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Bundesministerium für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie der Republik Österreich

Radetzkystraße 2, 1030 Wien

REPUBLIK ÖSTERREICH
Bundesministerium für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie
Eing: 07. April 2021
Zl.....Blg.....

Wien, am 1. April 2021

Sehr geehrte Damen und Herren,

die Botschaft der Ukraine in der Republik Österreich bezeugt dem Bundesministerium für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie ihre Hochachtung und beehrt sich, die Kopie des Schreibens der Vizeministerin für Umwelt und Naturressourcen der Ukraine Frau Iryna Stavchuk zu übermitteln, mit dem die von österreichischer Seite gestellten Fragen über die Zaporizhzhya, South-Ukraine und Rivne Kernkraftwerke beantwortet werden.

Die Botschaft der Ukraine in der Republik Österreich benützt diesen Anlass, das Bundesministerium für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie erneut ihrer ausgezeichneten Hochachtung zu versichern.

Dr. Olexander Scherba
Botschafter

Anlage

REPUBLIK ÖSTERREICH
Bundesministerium für Klimaschutz, Umwelt, Energie, Mobilität, Innovation und Technologie
Einlaufstelle
Eing: -6. APR. 2021
Zl. .....Blg. .....

МІНІСТЕРСТВО ЗАХИСТУ
ДОВКІЛЛЯ ТА ПРИРОДНИХ
РЕСУРСІВ УКРАЇНИ

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MINISTRY OF ENVIRONMENTAL
PROTECTION AND NATURAL
RESOURCES OF UKRAINE

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№ _____ від _____ 20__ р.

The Ministry of Environmental Protection and Natural Resources of Ukraine (hereinafter – the Ministry) presents its compliments to the Federal Ministry of Austria for Climate Action, Environment, Energy, Mobility, Innovation and Technology and has the honor inform following.

Please be informed that throughout 2019-2020 the Ukrainian governmental bodies have undergone significant transformations. The Ministry of environment and natural resources has been merged with the Ministry of Energy forming a new one – the Ministry of Energy and Environmental Protection. Less than a year later the new ministry has been split into two. On May 27, 2020 the Ministry of Environmental Protection and Natural Resources was created.

The process of splitting was not seamless. Significant part of institutional memory has been lost. This means that not only the Focal Points for the Espoo Convention were changing very often but part of the archives eventually was lost. We kindly ask you to consider this circumstance.

Ministry of Austria for
Climate Action,
Environment, Energy,
Mobility,
Innovation and Technology

UB
Міністерство захисту довкілля та природних ресурсів України
№25/4-15/5889-21 від 23.03.2021
КЕП: Ставчук І. І. 23.03.2021 14:54
58E2D9E7F900307B04000000EB8A2F0021058600

Zaporizhzhya NPP and South-Ukraine NPP

The Ministry has received the inquiry regarding the content of documentation to be provided to the Austrian Party (GZ.2021-0.114.095 dated 16.02.2021) and notes the following. According to the decision of the Interdepartmental Coordinating Council for the Implementation in Ukraine of the Convention on Environmental Impact Assessment in the Transboundary Context (dated 15.12.2016) the affected Parties shall be provided with Non-Technical Summary and Transboundary Impact Section of the EIA Report (translated in English).
These documents contain all elements of information about the environmental impact assessment for all units of this NPPs, provided for by the Annex II to the Espoo Convention. The present set of documentation has been presented to all affected parties that express their interest in the transboundary consultations in 2017 and 2018 (Germany, Romania, Poland, Moldova, Hungary, Slovakia).
The Ukrainian Party states its readiness to resume the transboundary consultations in form of the expert consultations in April 2021 via video conference due to COVID-19 restrictions.

Rivne NPP

Taking the opportunity, we would like to renew the communication from our side on the Rivne NPP transboundary consultations process. We propose to hold expert consultations between the parties starting from April 19, 2021 in a format of video conference. The Ukrainian Party is ready to discuss the issues raised by the Austrian Party regarding the national process of NPP licensing in the context of transboundary consultations.

It should be noted that the environmental impact assessment sent to affected parties in 2019 was carried out in 2018 for all the units of Rivne NPP. The report meets the requirements of the Law of Ukraine «On Environmental Impact Assessment» and the provisions of the Annex II of the Espoo Convention. Ukraine has provided the answers to Austria's comments on January 22, 2021 (please see enclosure).

We kindly ask the Austrian Party to consider the dates and the modality of the consultations and to inform the Ministry about your decision. Should you have any questions, please contact Ms. Olena Miskun (tel.: +38 050 352 10 57, miskun@mepr.gov.ua).

The Ministry avails itself of this opportunity to renew to the Ministry of Austria for Climate Action, Environment, Energy, Mobility, Innovation and Technology the assurances of its highest consideration.

Iryna STAVCHUK
Deputy Minister for European Integration

ANSWERS TO THE QUESTIONS OF THE REPUBLIC OF AUSTRIA AS A PARTY REGARDING EXTENSION OF THE LIFETIME OF RIVNE NPP 1 AND 2

№ з/п	Розділ/пункт	Коментар зачепленої сторони англійською / українською	Відповідь на коментар українською / англійською
Letter of Federal Ministry Republic of Austria for Climate Action, Environment, Energy, Mobility, Innovation and Technology dated 22/01/2021 ref.number 2021-0.047.752 ***Лист Федерального міністерства з питань клімату, охорони довкілля, енергії, мобільності, інновацій та технологій від 22.01.2021 № 2021-0.047.752***			
	2 OVERALL AND PROCEDURAL ASPECTS OF THE ENVIRONMENTAL IMPACT ASSESSMENT 2 ЗАГАЛЬНІ ТА ПРОЦЕДУРНІ АСПЕКТИ ОЦІНЮВАННЯ ВПЛИВУ НА ДОВКІЛЛЯ		
AU1	Question 1 Питання 1	How will the results of the EIA be taken into account?	The results of the SS "Rivne NPP" environmental impact assessment will be accounted for in accordance with requirements of the Law of Ukraine "*On environmental impact assessment*", namely requirements of the Article 11. The SS RNPP EIA was performed (as specified in the *Notification of the planned activities*) as for an economic player that operates nuclear units. To identify, collect and account for proposals of the public regarding the SS RNPP planned activities the Ministry of Environmental Protection of Ukraine arranged the public hearings at the regional centers of Khmelnytskyy, Rivne, Zhytomyr, Ternopil, Volyn, Lviv, Ivano-Frankivsk, Vinnytsya regions and in Kyiv between July 1 and July 11, 2019. According to the national legislation public discussion of the EIA report in Ukraine was completed on 31 July 2019. The Ministry of Environmental Protection of Ukraine provided the involved parties with the "*SS "Rivne NPP" EIA report*" in June 2019 asking to start its discussions.
AU2	Question 2 Питання 2	What are the further steps in the licensing procedure?	SS Rivne NPP of the SS NNEGC "Energoatom" is the economic operator working in the area of nuclear energy utilization. Activities in the area of nuclear energy utilization are subject to licensing according to the Laws of Ukraine, decisions of the Cabinet of Ministers of Ukraine, and regulatory documents. Based on requirements of the Article 8 of the Law of Ukraine "On licensing activities in the area of nuclear energy utilization" the operator of SS RNPP units based on the submitted applications, following the comprehensive safety assessment of the nuclear facility, demonstration of ability to implement all safety assurance measures have received the license for activities related to the given phase of nuclear facility's lifetime, namely operation of nuclear facilities. According to the Article 12 of the Law of Ukraine "On licensing activities in the area of nuclear energy utilization" SS RNPP of the SS NNEGC "Energoatom" to obtain the license for operation of nuclear facilities had submitted applications to the national nuclear and radiation safety regulatory authority. The applications were supplemented with the copies of the properly certified statutory documents, the documents attesting the safety level of nuclear facilities, as well as the documents that confirm the applicant's ability to adhere to the requirements related to performance of the applied activities, and established nuclear and radiation safety norms and rules. The list of the documents submitted with the application for license as well as requirements to their format and content are defined by the nuclear and radiation safety regulatory authority (SNRIU). Completeness and reliability of information contained in the submitted documents was verified by the nuclear and radiation safety regulatory authority through the state expert review of nuclear and radiation safety and inspection. Nuclear and radiation safety of RNPP nuclear facilities operation was confirmed, and this fact was documented in the results of the SNRIU Board activities and public hearings; required regulatory documents were prepared and required licenses were obtained for the period justified in the safety review documentation. Lifetime extension of the SS RNPP units as well as prolongation of the licenses' validity period were carried out by the economic operator in accordance with the Law of Ukraine "On the procedure of making decision as for siting, designing and construction of nuclear facilities and installations dedicated for radioactive waste management of national significance". The Article 6 of this law envisages that decision on lifetime extension of operating nuclear facilities and installations dedicated for radioactive waste

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			management of national significance us made by the national nuclear and radiation safety regulatory authority based on the conclusion of the state expert review of the nuclear and radiation safety level by amendment of the license for nuclear facility operation. The licenses were amended following the procedure identical as the one for obtaining the license. To amend the license the activities envisaged by the nuclear and radiation safety codes and standards in force in Ukraine have been completed: - Three years before the design lifetime expiration the operator developed the programs determining the scope, procedure, and deadlines for implementation of corresponding organizational and engineered measures aimed at units preparation for long-term operation. These programs and periodical safety review reports were submitted to the SNRIU. Based on the safety review results the regulatory authority determined compliance with the target safety criteria for operating NPP units, and defined the period, modes, and conditions of the units further operation; - periodical safety review of the units was completed. Conclusion of the state expert review of nuclear and radiation safety confirmed justification of the proposed period of further units operation that was the basis to make decision as for amendment of the licenses for nuclear facilities operation. Thus, SS RNPP as the economic operator in the area of nuclear energy utilization had completed all licensing procedures. Safety of the activities was confirmed. Necessary licenses were obtained (amended) according to the procedure established by the Ukrainian legislation. There are no other procedures and steps in the licensing process for the economic operator in the area of nuclear energy utilization. In the future the licensing procedures envisaged by the legislation, regulations, nuclear safety codes and standards in force in Ukraine will be followed as well.
	3 SPENT FUEL AND RADIOACTIVE WASTE 3 ВІДПРАЦЬОВАНЕ ПАЛИВО ТА РАДІОАКТИВНІ ВІДХОДИ		
AU3	Question 1 Питання 1	What is the expected inventory of spent fuel and radioactive waste from the lifetime extension of Rivne 1&2?	The spent nuclear fuel management technology was developed during the VVER plant designing and it envisages periodical shipment of spent nuclear fuel (SNF) to Russian Federation, its reprocessing with uranium (plutonium) segregation, and conditioning of the generated high-level waste (HLW) to the form appropriate for further storage. According to the current SNF shipment contracts it is envisaged that the HLW generated during the SNF reprocessing will be returned to Ukraine. After the units 1&2 lifetime extension in 2010 the spent fuel was shipped to RF for reprocessing in the contracted volumes. The total expected amount of spent nuclear fuel from lifetime extension of units 1&2 till 2030 is 3055 spent nuclear fuel assemblies. The expected SRW volume from lifetime extension of units 1&2 is about 2400 m^3, expected LRW volume – about 2500 m^3. Available free volumes of RAW storage facilities are sufficient for waste storage during the long-term operation of the units.
AU4	Question 2 Питання 2	What is the status of the central interim storage facility for spent fuel (CSFSF)?	In 2005 the SE NNEGC "Energoatom" and Holtec International (USA) signed the contract for designing and construction of the centralized spent fuel storage facility (CSFSF). In February 2009 the Cabinet of Ministers of Ukraine approved the design estimates for the CSFSF by its decision No. 131-r. In 2012 The Parliament of Ukraine adopted the Law No. 4384-VI "On spent nuclear fuel management regarding siting, designing, and construction of the centralized storage facility for spent nuclear fuel from VVER reactors of Ukrainian nuclear power plants". As of beginning of 2021, construction of the main facilities of the CSFSF first phase is completed. In 2021 it is planned to complete non-designing activities at equipment of RNPP units 1&2 and to obtain authorizations for the first SNF batch shipment to the CSFSF. Information on the SNF volumes and storage period at the CSFSF is provided below. Design capacity, spent fuel assemblies - 16529 including from: VVER-1000 reactors – 12010 VVER-440 reactors – 4519 Design capacity of the first phase, spent fuel assemblies - 3616

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			including from: VVER-1000 reactors – 2511 VVER-440 reactors – 1105 CSFSF design lifetime – 100 years.
AU5	Question 3 Питання 3	Is an international cooperation for final disposal of spent fuel and/or radioactive waste planned?	International cooperation in part of the RAW final disposal is implemented on the permanent basis within the projects under the Instrument for Nuclear Safety Cooperation (INSC). International cooperation is planned in the area of studying the international experience of SNF final disposal. The CSFSF design lifetime provides sufficient time and possibilities to study international experience and to make decision as for the SNF final disposal.
AU6	Question 4 Питання 4	Which interim and final storages for radioactive waste are in operation in Ukraine, will their capacity be sufficient to dispose of all radioactive waste from the lifetime extension and decommissioning of Rivne 1&2?	The RAW interim storage facilities are sufficient for long-term operation of units 1&2. According to the Law of Ukraine "On radioactive waste management" radioactive waste disposal is carried out exclusively by the specialist companies for radioactive waste management provided availability of the corresponding license granted in accordance with the established procedure, and at the specially dedicated radioactive waste storage facilities. Construction of the RAW final disposal facilities is carried out by the specialist companies in accordance with the Law of Ukraine "On the State targeted environmental program of radioactive waste management" and decision of the Cabinet of Ministers of Ukraine No. 990 dated 19 August 2009 "On approval of the Strategy for radioactive waste management in Ukraine".
AU7	Question 5 Питання 5	How can the safe storage of spent fuel and radioactive waste be ensured if the interim storages and final disposals will not be ready in time?	In case of force-majeure situation and unavailability of the centralized spent fuel storage facility (CSFSF), the spent nuclear fuel management strategy developed during the VVER units designing phase envisages periodical SNF shipment to RF for reprocessing and conditioning of the generated high level waste into form suitable for further storage. The CSFSF design lifetime provides sufficient time and possibilities to study international experience and to make decision as for final disposal of the SNF stored at the CSFSF.
	4 LONG-TERM OPERATION OF REACTOR TYPE VVER 440 4 ЕКСПЛУАТАЦІЯ РЕАКТОРІВ ТИПУ ВВЕР-440 У ПОНАДПРОЕКТНИЙ ТЕРМІН		
AU8	Question 1 Питання 1	What is the time schedule for the necessary improvement of the ageing management programme (AMP) based on the findings of the Topical Peer Review (TPR) based on Article 8e of EU Directive 2014/87/EURATOM?	The RNPP approaches to development and organization of lifetime management activities do not contradict to the provisions set forth in the Article 8e of the EU Directive 2014/87/EURATOM. According to requirements of the national regulations, the Operator reviews the AMP based on results of its effectiveness assessment (if necessary) but at least during each periodical safety review of the unit (i.e. every 10 years) or on demand of the nuclear and radiation safety regulatory authority. In fact, the actual RNPP AMP for units 1&2 is revised and updated at least once a year depending on operating experience, results of the completed ageing management activities, equipment modernization, and SNRIU requests. All changes to the AMP undergo the nuclear and radiation safety review and are agreed with the regulator. The AMP for units 1&2 is the integrated program that was developed and agreed with the regulator with account for the nuclear safety codes and standards in force in Ukraine and the IAEA recommendations.
AU9	Question 2 Питання 2	What are the specific findings of the ageing management programme for Rivne 1&2?	Positive results of technical condition evaluation for critical elements and structures (E&S) confirm effectiveness of the existing ageing management system. Effectiveness of the E&S ageing management activities is confirmed by the following facts: – no unit unplanned down time due to component failures caused by ageing; – no deviations of operational parameters of the unit components subject to ageing management set forth in the operational documentation;

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			– no changes in the outage and maintenance frequency. Evaluation of effectiveness of the AMP for units 1&2 is performed based on 9 attributes with account for international experience. Conclusions on effectiveness of RNPP AMP implementation: – AMP for units 1&2 covers all E&S that must be included into the program according to the scoping methodology according to the regulatory documentation. For all E&S included into the AMP the ageing effects are identified and degradation mechanisms are determined. Ageing effects and degradation mechanisms are listed for all elements and structures included into the AMP lists. – SS RNPP ageing management activities are aimed at restraining/mitigation of elements and structures degradation caused by ageing. Preventive measures include adherence to the water chemistry norms according to the requirements set forth in the regulatory documents. – Identification of the ageing effects precedes achievement of the E&S limit state. For this purpose, the technical condition parameters are monitored using appropriate methods and techniques. Inspection frequency and representative samples have been identified and justified. These activities are based on performance of the in-service metal inspection according to the established frequency and scope. Ageing effects for buildings and structures are detected during surveys and technical inspection of civil structures. – The current technical condition evaluation results are compared against the previous results to determine the degradation rate. Information on completed inspections is registered in the technical data sheets (passports) of the corresponding equipment and pipelines. Comparative analysis of the actual and previous inspection results is performed. – Activities (operation, maintenance, replacement, and implementation of organizational and engineered measures) are carried out that allow mitigating further degradation after the ageing effects are identified and degradation mechanisms are determined. Here, the technical condition parameters are still within the acceptance criteria. – Acceptance criteria used to determine necessity of corrective actions ensure the E&S performing the assigned functions during the service life. Acceptance criteria are developed based on the nuclear and radiation safety codes and standards. – Actions to be taken when acceptance criteria are not met have been identified. They are described in detail in the consolidated ageing management schedules. Corrective actions are aimed at elimination of the causes and timely prevention of degradation re-development as well as retaining/mitigating E&S degradation caused by ageing. – SS RNPP determined the procedure of operating experience use with establishment of accumulation and analysis system elements, their interfaces, and functions of SS RNPP departments within activities related to use of the operating experience. The OE activities are based on systematic search, selection, and analysis of the available operating experience with its further implementation by development, incorporation, and evaluation of corrective actions' efficiency (effectiveness). – The SS RNPP quality assurance system ensures the AMP implementation and maintaining it up-to-date. To ensure effective ageing management of elements and structures SS RNPP uses a set of automated information systems that accumulate and store information containing the design data, manufacturing data, operation and maintenance history, inspection and R&D results.
AU10	Question 3 Питання 3	What are the results of Safety Factor (SF) 4 (structures, systems and components ageing) of the last periodic safety review?	Results obtained for the SF-4 On the basis of AMP evaluation criteria and based on ageing management analysis the following may be concluded: SS RNPP management team exercises continuous monitoring of the ageing management activities documentation process. Within the existing IMS, ageing management is organized as a systematic process. Within the process the parties have been identified, and responsibilities for work execution within the ageing management process are determined for each party. Within the SS RNPP organizational structure there is a department coordinating the matters related to ageing management;

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			SS RNPP has developed, implemented, and maintains up-to-date the AMP for units 1&2. With account for accumulated experience, the AMPs were defined for each element included into the AMP list, and ageing effects and ageing mechanisms (including the dominant ones) were identified; According to AMP for units 1&2 the ageing management activities include: understanding of ageing phenomenon; ageing control; mitigation of ageing effects; Understanding of ageing phenomenon is the basis for effective control and mitigation of ageing effects. To understand ageing impact, the degradation mechanisms and consequences are studied during operation through inspections and testing (including non-destructive examination): ageing monitoring is carried out through in-service inspection and testing, surveys (technical examinations carried out according to the schedules developed by departments owning the equipment), equipment maintenance performed according to the technical specifications and instructions in force at SS RNPP; mitigation of ageing effects includes the actions limiting degradation after its identification, namely: actions during operation, maintenance or equipment replacement that mitigate the identified ageing effects and/or degradation of a structure/element. Actions aimed at mitigation of ageing effects include: – maintenance of the structure or element including repair and periodical replacement of components (parts, assemblies); – practical activities aimed at minimization of the rate of degradation caused by a structure or element ageing; – possible changes in the design and materials of the structure or element to reduce their degradation; periodical evaluation of the ageing management effectiveness is carried out to improve the overall AMP and ageing management programs for individual structures and elements. Analysis of the ageing management activities compliance with nine attributes performed in 2018 confirmed effectiveness of SS RNPP ageing management activities; evaluation of the actual condition of the AMP elements is carried out with the frequency defined by the operational and maintenance documentation. Before each outage of units 1&2 the working program of in-service metal inspection and an additional in-service metal inspection program for equipment and pipelines are developed that account for requests from the departments compiled based on operating experience. The scope and acceptance criteria for in-service inspection are defined by the regulatory documents; the protocols, reports, and conclusions prepared based on the metal inspection results all defects are recorded that exceed the minimum recorded level with specification of their size and location. Information on completed inspection is recorded to the technical data sheets of the corresponding equipment and pipelines; monitoring of the ageing effects as well as determination of the actual technical condition of the AMP elements is performed by equipment examination. Demonstration of ageing mechanisms such as stress corrosion cracking, local corrosion, corrosion fatigue, erosion corrosion, etc. is detected using non-destructive examination methods. During execution of the planned activities on technical condition evaluation within the on-going maintenance activities additional examination is carried out for components with previously identified defects or subject to preventive maintenance works. Such approach allows evaluating effectiveness of the implemented measures; applied at SS RNPP monitoring and diagnostics means allow the component condition monitoring, and the established frequency and scope of testing, examination, in-service inspection, and maintenance allow keeping equipment in operable condition with account for the unit safe operation limits and conditions;

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			monitoring of ageing management activities implementation is carried out by the departments owing the equipment as well as within self-assessment of the ageing management activities. Annually a report is prepared aimed at analysis of the SS RNPP performance effectiveness in part of implementation of technical and operational measures to keep degradation of the AMP elements within the acceptable limits. Effectiveness analysis is aimed at elimination of deficiencies and improvement of the ageing management system at SS RNPP units. Accounting for the obtained results of technical condition prediction, and with account for ageing of elements that limit the unit service life, availability of an effective ageing management program for SS RNPP units 1&2 and implementation of the measures developed based on the safety review results, safe operation of equipment and structures is possible during the long-term operation period till the next periodical safety review. As for the comments related to ageing of the structures, systems and components, it should be noted that the periodical safety review report, SF-4 "Ageing of structures, systems, and components", Chapter 5 "Analysis of ageing effects for civil structures" considers the following buildings and structures: • reactor building; • civil structures of the reactor pit; • civil structures of the spent fuel pond; • electrical equipment rack; • civil structures of the overhead pass between he ractor building and auxiliary building No. 1; • civil structures of the turbine hall; • civil structures of he auxiliary building of units 1&2; • civil structures of the DG station and diesel fuel storage. Survey, renovation, protection, monitoring and ageing effects mitigation measures, corrective actions for equipment, buildings and structures are included into he AMP for units 1&2. The regulator oversees implementation of such measures.
AU11	Question 4 Питання 4	What are the results of the embrittlement of the reactor pressure vessels (RPVs)?	Radiation embrittlement is the main process that limits the service life of reactor pressure vessels (RPV) made of ferrite steel 15Х2МФА. Weld joint No. 4 located across the core is the most dangerous RPV element from the standpoint of brittle fracture resistance that determines the radiation service life of the whole RPV. To restore mechanical properties of the RPV weld joint No. 4 it was annealed at unit 1 to reduce its critical brittle temperature. Analysis results for the weld joint No. 4 brittle fracture resistance confirmed that criteria of the RPV brittle fracture resistance are met till the end of operational period of 60 years (2040). Annealing was not performed at unit 2. Analysis results for the weld joint No. 4 brittle fracture resistance confirmed that criteria of the RPV brittle fracture resistance are met till the end of operational period of 60 years (2041). Radiation embrittlement is not a cause of cracking but it reduces metal resistance to development of crack that evolved in result of fatigue, stress corrosion or during the RPV manufacturing. The following measures were implemented to ensure the RPV brittle fracture resistance: use of fuel loads with reduced neutron leackage; primary circuit cold overpressure protection; ECCS water heatup to above 55°C that assists to reduction of thermal impacts onto the RPV cylinder part in emergency situations; interlocks for reactor protection against reactor cooldown in case of accidents with secondary steamlines rupture. Besides, responding to the comments on participation of Ukraine in the Topical expert review (TER) "Ageing management" within implementation of the Directive 2014/87/EURATOM on nuclear safety that was performed in 2017-2018, it should be noted that:

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			• according to the Decision of the SNRIU Board No. 9 dated 05.09.2019 made based on results of the WENRA National ageing management report the following document was approved: |ENSREG: The first topical peer review. National ageing management action plan (Ukraine)"; • to fulfill requirements of the SNRIU (the letter dated 09.10.2019) SS RNPP has planned the corresponding actions.
AU12	Question 5 Питання 5	Is the preparation of a systematic evaluation of the Rivne 1&2 design deviations from the current international safety standards and requirements envisaged?	Pursuant to section 3 [22.1.133.OB.03.07.03. "Rivne NPP. Unit 1. Safety analysis report. Additional materials on safety assessment. Volume 7. Analysis of design solutions and performance indicators. Deterministic assessment of safety level. Part 3. Analysis of deviations from requirements in force", 2019] all measures under the Safety enhancement concept for operating NPP units were included into the Consolidated safety enhancement program (CSEP, 2007). The CSEP was aimed at: • Elimination of the operating NPP units' design deviations from the acting national safety codes and/or reduction of such deviations' safety impact by implementation of compensatory measures as well as recommendations of the IAEA and other international organizations as for safety enhancement of Ukrainian NPPs. • Definition of the scope of works in the area of safety enhancement required for development of long-term investment programs for each unit. For further implementation of the safety enhancement measures at Ukrainian NPP units, the "Comprehensive (consolidated) safety enhancement program for Ukrainian NPP units" was adopted in 2010 within the National long-term strategy of safety enhancement and fulfillment of the Ukraine's international obligations. With new codes and standards coming into effect, the lists of deviations from the safety codes' requirements were compiled. SS Rivne NPP continuously deals with development and implementation of safety enhancement measures including the ones for elimination of deviations from the safety codes and standards. The measures from the "Implementation schedule of the Comprehensive (consolidated) safety enhancement program for Ukrainian NPP units" are included into the implementation schedules for RNPP units 1&2. The approach to classification of deviations from safety standards is similar to the IAEA principles proposed during development of the IAEA off-budget project in the document IAEA-EBP-WWER-03. Pursuant to section 3 item 3.1 [22.1.133.ZPPB.06. Rivne NPP. Unit 1. Periodical safety review report. Volume 6. Chapter 6. Comprehensive safety analysis", 2020] implementation of the safety enhancement measures according to the "Implementation schedule of the Comprehensive (consolidated) safety enhancement program for V-213 RF" will cover the defense-in-depth improvement measures determined based on the results of safety assessments, implementation of the IAEA experts' recommendations on unit design safety enhancement, and recommendations of the IAEA and RISKAUDIT experts' recommendations on elimination of safety issues and majority of deviations. Safe operation of the reactor facilities in compliance with international requirements was confirmed by the OSART and WANO missions reviewing compliance of operational safety level against international requirements. SS Rivne NPP periodically receives the operational reviews, technical support missions, seminars, workshops under the auspices of the IAEA and WANO with involvement of experts from other Ukrainian NPPs and international experts. In general, both according to the SF-9 review results, and according to external independent reviews' results in this area, the SS RNPP pursuit towards improvement of the operating experience accumulation, analysis and use system to achieve full compliance with the success and quality criteria defined by the national and international requirements to this factor was confirmed. SS Rivne NPP has implemented and uses the IMS that ensures continuous performance assessment aimed at continuous improvement at all management levels. The RNPP IMS is certified by the TÜV NORD CERT for compliance with international standards ISO 9001:2015, ISO 14001:2015 and BS OHSAS 18001:2007. Self-assessment of the IMS is carried out on the permanent basis. Safe operation of the reactor facilities in compliance with international requirements was confirmed by the OSART and WANO missions reviewing compliance of operational safety level against international requirements.

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AU13	Question 6 Питання 6	Which safety systems and Severe Accident Management (SAM) systems are shared between the units?	The NPP design is based on the defense-in-depth concept ensuring prevention of: • failure of physical barriers intactness; • physical barriers failure in case of considered initiating events; • physical barriers failure resulting from failure of other barriers; • common cause failure of physical barriers. Safety systems and components are designed with account for the following principles: • redundancy; • diversity; • physical separation; • single failure. The NPP design defines and the SAR justifies engineered measures to ensure preservation of water inventory sufficient for emergency cooldown of the reactor facility in case of external hazards. The essential service water system design (a normal operation system that combines the functions of supporting safety system) complies with the above requirements of the codes and standards except for the shared water reservoirs of units 1&2 containing network water in part of the redundancy principle.
AU14	Question 7 Питання 7	To which extent were and will international documents (IAEA, WENRA) be applied in a binding manner for the lifetime extension?	In organization of works on lifetime extension and long-term operation SS RNPP follows the national codes and standards as well as the branch documents of the SS NNEGC "Energoatom" that were developed with account for recommendations of the following IAEA documents: 1. IAEA. Ageing Management for Nuclear Power Plants: International Generic Ageing Lessons Learned (IGALL), IAEA Safety Reports Series No. 82, Vienna 2015 2. INTERNATIONAL ATOMIC ENERGY AGENCY, Ageing Management and Development of a Programme for Long Term Operation of Nuclear Power Plants, Specific Safety Guide No. SSG-48, IAEA, Vienna 2018 3. IAEA-TECDOC-1557 Assessment and Management of Ageing of Major NPP Components Important to Safety - PWR Pressure Vessel Internals, IAEA, Vienna 2007 4. IAEA-TECDOC-1556 Assessment and Management of Ageing of Major NPP Components Important to Safety - PWR Vessels, IAEA, Vienna 2008 5. Unified Procedure for Lifetime Assessment of Components and Piping in WWER NPPs “VERLIFE”, version, 2008 6. IGALL Database (/gnssn.iaea.org/) - AMR tables, a collection of AMPs, a collection of TLAAs
AU15	Question 8 Питання 8	When will the WENRA RL be fully implemented in the Ukrainian regulations? Is the application of the RL binding?	This question is not under control of the SS NNEGC "Energoatom".
AU16	Question 9 Питання 9	When will be conducted a review on whether the Rivne 1&2 meets the WENRA RL requirements?	Review of SS RNPP units 1&2 compliance with the WENRA RL may be conducted after incorporation of such requirements into the Ukrainian codes and standards.
	5 ACCIDENT ANALYSES		

№ з/п	Розділ/пункт	Коментар зачепленої сторони англійською / українською	Відповідь на коментар українською / англійською
	5 АНАЛІЗ АВАРІЙ		
AU17	Question 1 Питання 1	What are the source terms of the calculated BDBA in the PSA 2 including releases from the spent fuel pools?	Calculation results for individual isotopes releases in case of BDBA at the reactor and spent fuel pond are provided in the following documents: • 22.1.133.OB.04.06.04. Rivne NPP. Unit 1. Safety analysis report. Probabilistic safety assessment. Annex VI. Calculations and analytical justification of accident process behavior. Book 4. Severe accident analysis for the reactor facility. 2020. 381310.203.003.OT01-04 (2-RUTA-AO-RAES). Rivne NPP. Unit 2. Development of analytical justification of the severe accident management strategies and SAMG development for RNPP unit 2. Phase 3. Analytical justification of the severe accident management guideline (SAMG) for RNPP unit 2. 2015.
AU18	Question 2 Питання 2	Which requirements have the filtered venting systems to fulfil, particularly regarding earthquake resistance?	Implementation of the filtered venting system was not considered in the modernization projects for VVER-440 units.
AU19	Question 3 Питання 3	What is the currently valid time schedule for the implementation of all required SAM features for the Rivne 1&2?	The following actions have been completed for RNPP units 1&2: 1) Makeup lines from the mobile pumping units in case of long-term station blackout for: • spent fuel storage pond; • additional SG feedwater system tanks; • group A service water consumers in case of the spray ponds dewatering. 2) Electrical power supply restoration for the 0.4 kV safety trains under the long-term station blackout conditions using the mobile diesel generator. 3) Hydrogen concentration monitoring system in the SG compartment, RCP compartment, and PRZ compartment. 4) Emergency and post-accident monitoring system in case of long-term station blackout. 5) Analysis of possibility of the corium in-vessel retention strategy implementation. The following measures are going on: • Reactor pressure vessel (RPV) external cooling (deadline – 2022); • System of hydrogen concentration reduction inside the containment for beyond design basis accidents (deadline – 2023); • Forced containment venting system (deadline – 2023).
AU20	Question 4 Питання 4	What are the parameters of the maximum aircraft crash (plane mass and speed) the buildings of the Rivne 1&2 can withstand?	In the PSA it is conservatively assumed that a crash of any plane or helicopter onto the buildings of RNPP units 1&2 would result in damage of such buildings. In such case the summary frequency of an aircraft crash at the reactor building of the unit us 3.11E-07 per year [22.1.133.OB.04.10.Rev.1. Rivne NPP. Unit 1. Safety analysis report. Probabilistic safety assessment. Annex X. External hazards. 2020].

<table>
<tr><th>№ з/п</th><th>Розділ/пункт</th><th>Коментар зачепленої сторони англійською / українською</th><th>Відповідь на коментар українською / англійською</th></tr>
<tr><td>AU21</td><td>Question 5
Питання 5</td><td>What is the technical justification of the BDBA that is chosen to calculate possible trans-boundary consequences?</td><td>
When determining the radionuclide release during the beyond design basis accident (BDBA), the limit value of Cs-137 release into the environment at the level of 30 TBq was taken as the basis, in accordance with the safety requirements of European operating organizations for designs of nuclear power plant with light-water reactors. The Cs-137 isotope was chosen because of its dominant importance for long-term environmental contamination, as well as its effect on the health consequences.
Other isotopes in the form of aerosols (that is, all radioactive decay products, except for noble gases and gaseous isotopes of iodine) are released into the environment in proportion to this value, even if these isotopes are released into the atmosphere.
For noble gases and gaseous forms of iodine, the activity of release was calculated at the level of 0.5% of all activity in the containment per day. The total release activity over the entire release period was conservatively set at level of 7-times release activity during the first day.
The height of release is conservatively considered as near-surface, which corresponds to the predicted release routes in case of serious accidents due to leakage of containment.
Into the general list of radionuclides that can enter the environment, in addition to the isotopes taken as an example, other radioisotopes from the same group are added, and they are represented in a common term in the same ratio as in the aggregate of decay products in the reactor core, relative to isotope taken as an example.
When calculating the dose of the proposed source member, it is recommended to take into account the release of individual radioisotopes, in accordance with a time interval of linear duration from 0 to 24 hours after the accident, which is a conservative approach compared with the considered release duration of 7 days.
Table. 3.5 (Book 7, “Transboundary environmental impact of production activities”) provides the parameters for the release of radionuclides during the maximum design basis accident. The duration of this accident is assumed to be 60 minutes. All other accidents leading to lower releases of radionuclides are not considered.

Table 3.5 - Activity of radionuclides releases during the maximum design basis accident (MDBA) at RNPP, Bq
<table>
<tr><th>Radionuclide</th><th>Half life</th><th>Release at MDBA, Bq</th></tr>
<tr><td>Kr-88</td><td>2,84 years</td><td>2,00E+13</td></tr>
<tr><td>Sr-90</td><td>29,1 years</td><td>3,10E+11</td></tr>
<tr><td>Ru-103</td><td>39,6 days</td><td>4,50E+12</td></tr>
<tr><td>Ru-106</td><td>1,01 year</td><td>6,60E+11</td></tr>
<tr><td>I-131</td><td>8,04 days</td><td>4,98E+12</td></tr>
<tr><td>I-132</td><td>2,3 years</td><td>2,70E+12</td></tr>
<tr><td>I-133</td><td>20,8 years</td><td>4,00E+12</td></tr>
<tr><td>I-135</td><td>6,61 years</td><td>2,30E+12</td></tr>
<tr><td>Cs-134</td><td>2,06 years</td><td>7,80E+11</td></tr>
<tr><td>Cs-137</td><td>30,0 years</td><td>5,00E+11</td></tr>
<tr><td>La-140</td><td>1,68 days</td><td>8,40E+12</td></tr>
<tr><td>Ce-141</td><td>35,2 days</td><td>1,40E+13</td></tr>
<tr><td>Ce-144</td><td>284 days</td><td>8,60E+12</td></tr>
</table>
</td></tr>
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№ з/п	Розділ/пункт	Коментар зачепленої сторони англійською / українською	Відповідь на коментар українською / англійською

The main radionuclides and their release during the beyond design basis accident are given in table. 3.6. (Book 7 "Transboundary environmental impact of production activities").

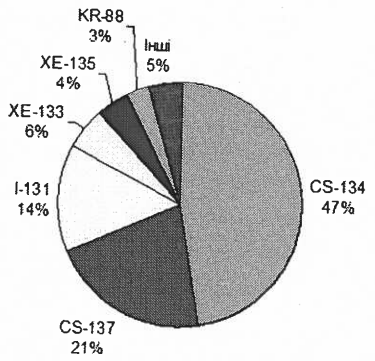
Table 3.6 - Activity of radionuclides releases during the beyond design basis accident at RNPP, Bq

Radionuclide	Release, TBq	Radionuclide	Release, TBq
Xe-133	3,50E+05	Cs-136	1,50E+01
Kr-85	2,10E+03	Te-131m	2,00E+01
Kr-85m	5,30E+04	Te-129m	8,00E+00
Kr-87	1,10E+05	Te-132	2,00E+02
Kr-88	1,40E+05	Sb-127	1,60E+01
Xe-131m	2,10E+03	Sb-129	4,60E+01
Xe-133m	1,10E+04	Sr-90	5,00E+00
Xe-135	1,10E+05	Sr-89	6,00E+01
Xe-135m	7,70E+04	Sr-91	7,50E+01
Xe-138	3,20E+05	Ru-103	3,00E+00
I-131	1,00E+03	Mo-99	4,00E+00
I-132	1,50E+03	La-140	5,00E+00
I-133	2,10E+03	Y-91	4,00E+00
I-134	2,30E+03	Ce-141	4,00E+00
I-135	2,00E+03	Ce-144	3,00E+00
Cs-137	3,00E+01	Np-239	4,80E+01
Cs-134	6,00E+01	Ba-140	1,00E+02

Also, the contribution of Xe-135, Xe-137 was calculated and shown, and the corresponding conclusions were drawn.

The expected effective doses for the population after MDBA and BDBA are small compared to the natural radiation background. According to the report of the UN Scientific Committee on the effects of atomic radiation presented to the UN General Assembly for 1993, the annual effective dose from natural sources of radiation in areas with normal radiation background is 2.4 mSv, that is, over 50 years, this dose will be 120 mSv. And during BDBA the expected dose over 50 years is less than 13 mSv for all countries.

The relative contribution of various nuclides to the expected effective dose at a distance of 340 km from the RNPP during BDBA is shown in the diagram below.

№ з/п	Розділ/пункт	Коментар зачепленої сторони англійською / українською	Відповідь на коментар українською / англійською
			Ефективна доза  As follows from the data on the diagram, the largest contributions are made by cesium isotopes: 134Cs - 47% and 137Cs - 21%. Inert gases: 133Xe, 135Xe and 88Kr also make a noticeable contribution to the total effective dose. The total contribution of the remaining 29 nuclides during BDBA is less than 5%.
	6 ACCIDENTS INITIATED BY NATURAL EVENTS AND SITE ASSESSMENT 6 АВАРІЇ, ІНІЦІЙОВАНІ ПРИРОДНИМИ ПОДІЯМИ, ТА ОЦІНКА МАЙДАНЧИКА		
			General information regarding analysis of the accident caused by natural events and site assessment As the EIA report was prepared in 2018, it used the actual results of the probabilistic safety assessment (PSA) for RNPP units 1&2 as of 31.03.2014. Within the current periodical safety review for units 1&2 the PSA and SF-6,7 of the periodical safety review reports were updated as of 01.07.2018. The updated materials contain a much wider list of external hazards that were subject to safety impact review, and account for upgrading measures implemented at units 1&2 as of 01.07.2018, including the measures developed based on the lessons learnt from the Fukushima accident. Documents: 1. 22.1.133.OB.04.10.Rev.1. Rivne NPP. Unit 1. Safety analysis report. Probabilistic safety assessment. Annex X. External hazards. 2020. 2. 22.1.133.OB.12.03.Rev.1. Rivne NPP. Unit 1. Safety analysis report. Probabilistic safety assessment. PSA update report. 2020. 22.1.133.OPPB.02.03. Rivne NPP. Unit 1. Periodical safety review report, Safety factor 7. Chapter 2. Unit safety analysis. PART 3. Analysis of safety impact from internal and external events. 2020
AU22	Question 1 Питання 1	Why has flooding due to extreme precipitation been excluded from the further consideration of natural hazards?	Floods caused by extreme precipitations have been analyzed in the PSA. Based on the analysis results it was defined that heavy rains may result in malfunction of the open switchyard equipment and other normal power supply system equipment that may cause initiating events of the group "Loss of all 6 kV house loads power supply buses" that is considered in the Level 1 PSA for internal initiating events. This group covers, in particular, events associated with the loss of external (open switchyard and the grid) and internal power supply sources of the unit. In IE frequency determination for the Level 1 PSA for internal events based on statistics of actual operational occurrences various initiators were accounted for including the IE caused by external factors. The IE group "Loss of all 6 kV house

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			loads power supply buses" frequency for RNPP units 1&2 is 3.29E-02 per year, and conditional core damage probability (CCDF) for these IE is 3,86T-06 that proves high potential of the units to achieve safe state in case of such IE occurrence. Documents: 1. 22.1.133.OB.04.10.Rev.1. Rivne NPP. Unit 1. Safety analysis report. Probabilistic safety assessment. Annex X. External hazards. 2020. 2. 22.1.133.OB.12.03.Rev.1. Rivne NPP. Unit 1. Safety analysis report. Probabilistic safety assessment. PSA update report. 2020.
AU23	Question 2 Питання 2	The probability of the water level of the River Styr to drop below the critical value of 158.80 m in case of drought is stated with 0.3% per year. Would the dropping of the water level even lower result in the full unavailability of cooling water from the River Styr?	Abnormal water level reduction in the River Styr does not pose danger for NPP structures and components. The impact of abnormal river water level drop onto the pumping station of makeup water cannot cause an initiating event in accordance with the approach adopted in the probabilistic risk assessment. In case of abnormal water level drop in the River Styr, failure of the pumping station of makeup water, and impossibility to make up the circulating water system the units will be shut down in a planned manner. SS RNPP has developed and applies the "Guideline on prevention of operational occurrences at SS RNPP in case of water level drop in the River Styr". The document defines several scenarios of human actions depending on the criteria (up to units disconnection from the grid and brining reactors to the Cold Shutdown state that is a standard mode of normal operation).
AU24	Question 3 Питання 3	Are the water reserves at the primary and secondary circuits of the WWER units large enough to cool all four reactors after shutdown from full power and maintain cooling until a safe state is reached in cases when no cooling water is available from River Styr?	In case of complete loss of water supply from the Styr (failure of the makeup water system) is considered within the probabilistic safety assessment and additional targeted safety review for Rivne NPP units. A failure of the makeup water system may result in termination of water supply from the essential and non-essential service water systems. In such case the units must be shut down and heat removal would be arranged using the stationary systems. Water from the cooling towers' bowl, supply and discharge channels of the circulation water system may be used as an additional source to ensure water supply to essential loads of the primary and secondary circuits that are involved into normal operation and remain in operation to cope with emergency situations. The circulation water system inventory is sufficient to maintain the RNPP units in safe state for 27 days. In extreme situations it is envisaged to supply cooling water of drinking water quality from two independent water intakes. Documents: 1. 22.1.133.OB.04.10.Rev.1. Rivne NPP. Unit 1. Safety analysis report. Probabilistic safety assessment. Annex X. External hazards. 2020. 2. OTsPB-0.41.002.02. Additional targeted safety review for RNPP units with account for the lessons learnt from the Fukushima accident. Chapter 2. External hazards assessment. 2012.
AU25	Question 4 Питання 4	Is it intended to equip the Rivne NPP with a second, independent cooling water supply such as ground water wells to ensure the availability of cooling water/essential service water in case of low river water levels and drought?	Complete loss of water supply from the River Styr (failure of the makeup water system) is considered within the probabilistic risk assessment and additional targeted safety re-assessment for RNPP units. A failure of the makeup water system may result in termination of water supply from the normal and essential service water systems. In such case the units must be shut down, and residual heat removal will be arranged using the stationary systems. Water from the cooling towers' bowls as well as from the inflow and outflow channels of the circulating water system may be used as additional source of water to supply essential loads of the primary and secondary circuits involved into normal operation and remaining in operation during mitigation of emergency situations. The circulating water system's inventory is sufficient to keep the RNPP units safe for 27 days. In extreme situations there is a possibility of drinking-water quality cooling water supply from two independent underground water intake wells.
AU26	Question 5 Питання 5	With respect to snow loads the EIA REPORT BOOK 1 (2018, p. 109) refers to a “current normative	При продовженні термінів експлуатації енергоблоків № 1, 2 були виконані перевірочні розрахунки будівельних конструкцій будівель та споруд, що містять системи важливі для безпеки, на сприйняття навантажень та впливів, що регламентовані діючими нормативними документами України в галузі будівництва.

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		document" that sets the normative values of the snow load for the Rivne region to 1,400 Pa. This value is above the original design. What are the consequences of this discrepancy between the status as-built and the current requirements for buildings housing safetyrelevant SSCs of the Rivne reactors?	Verification calculations of civil structures of the buildings and facilities housing the safety-related systems for resistance to loads and impacts regulated by the acting Ukrainian regulations in the area of construction were performed during the lifetime extension of units 1&2. The snow load of 1400 Pa (for Rivne region) was accounted for according to the acting Ukrainian construction norms in the verification calculations for civil structures of units 1&2. According to results of the performed verification calculations, safety and reliability of civil structures is ensured from the standpoint of load bearing capacity and strain capacity during the long-term operation in all operational modes including the most unfavorable external impacts. Thus, discrepancy between the as-built and current requirements for buildings and structures does not impact reliable operation of the buildings housing the safety-related equipment.
AU27	Question 6 Питання 6	TERMINOLOGY USED FOR THE DESCRIPTION OF SEISMIC HAZARDS IN THE EIA REPORT BOOK 3 VOL 3 (2018, P. 718ff) appears unclear. The Austrian experts had to assume that the "design basis earthquake (DBE)", also termed "Project Earthquake (PE)", refers to SL-1 as used by IAEA (2010) and the "safe shutdown earthquake (SSE)", also termed "maximum estimated earthquake (MEE)", refers to SL-2 (IAEA, 2010) or the Design Basis Earthquake (WENRA, 2014a; 2015). Also they assumed further that terms like "5 point", "6 point", "magnitude 5", "magnitude 6" refer to intensity (MSK-64 scale) instead of magnitude. Is this correct?	The maximum estimated earthquake (MEE) – an earthquake with the maximum expected intensity at the NPP site with occurrence frequency per 10000 years (*NP 306.2.208-2016)*. Project earthquake (PE) - an earthquake with expected intensity at the NPP site with occurrence frequency per 100 years for operating NPP units and once every 1000 years for new NPP units (*NP 306.2.208-2016)*. According to the document "*Designing and qualification of seismic resistant structures of nuclear power plants. Guideline*" NS-G-1.6, the LS-1 refers to the project earthquake, and SL-2 refers to the maximum estimated earthquake. The terms "5 points", "6 points", "magnitude 5", and "magnitude 6" refer to intensity according to the MSK-64 scale. Actually, the terms «design basis earthquake» and «project earthquake» are equivalent (SL-1). The same refers to the terms «safe shutdown earthquake» and «maximum estimated earthquake» (SL-2). Different terminology is the result of incorrect translation into English. The terms "magnitude 5", "magnitude 6" actually refer to the earthquake intensity 5 and 6 according to MSK-64.
AU28	Question 7 Питання 7	EIA includes contradicting information about the recurrence interval of "maximum estimated earthquake" (also termed "safe shutdown earthquake") with I=6. Both, values of 5,000 and 10,000 years	The recurrence value of 5000 years for the safe shutdown earthquake is erroneous. An earthquake of the maximum expected intensity is assumed as the "maximum estimated earthquake" at the NPP site with recurrence of 10000 years. For RNPP site such an earthquake is I=6 earthquake that is confirmed by the studies [Rivne NPP. Unit 4. Technical report on results of additional seismic hazard studies. 2001].

№ з/п	Розділ/пункт	Коментар зачепленої сторони англійською / українською	Відповідь на коментар українською / англійською
		are stated as recurrence intervals. The Austrian experts ask for the clarification of this contradiction.	
AU29	Question 8 Питання 8	It appears that I=VI MSK64 is associated with Peak Ground Acceleration (PGA) of 0.05g. What is the basis for such a correlation between macroseismic intensity and ground acceleration?	According to the acting Ukrainian construction norms Rivne NPP is related to the territory for which the maximum estimated earthquake intensity is 6 per MSK-64 that corresponds to the plant design value. The peak ground acceleration (PGA) of 0.05g corresponds to the intensity 6 per MSK-64.
AU30	Question 9 Питання 9	The IEA document mentions additional seismic hazard assessments that were performed in the late 1990ies and early 2000nds. These, however, are not further explained in the EIA Document. The Austrian experts ask to provide those references and results of these investigations for the Rivne NPP site.	The last comprehensive seismic safety studies of SS RNPP site territory were performed in 1999-2001. In course of additional examination of the SS RNPP site seismic safety the experts of the Geophysics Institute of the National Academy of Science of Ukraine performed the seismic hazard assessment using deterministic approach and probabilistic assessment based on the lineament-domain approach. Based on calculation results for seismic impact characteristics for SS RNPP site according to the traditional deterministic method the seismic impact intensity for PE equals to 5, and for MEE equals to 6 according to MSK-64.
AU31	Question 10 Питання 10	Karstification and suffusion are listed as hazardous phenomena destabilizing the soil under the NPP site, also under the reactor buildings. Accordingto the EIA REPORT BOOK 3 VOLUME 3, (2018, p.721-722) the foundations for unit 4 are laid on piles reaching below the karstified layer into basalt. Are the foundations of the other reactor units constructed in the same way? Are the concrete injections sufficient to stabilize fundaments of the other blocks? How is the stability of foundations secured for other buildings housing	There are four units in operation at the RNPP site. Essential structures of unit 4 are built on the piles reaching into basalt, i.e. passing through the layers subject to karstification impact, thus ensuring their reliable operation. Resistance of the rest of buildings and structures of unit 4 and buildings and structures of units 1, 2, 3 is improved owing to cementation of the chalk layer and basalt contact area. Simultaneously with cementation reinforcement of soils was done using the well-and-injection tubes passing through the chalk layer. Technical report "*Comprehensive analysis of geophysical, hydrogeological, and geodetic survey with account for engineering and geological site conditions and man-caused impact onto the geological environment between 2010 and 2018, and prediction of the SS RNPP buildings' and structures' settlement and careen till 2030*" was developed in 2019. Conclusions of the above Technical Report specify, in particular: - Settlement and careen of all facilities located at the SS RNPP site are within the allowed values and do not impact safe operation of buildings and structures. - Cementation of the chalk layer besides prevention of the possible suffusion processes assisted improvement of the strain capacity of the soil foundation that, actually, can explain absence of significant settlement of buildings and structures that were observed in 2010-2018. - When defining effectiveness of chalk layer cementation in the foundation of buildings and structures located within the SS RNPP site, possibility of additional settlement and careen deformations development due to rheological processes in the loaded soil mass, determines necessity of continuous geodetic monitoring of buildings and structures to detect unpredicted deformations in the soil foundations.

№ з/п	Розділ/пункт	Коментар зачепленої сторони англійською / українською	Відповідь на коментар українською / англійською
		safety-relevant equipment and safety-relevant underground piping?	- Providing non-excess of the load carrying capacity of the cemented soil foundation by current loads, activation and development of negative deformation processes should not be expected at such areas till 2030. For anthropogenic safety assurance the SS RNPP performs continuous condition monitoring of soils, buildings and structures of units 1÷4 and of the rest of the site: - hydrogeological monitoring of the ground waters (monitoring of the underground water level and temperature, its chemical composition) at 193 hydrogeological monitoring wells; - monitoring of soil humidity and density under the foundations of buildings and structures using radioisotopic logging at 193 geophysical wells; - monitoring of buildings and structures settlement and careen using 3288 settlement marks; - inspection of buildings and structures; - monthly survey of the plant site for suffusion and karst occurrences. Currently the site geological environment is balanced, corresponds to geotechnical properties of the soils at the foundations of buildings and structures, and ensures reliable operation of buildings and structures. Over the last 39 years of SS RNPP site observations there were no cases of identified suffusion and karst development at the ground surface.
AU32	Question 11 Питання 11	How is sewage water removed from the site? Is it secured that concentrated seepage of sewage water from surface runoffs and/or direct infiltration of sewage water does not lead to extended man-made karstification and suffusion?	The SS RNPP site design envisages the site improvement measures including: - vertical planning and water removal lines that ensure prompt collection and removal of rainwater and surface water to the rainwater sewage system; - paving next to buildings and structures including extended asphalting and paving of territory around the cooling towers. The existing rainwater sewage system and treatment facilities cope with rainwater removal from the SS RNPP site. There is no water stagnation observed at the territory. Thus, there is no significant surface water impact onto activation of suffusion and karstification processes.
AU33	Question 12 Питання 12	The formation of a "ground water dome" at the site proves the continued outflow of large amounts of water from the hydro-engineering installations. How is it secured that these outflows do not destabilize the foundation soil by increased karstification and suffusion? Are the cooling towers, cooling water channels and pipes, which are supposed to be the sources of infiltrating water, subjected to a monitoring program to secure their stability? Are those structures made of watertight concrete or	12.1. Before construction had started, the natural groundwater ridge was located at the site territory in the area of outflow channel of unit 4 and cooling towers 5&6 with the absolute ridge elevation 178,60 m. Over the SS RNPP operation period some migration of the ridge top was observed between units 1&2 and 4. As of 31.12.2020 the groundwater level exceeds the natural level by 1,97 m. Additional engineering and research studies performed in 2008-2019 have not identified notable changes in hydrogeological environment and geotechnical properties of soils. Cementation of the chalk layer and basalt contact area was performed under the units' buildings and structures. AT the same time the soils were reinforced with well-and-injection tubes passing through the chalk layer. There were no cases of suffusion and karstification identified at the mentioned territory over the whole plant operation period. 12.2. To ensure stable operation of hydraulic facilities the quarterly condition monitoring of the hydraulic facilities' civil structures is carried out according to the approved schedule. Pursuant to operational documentation, hydraulic facilities surveys are performed every 15 days, and extraordinary surveys are performed following the extreme meteorological events (heavy snowfalls, heavy rains, strong wind, hurricane). Once every 5 years the industry-wide commission performs the streamlined survey of hydraulic facilities and reviews the oversight arrangements within the scope of requirements of the branch regulations. Civil structures of hydraulic facilities are made of B8 watertight concrete.

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		lined with other impermeable materials? What are the measures envisaged to reduce or prevent the infiltration of technical water and reduce karstification / suffusion processes?	The following measures preventing the service water infiltration into the ground have been implemented during the hydraulic facilities construction: - hydraulic insulation of facilities according to the design documentation; - paving around the facilities; - vertical planning of the territory and arrangement of necessary services ensuring prompt collection and removal of rainwater and surface water to the rainwater sewage system. 12.3. The following measures preventing the service water infiltration into the ground have been implemented over the hydraulic facilities operation period: - 1983 – draining of all hydraulic facilities with further application of asphalt-bituminous hydraulic insulation and its protection with the concrete and gunned-concrete layer; 2003÷2007 – repair of the damaged and destroyed surfaces of the concrete and hydraulic insulation layer (spray ponds of units 1÷4; bowls of cooling towers 1&2; open outflow channel of units 1&2 with overflow device; closed outflow channels of units 1, 2, 3; channels of the cooling towers 1&2; intake basins of unit pumping station BNS-1; breast wall of unit pumping station BNS-1).
	7 ACCIDENTS WITH INVOLVEMENT OF THIRD PARTIES AND MAN-MADE IMPACTS 7 АВАРІЇ ЗА УЧАСТЮ ТРЕТІХ СТОРІН ТА ФАКТОРІВ ТЕХНОГЕННОГО ВПЛИВУ		
AU34	Question 1 Питання 1	What are the requirements with respect to the planned NPP design against the deliberate crash of a commercial aircraft?	It is conservatively accepted within the framework of the PSA that the crash of any aircraft or helicopter on the buildings of RNPP units 1, 2 leads to destruction of these buildings. The total frequency of aircraft crashes on the reactor building is 3,11E-07 1/year [22.1.133.OB.04.10.Rev.1. Rivne NPP. Unit 1. Safety Analysis Report. Probabilistic safety analysis. Annex X. External hazards. 2020]. External and internal threats to nuclear facilities and nuclear materials that should be taken into account during the designing of the reactor building and other buildings important to safety are identified by the «Design Basis Threat to NF, NM, RAW and Other IRS in Ukraine» (Design Basis Threat) approved by the Decree of the President of Ukraine No. 97-4т/2019 dated 03.04.2019 (classified as "secret"). The design basis threat was determined based on the assessment of threats and in accordance with the Law of Ukraine "On physical protection of nuclear facilities, nuclear materials, radioactive waste, other ionizing radiation sources". The physical protection system ensures counteraction to external and internal threats to nuclear facilities and nuclear materials. The ability of the physical protection system to counter the design basis threat including the threat caused by ageing degradation of equipment and engineering controls is determined during the vulnerability assessment of nuclear facilities and nuclear materials (Nuclear Security Assessment). Based on the results of the vulnerability assessment the corresponding report is prepared and submitted to the regulatory authority in accordance with the procedure established by the SNRIU. This report is classified as "secret" and covers the risk mitigation measures.
AU35	Question 2 Питання 2	Against which external attacks must the reactor building and other safety relevant buildings be designed? Is this protection still guaranteed despite adverse ageing effects?	
AU36	Question 3 Питання 3	Is a peer-review mission of the IAEA International Physical Protection Advisory Service (IPPAS) planned?	SS RNPP of the SE «NNEGC «Energoatom» does not have information about the planned peer review missions of the IAEA International Physical Protection Advisory Service (IPPAS).
	8 TRANS-BOUNDARY IMPACTS 8 ТРАНСКОРДОННІ ВПЛИВИ		

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<tr><th>№ з/п</th><th>Розділ/пункт</th><th>Коментар зачепленої сторони англійською / українською</th><th>Відповідь на коментар українською / англійською</th></tr>
<tr><td>AU37</td><td>Question 1
Питання 1</td><td>Please provide the quantitative results of the calculated ground deposition of I-131 and Cs-137 for the distance to Austria.</td><td>The calculations were performed using the European decision support system JRODOS. When analyzing the emission source of 30 TBq Cs-137 for a beyond design basis accident (BDBA), depending on the wind speed the density of ground deposition of radionuclides at the borderline of Austria was:
<table>
<tr><th>Wind speed, m/s</th><th>Cs-137, Bq/m^2</th><th>I-131, Bq/m^2</th></tr>
<tr><td>1</td><td>27.0</td><td>0.6</td></tr>
<tr><td>3</td><td>18.0</td><td>21.4</td></tr>
<tr><td>5</td><td>10.4</td><td>27.3</td></tr>
<tr><td>10</td><td>4.5</td><td>20.6</td></tr>
</table>
Based on a conservative approach, the density of ground deposition of I-131 and Cs-137 will be 27 Bq/m^2.
Note. The following parameters were used for calculation: emission duration - 24 hours; atmospheric stability category - "D", without precipitation; wind direction - 70°; activity of Cs-137 - 30 TBq, I-131 - 30 TBq; effective emission height - 100 m; diffusion model - "Dipcot"</td></tr>
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