects.

### C.VI. Proposal for the monitoring and after-project analysis

According to the EIAR, the radiation monitoring program of EBO3 will correspond to the current monitoring system of the nuclear facilities on the site, and the EBO3 monitoring system could either be integrated into the current monitoring system or be built as an autonomous system.

The description of the monitoring system provided in this subchapter is found adequate, in full conformity with the EU legislation requirements (EUROPEAN COMMISSION 2000) and IAEA guidelines (IAEA 2005).

### C.VII. Assessment methods and data sources

According to EIAR, the assessment methods used for the purposes of environmental impact assessment were “*strictly subordinated to a conservative approach*”, meaning that all impacts were assessed in their potential maximum and in cumulative or concurrent impact with the other installations at the site and the environmental background. As it was already showed, this was not always the case.

## C.VIII. Shortcomings and uncertainties in the knowledge

According to (UNECE 1991), the gaps in knowledge and the uncertainties encountered in compiling the required information for the EIA have to be identified by the proponent and presented in the EIA Report. As such, in this section of the report JESS states that no shortcomings or uncertainties occurred during the preparation of the report, which could have been making impossible the clear specification of the assumed impacts of the project on the environment and public health.

Due to the fact that the new NPP is planned to be constructed on Bohunice site, where there are also other nuclear installations in operation, the environmental conditions are known from the environmental monitoring programs implemented by the operators of these installations. Additional studies were performed in order to investigate in more details some specific conditions at the site, and these studies are listed in section C.XII of the report.

Regarding the data of the new units to be built, the developer considers that although the detailed technical data of the different designs considered for the new NPP are not known at the moment, the basic data provided by the possible suppliers were sufficient for assessing the possible impact on the environment and public health. In addition to this, the proponent states that the impacts were estimated based on conservative scenarios, thus resulting in the maximum impact possible. However, as it was already shown, some doubts about the data used to estimate the source terms are still evident and more evidence should be provided to clarify such aspects.

The only uncertainty identified by JESS is related with the administrative procedures necessary to be followed for further implementation of the project, which consist in obtaining all other permits and authorizations required by the national legislation (e.g. the agreement for the location of the new NPP, the planning decision, the construction permission, the permission for operation, the permission for activities leading to exposure, etc.). In the report it was assumed that all legal requirements for the development of the project will be met. If this will not be the case in reality, then the project will not be implemented, but this will not affect the environment.

# 8 LIST OF ABBREVIATIONS

BDBA ................. beyond design-basis accident

BSS ................... Basic Safety Standards

CDF ................... Core Damage Frequency

DBA ................... design-basis accident

EBO3 ................. New NPP at Jaslovské Bohunice site

EIA ..................... Environmental Impact Assessment

EIAR .................. Environmental Impact Assessment Report

EU ..................... European Union

EURATOM ......... European Atomic Energy Community

EUR ................... European Utility Requirements

EIA ..................... Environmental Impact Assessment

EURDEP ............ European Radiological Data Exchange Platform

HLW .................. High-Level Waste

ILW .................... Intermediate Level Waste

IAEA .................. International Atomic Energy Agency

ICRP .................. International Commission on Radiological Protection

JAVYS ............... Jadrová a vyraďovacia spoločnosť a. s. (Nuclear and Decommissioning Company)

JESS ................. Jadrová Energetická Spoločnosť Slovenska, a. s. (Nuclear Energy Company of the Slovak Republic)

LILW .................. Low and Intermediate Level Waste

LLW ................... Low Level Waste

LOCA ................. Loss of Cooling Agent

LRF .................... Large Release Fraction

MS ..................... Member States

NPP ................... Nuclear Power Plant

NEA-OECD ........ Nuclear Energy Agency of the Organization for Economic and Co-operation Development

PWR .................. Pressurized Water Reactor

RADD ................ Radioactive Discharges Database

RW .................... Radioactive Waste

SF ...................... Spent Fuel

SR ..................... Slovak Republic

UJD SR ............. Nuclear Regulatory Authority of the Slovak Republic

UN ..................... United Nations

VLLW ................. Very Low Level Waste

WANO ............... World Association of Nuclear Operator

WENRA ............. Western European Nuclear Regulators Association

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