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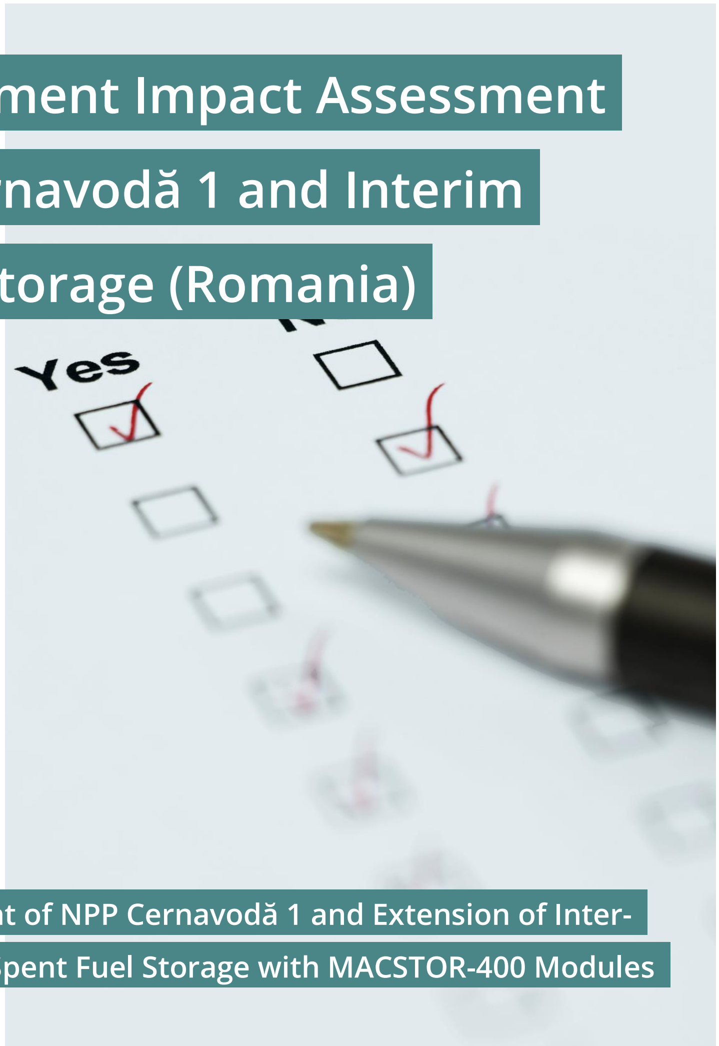
# Environment Impact Assessment NPP Cernavodă 1 and Interim Waste Storage (Romania)

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Refurbishment of NPP Cernavodă 1 and Extension of Intermediate Dry Spent Fuel Storage with MACSTOR-400 Modules

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# ENVIRONMENT IMPACT ASSESSMENT NPP CERNAVODĂ 1 AND INTERIM WASTE STORAGE (ROMANIA)

## *FINAL CONSULTATION REPORT*

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# EXECUTIVE SUMMARY

The Romanian NPP, located in Cernavoda, has two units in operation, both CANDU-PHWR-600 type reactors (CANadian Deuterium Uranium), using natural uranium as fuel and heavy water as moderator and cooling agent. They contribute with ~20% to the electricity generated in Romania. Unit 1 (U1) started operation in 1996 and Unit 2 (U2) in 2007. CANDU reactors have an initial lifetime of 30 years; following a refurbishment process, this lifetime can be extended with another 30 years. The Energy Strategy of Romania considers nuclear energy as an important element for the security of energy supply, and as such a lifetime extension of U1 of Cernavoda NPP is envisaged; for this, a refurbishment and modernization project is proposed. In parallel a project is to extend the capacity of the on-site Spent Fuel Storage Facility with bigger modules, aiming to have a double storage was initiated.

Based on the Romanian Environment Impact Assessment Law (EIA Law) transposing the EIA Directive (2011/92/EU as amended), the refurbishment of U1 and extension of the on-site Spent Fuel Storage Facility is subject to an EIA. As required by the Romanian Law ratifying the Espoo Convention, the project developer submitted the necessary documentation to the Romanian Ministry for Environment, Waters and Forests for starting the consultation process within the EIA procedure. A notification was also sent to Austria, which participates in this cross-border procedure.

Being a potentially affected party in a case of a radiological release from Cernavoda site, Austria has an interest to participate in the EIA procedure. In this respect, the Austrian Federal Environment Agency (UBA) engaged an expert team of ENCO to assess the EIA and develop an expert statement. The main conclusions of this expert statement are:

- The EIA report follows the content required by the EIA Directive, however, the radiological impact – that is the most important one for nuclear projects – is not presented with a sufficient level of detail.
- The refurbishment of U1 will generate large amounts of radioactive waste (RW), for which a new storage facility will be built on-site; the management of the RW that will be generated by the refurbishing process is appropriately described in the EIA report.
- Spent Nuclear Fuel (SNF) is considered in Romania as radioactive waste; the national Strategy for the Safe Management of Radioactive Waste and Spent Nuclear Fuel prescribes the disposal of SNF in a geological repository expected to be operational by 2055; until then, all SNF generated by Cernavoda NPP will be stored on site. Following an initial cooling for minimum 6 years in the SNF pool, the spent fuel is stored on-site in the Dry Interim Spent Fuel Storage Facility (DICA). Currently, DICA consists in 17 modules MACSTOR-200 (where 204.000 spent fuel bundles are stored); 20 other modules with double storage capacity (MACSTOR-400) are planned to be built for the storage of future 480.000 spent fuel bundles

(to be generated by U1 and U2, within original design life as well as extended design life – total of 60 years).

- Accidents with involvement of third parties are only marginally mentioned in the EIA report. The Population Health Impact Assessment Study conducted for the purposes of the EIA concludes that "the potential population health effects arising from a malfunction, radiological/nuclear accident or malicious act are often of interest to members of the public living near a nuclear facility", but it is not clear if malicious acts have been included in the scenarios analysed. The impact of a heavy, commercial aircraft on DICA has been identified as a severe accident, but then screened out based on a very low frequency. The authors of the EIA report consider that only those scenarios with a frequency higher than 1 x $10^{-6}$ should be considered in an EIA for a NPP, which is incorrect.
- The only results of an accident analysis presented in a transboundary context are those of a postulated (design-basis) accident, considered in the last revision of the FSAR of Cernavoda U1 as having the most serious consequences. The maximum value of the individual effective dose following the exposure to the postulated release for a period of 30 days is 5.5 mSv, at 1 km distance from the reactor. At 30 km distance, this value drops to 16 µSv; at 100 km distance, the values are 1 – 3 µSv. While this is not surprising – the maximum 1-y effective dose for an adult in Austria estimated by FlexRISK is 10 µSv – severe accidents and accidents affecting more than one nuclear installation at the site could result in higher doses.

Following the review of the EIA report, an initial set of questions were raised in relation with different topics of interest, including long-term operation, severe accidents and their potential transboundary impact. Although all the questions were answered by the Romanian counterpart, not all of them were assessed as technically completed to the extent that a full understanding could be reached. In some of the answers, the information provided was only a repeat of what was already included in the EIA report, thus providing no additional information that would help understating the issue of interest.

As a result, a second set of questions was formulated, aiming to obtain more details about the topics of interest. The Romanian counterpart answered the additional questions, and submitted a reply to Austrian authorities in January 2025. The review of these new answers revealed the fact that, while all questions have been addressed, the answers to the most important ones were not complete. The project proponent is claiming that nuclear safety analyses represent sensitive information in accordance with the Romanian legislation, and as such they cannot be disclosed. Very few results have been provided, however those cannot be used to estimate a potential radiological impact on Austria.

It is therefore recommended to inform the Romanian Ministry of Environment that the EIA report for Cernavoda NPP U1 refurbishment and for the extension of DICA with MACSTOR 400 modules has not been elaborated in accordance with the Guidance provided by the Ministry, and that the project proponent did not provide meaningful information about the potential radiological impact of nuclear accidents affecting Cernavoda NPP (and the extended DICA) on Austrian territory.

# ZUSAMMENFASSUNG

Das rumänische Kernkraftwerk Cernavoda hat zwei Reaktorblöcke vom Typ CANDU-PHWR-600 (CANadian Deuterium Uranium), welche natürliches Uran als Brennstoff und schweres Wasser als Moderator und Kühlmittel verwenden. Sie tragen etwa 20 % zur in Rumänien erzeugten Elektrizität bei. Block 1 (U1) ging 1996 in Betrieb und Block 2 (U2) 2007. CANDU-Reaktoren haben eine ursprüngliche Lebensdauer von 30 Jahren; nach einer Generalüberholung kann diese Lebensdauer um weitere 30 Jahre verlängert werden. Die Energiestrategie Rumäniens betrachtet Kernenergie als wichtiges Element für die Sicherheit der Energieversorgung, und daher ist eine Verlängerung der Lebensdauer von U1 des Kernkraftwerks Cernavoda vorgesehen; zu diesem Zweck ist ein Sanierungs- und Modernisierungsprojekt vorgeschlagen. Parallel dazu wurde ein Projekt zur Erweiterung der Kapazität des Lagers für abgebrannte Brennelemente vor Ort mit größeren Modulen mit dem Ziel einer doppelten Lagerung initiiert.

Basierend auf dem rumänischen Gesetz zur Umweltverträglichkeitsprüfung (UVP-Gesetz), das die UVP-Richtlinie (2011/92/EU in der geänderten Fassung) umsetzt, unterliegen die Sanierung von U1 und die Erweiterung der Lagereinrichtung für abgebrannte Brennelemente vor Ort einer UVP. Wie im rumänischen Gesetz zur Ratifizierung der Espoo-Konvention vorgeschrieben, hat der Projektentwickler dem rumänischen Ministerium für Umwelt, Gewässer und Wälder die erforderlichen Unterlagen zur Einleitung des Konsultationsprozesses im Rahmen des UVP-Verfahrens vorgelegt. Eine Notifizierung wurde auch an Österreich gesendet, das an diesem grenzüberschreitenden Verfahren teilnimmt.

Als potenziell betroffene Partei im Falle einer radiologischen Freisetzung am Standort Cernavoda hat Österreich ein Interesse daran, am UVP-Verfahren teilzunehmen. In dieser Hinsicht hat das österreichische Umweltbundesamt (UBA) ein Expertenteam von ENCO beauftragt, die UVP zu bewerten und eine Expertenmeinung zu erarbeiten. Die wichtigsten Schlussfolgerungen dieser Expertenmeinung sind:

- Der UVP-Bericht entspricht inhaltlich den Anforderungen der UVP-Richtlinie, die radiologischen Auswirkungen – die bei Kernkraftwerken die wichtigsten sind – werden jedoch nicht detailliert genug dargestellt.
- Bei der Sanierung von U1 fallen große Mengen radioaktiver Abfälle an, für die vor Ort ein neues Lager errichtet wird. Die Handhabung der im Zuge der Sanierung anfallenden Abfälle ist im UVP-Bericht ausführlich beschrieben.
- Abgebrannter Kernbrennstoff (SNF) gilt in Rumänien als radioaktiver Abfall; die nationale Strategie für die sichere Entsorgung radioaktiver Abfälle und abgebrannter Kernbrennstoffe sieht die Entsorgung von SNF in einem geologischen Endlager vor, das voraussichtlich 2055 betriebsbereit sein wird; bis dahin wird der gesamte vom Kernkraftwerk Cernavoda erzeugte SNF vor Ort gelagert. Nach einer anfänglichen Abkühlung für mindestens 6 Jahre im SNF-Becken wird der abgebrannte Brennstoff vor Ort im trocke-

nen Zwischenlager für abgebrannte Brennelemente (DICA) gelagert. Derzeit besteht DICA aus 17 Modulen MACSTOR-200 (in denen 204.000 abgebrannte Brennelemente gelagert werden); 20 weitere Module mit doppelter Lagerkapazität (MACSTOR-400) sollen gebaut werden, um künftig 480.000 abgebrannte Brennelemente (die von U1 und U2 erzeugt werden, innerhalb der ursprünglichen sowie der verlängerten Lebensdauer – insgesamt 60 Jahre) zu lagern.

- Unfälle mit Beteiligung Dritter werden im EIA-Bericht nur am Rande erwähnt. Die für die Zwecke der EIA durchgeführte Population Health Impact Assessment Study kommt zu dem Schluss, dass „die potenziellen Auswirkungen auf die Gesundheit der Bevölkerung, die sich aus einer Fehlfunktion, einem radiologischen/nuklearen Unfall oder einer böswilligen Handlung ergeben, für die Bevölkerung, die in der Nähe einer nuklearen Anlage lebt, häufig von Interesse sind“, es ist jedoch nicht klar, ob böswillige Handlungen in den analysierten Szenarien berücksichtigt wurden. Der Aufprall eines schweren Verkehrsflugzeugs auf DICA wurde als schwerer Unfall identifiziert, dann jedoch aufgrund einer sehr geringen Häufigkeit ausgeschlossen. Die Autoren des EIA-Berichts sind der Ansicht, dass bei einer EIA für ein Kernkraftwerk nur Szenarien mit einer Häufigkeit von mehr als $1x10^{-6}$ berücksichtigt werden sollten, was nicht richtig ist.
- Die einzigen Ergebnisse einer Unfallanalyse, die in einem grenzüberschreitenden Kontext präsentiert wurden, sind jene eines postulierten (Auslegungs-)Unfalls, der in der letzten Revision des FSAR von Cernavoda U1 als derjenige mit den schwerwiegendsten Folgen angesehen wurde. Der Maximalwert der individuellen effektiven Dosis nach Exposition gegenüber der postulierten Freisetzung für einen Zeitraum von 30 Tagen beträgt 5,5 mSv in 1 km Entfernung vom Reaktor. In 30 km Entfernung sinkt dieser Wert auf 16 µSv; in 100 km Entfernung betragen die Werte 1 – 3 µSv. Dies ist zwar nicht überraschend – die von FlexRISK geschätzte maximale 1-Jahres-Effektivdosis für einen Erwachsenen in Österreich beträgt 10 µSv –, aber schwere Unfälle und Unfälle, die mehr als eine Kernanlage am Standort betreffen, könnten zu höheren Dosen führen.

Nach der Überprüfung des UVP-Berichts wurde eine erste Reihe von Fragen zu verschiedenen Themen von Interesse gestellt, darunter Langzeitbetrieb, schwere Unfälle und ihre möglichen grenzüberschreitenden Auswirkungen. Obwohl alle Fragen von der rumänischen Seite beantwortet wurden, wurden nicht alle als technisch vollständig genug bewertet, um ein vollständiges Verständnis zu erreichen. In einigen Antworten waren die bereitgestellten Informationen lediglich eine Wiederholung dessen, was bereits im UVP-Bericht enthalten war, und lieferten somit keine zusätzlichen Informationen, die dazu beitragen würden, das interessierende Thema zu verstehen.

Daraufhin wurde ein zweiter Fragenkatalog formuliert, der darauf abzielte, mehr Einzelheiten zu den betreffenden Themen zu erfahren. Die rumänische Seite beantwortete die zusätzlichen Fragen und übermittelte den österreichischen Behörden im Januar 2025 eine Antwort . Die Überprüfung dieser neuen Antworten ergab, dass zwar alle Fragen behandelt wurden, die Antworten auf die wichtigsten jedoch nicht vollständig waren. Der Projektträger behauptet, dass nukleare Sicherheitsanalysen gemäß der rumänischen Gesetzgebung sensible Informationen darstellen und daher nicht offengelegt werden können. Es wurden nur sehr wenige Ergebnisse vorgelegt, diese können jedoch nicht zur Abschätzung potenzieller radiologischer Auswirkungen auf Österreich verwendet werden.

Es wird daher empfohlen, das rumänische Umweltministerium darüber zu informieren, dass der UVP-Bericht für die Sanierung des Kernkraftwerks Cernavoda U1 und für die Erweiterung der DICA mit MACSTOR 400-Modulen nicht in Übereinstimmung mit den Leitlinien des Ministeriums erstellt wurde und dass der Projektträger keine aussagekräftigen Informationen über die potenziellen radiologischen Auswirkungen von Nuklearunfällen im Kernkraftwerk Cernavoda (und der erweiterten DICA) auf österreichischem Gebiet bereitgestellt hat.

# 1 EVALUATION OF ANSWERS TO AUSTRIAN QUESTIONS

In the course of the evaluation of the EIA report for Cernavoda NPP U1 refurbishment and for the extension of DICA with MACSTOR 400 modules, a total of eleven questions were raised in relation with five different areas of interest, from long-term operation, over severe accidents to the transboundary impacts. The questions raised encompassed:

1. *Could you please specify what is the current stage of the DIDR-U5 establishment?*
2. *Could you please specify what is the current stage of the LILW-SL Repository development?*
3. *Could you please explain if the U1 refurbishment activities will involve the Spent Fuel Storage Pool, and if yes, what will happen with the SNF stored there?*
4. *Do the conditions from the EIA procedure have a binding effect on the subsequent procedures, in particular the nuclear law procedure? What would happen if, during the EIA consultations, a negative opinion from the public will be received?*
5. *Please provide the results of the nuclear safety analyses for the refurbishment of Cernavoda NPP U1 and extension of DICA with MACSTOR-400 modules (in case they have been finalised in the meanwhile).*
6. *Please describe in more details how the cumulative radiological impact has been estimated for the refurbishment period and after that.*
7. *Could you confirm that security events have been analysed, and if yes, that they have no significant impact (in terms of radiological consequences)?*
8. *Could you present the radiological consequences of the scenario involving the impact of an aircraft on DICA?*
9. *Have you considered the impact of a military aircraft (flying to/from the 57th Air Base "Captain Aviator Constantin Cantacuzino") too? If yes, could you present the results?*
10. *Please present in a transboundary context the results of the severe accidents that may affect the nuclear installations in operation at any one time on Cernavoda NPP site (i.e. during the refurbishment project and after that).*
11. *Please present in a transboundary context the cumulative radiological impact of the nuclear installations in operation at any one time on Cernavoda NPP site (i.e. during the refurbishment project and after that).*

Although all of the questions were answered, not all of them were assessed as technically completed to the extent that a full understanding could be reached. In some of the answers, the information provided was only a repeat of what was already in the EIA report, thus providing no additional information that would help understating the issue of interest.

A second set of questions has then been issued, aiming to obtain the necessary clarifications. The Romanian counterpart answered these additional questions, however, once again, although all seven questions and the additional recommendation were answered, the most important information has not been submitted.

The analysis as below is to document the evaluation of the answers received to both set of questions, with emphasis on the potential additional actions that could be taken by the Austrian authorities.

**Q1) Could you please specify what is the current stage of the DIDR-U5 establishment?**

***Answer*** According to the Feasibility Study Report prepared for the Feasibility Study of Radioactive Waste Management in CNE Cernavodă, the Unit 5 building, properly prepared, can be used for the storage of radioactive waste resulting from the refurbishment activities. This solution is based on the assessment of the structural integrity based on the change of purpose of the Unit 5 reactor building for radioactive waste storage (change of the basement and addition of new floors). During the structural integrity assessment, stability (overturning and sliding) and bearing capacity checks were carried out and the requirements were found to be met. No further activities are carried out until the Environmental Agreement and Nuclear Construction Permit are issued as per applicable laws. Thus, the DIDR-U5 unit is currently in conservation.

***Evaluation*** The question has been answered, however the answer raises questions about (1) the availability of the new RW storage facility (DIDR-U5) at the time it is needed, and (2) the need for a separate EIA and operation license.

***Conclusion*** It is suggested to require an additional clarification on these two aspects from the Romanian counterpart.

**Q1-1) Based on your answer, we would like to know what will happen if the dedicated RW storage (DIDR-U5) will not be ready on time?**

***Answer*** The new RW storage facility (DIDR-U5) will be available in due time to receive materials resulted from the U1 refurbishment activities.

The EIA has been conducted integrating all Unit 1 refurbishment activities, both those that will be executed prior the refurbishment outage (which include DIDR-U5 sub-project, other civil office buildings and warehouses, site infrastructure (site-internal roads, access points, and so on), as well as those that will be executed during the refurbishment outage. Taking this into account, all the refurbishment activities of Unit 1 will be carried out through a single EPC (Engineering, Procurement, Construction) contract. Through the EPC contract, the planning of the refurbishment activities execution will be integrated, based on the technological and regulatory sequentially, and the start of each activity will be conditioned by the completion of the previous activity (for example: no activity will be started that requires the storage of radioactive waste if there is no available approved location for their storage).

***Evaluation*** The question was answered satisfactorily (according to the provided explanation, the arrangement of the new DIDR in the U5 is part of the refurbishment project, which will be implemented in phases with each phase being conditioned by the finalization of the previous phase).

***Conclusion*** No need for further action.

**Q2) Could you please explain if the U1 refurbishment activities will involve the Spent Fuel Storage Pool, and if yes, what will happen with the SNF stored there?**

***Answer*** The current national strategy includes the construction of a new surface final repository for low and intermediate level short-lived radioactive waste (LILW-SL) in the DFDSMA. This new repository is planned to be constructed for the disposal of LILW-SL generated from the operation, refurbishment and decommissioning of 4 CANDU reactors at CNE Cernavodă. The National Strategy was approved by Government Ordinance 102/2022 on the basis of the Strategic Environmental Assessment (SEA) procedure which included a transboundary consultation process, under the conditions of the law.

In the year 2023, ANDR obtained by Resolution No. 2 of 16.01.2023 of the Saligny City Council (HCL), the approval of the Urban Development Plan (Plan Urbanistic Zonal - PUZ) and the Local Urban Development Regulations (RLU) for the near surface landfill and for LILW-LL. (DFDSMA). The following documents were the basis for the approval of the PUZ: Geotechnical Study, Traffic Study, Strategic Environmental Assessment Study (SEA procedure) and Sociological Research on the perception of the inhabitants on the intention to realize the DFDSMA on the territory of Saligny Municipality, Constanta County.

Based on the technical documents and studies that have been carried out for the DFDSMA project, ANDR has taken a number of steps and started the procurement process for the Engineering Services for the site and construction permits for the Definitive Disposal for LILW - SL (DFDSMA).

Currently, ANDR is carrying out all the activities necessary to obtain the site authorization for the LLRWMF in the village of Saligny, Constanta County, in accordance with the CNCAN regulations "Norm on radiological safety requirements for radioactive waste disposal" approved in 2019.

***Evaluation*** Question answered satisfactorily.

***Conclusion*** No need for further action.

**Q3) Could you please explain if the U1 refurbishment activities will involve the Spent Fuel Storage Pool, and if yes, what will happen with the SNF stored there?**

***Answer*** After shutdown of U1 for refurbishment, the irradiated fuel (spent fuel bundles) will be discharged entirely from the reactor's active reactor area into the spent fuel pool (SFB). After discharge from the reactor's active reactor area, the spent fuel bundles are stored under water in the SFB for at least 6 years to be cooled to a radioactive decay power of 6W per spent fuel bundle. After 6 years, the spent fuel bundles are transferred from the BCU to the dry fuel storage facilities (MACSTOR modules). During the implementation of the Unit 1 Refurbishment Project, the BCU will be operated according to the Unit 1 Operating Authorization issued by CNCAN, and the transfer of spent fuel bundles from the BCU to the dry fuel storage facilities will continue according to the spent fuel transfer authorizations issued by CNCAN. In addition, during the execution of the Unit 1 Refurbishment Project, the re-cladding of part of the BCU walls will be carried out without affecting the spent fuel bundles stored in the BCU.

***Evaluation*** Question answered satisfactorily.

***Conclusion*** No need for further action.

**Q4) Do the conditions from the EIA procedure have a binding effect on the sub-sequent procedures, in particular the nuclear law procedure? What would happen if, during the EIA consultations, a negative opinion from the public will be received?**

***Answer*** According to Law no. 111/1996 on the safe conduct, regulation, authorization and control of nuclear activities, updated and aligned with EU Directives, for the authorization of projects, the Environmental Authorization is issued by the Ministry of Environment after the issuance of the operating permit by CNCAN. The environmental permit, issued by the Ministry of Environment, is however a prerequisite for the site authorization issued by CNCAN.

Any conditions contained in the Environmental Agreement and in the Environmental Authorization are binding for the Permit Holder and their fulfilment will be proven during project implementation.

According to the limits and conditions of the authorizations and Law no. 111/1996, the nuclear regulatory authority must be informed within 7 days of any change in the limits and conditions imposed by the Agreements and Authorizations of other national authorities. In addition, the operating conditions in the authorization issued by CNCAN reinforce the Licensee's obligation to fully comply with the legislation and provisions of other Authorities, applied within a nuclear installation. Thus, retrofitting activities are not permitted until all necessary Agreements and Authorizations are issued.

***Evaluation*** While the first question has been answered, the second question was answered only from the perspective of national consultations.

***Conclusion*** It is suggested to request an additional clarification from the Romanian counterpart, explaining that our interest was related to the external consultation process.

**Q4-1) Our question was related with the external consultation process (not with the national public), could you therefore answer the question what would happen if, during the Espoo consultations, a negative opinion from the public of the countries potentially affected will be received?**

***Answer*** Regarding the environmental licensing procedure, as both the internal and the external consultation process are managed by the Ministry of Environment, Waters and Forests and the external consultation is an integral part of the EIA procedure, the review of the results of the internal and external consultation process is submitted to the Technical Advisory Committee, comprising of the most senior management representatives of all the national authorities and Ministries with responsibilities on environmental matters, which is summoned by the Ministry of Environment, Waters and Forests, for debate and decision. Comments received during the consultation process, internal or external, have equal status in this debate.

Supposing that a negative opinion would be received from the public in the consultation process, the basis for this opinion has to be analysed: if the negative opinion is justified based on valid technical considerations, then the issues are investigated and evaluated by experts in the Committee together with the nuclear regulator in order to determine their significance in relation to the national legislation and international standards and the best actions are decided, giving nuclear safety and radiological protection the first priority; if the negative opinion has no technical grounds, an explanation of the technical criteria for decision-making is provided and a reason for not taking additional actions based on that particular opinion. All the comments, proposals, recommendations, suggestions and opinions, as well as their resolutions, are made public.

***Evaluation*** Question answered satisfactorily (according to the explanation provided, external consultations are organized in the same way as internal consultations).

***Conclusion*** No need for further action.

**Q5) Please provide the results of the nuclear safety analyses for the refurbishment of Cernavodă NPP U1 and extension of DICA with MACSTOR-400 modules (in case they have been finalized in the meanwhile).**

***Answer*** Nuclear safety analyses for U1 operation after refurbishment are planned to be completed by the end of 2027.

The strategic program and the requirements for nuclear safety analyses are aligned with international standards (IAEA, CNSC, COG) and in accordance with national nuclear safety regulations issued by CNCAN.

For DICA MACSTOR 400 and DIDR-U5, according to National Nuclear Regulatory Authority - National Commission for the Control of Nuclear Activities (CNCAN), in accordance with the rules for the authorization of nuclear installations, the licensee will prepare the Nuclear Safety Report as the basis for authorization for each of the different stages of implementation of the investment. These reports are being prepared to support the applications for the Construction Authorizations for DICA MACSTOR-400 and DIDR-U5 respectively.

In accordance with the minimum content required by the licensing rules, the Nuclear Safety Report includes a chapter entitled "Nuclear Safety Analysis Project Basis". In order to apply for Construction Authorization for a project it is mandatory to obtain the Environmental Agreement. Thus, at this stage, activities are underway to prepare the Nuclear Safety Reports for each of the subprojects.

Therefore, relevant documents issued and approved up to the date of the environmental assessment were consulted in the RIM as the minimum relevant information and operational experience to carry out the assessment. However, all safety analysis documentation is under the constraints of the nuclear safeguards regulations and as such are not available for public consultation. A publicly available summary is presented on the CNCAN website during the public consultations that are part of the licensing process carried out by CNCAN.

The document on the results of the nuclear safety analyses for the refurbishment of Unit U1 at CNE Cernavodă and for the extension of the DICA with MACSTOR-400 modules is not subject to the RIM.

Under the Nuclear Safety Directive No. 87/2014, nuclear safety analyses are carried out for obtaining the operating license, not for obtaining the environmental permit. In addition, there were no requirements identified at European and international level to require nuclear safety analyses specifically for the refurbishment activities.

However, chapter 8.2 of the IMR presents the risk assessment based on nuclear safety analyses and refers to events or accidents that may occur during the implementation of the U1 refurbishment project and the DICA extension and involving radioactive materials or contaminated components of the facilities, except for the reactor and its annexes. The possible accident scenarios assessed for Darlington in Canada are also applicable to CNE Cernavodă, since the refurbishment activities are similar.

The accident scenarios involving the fall of the transfer container for retube components with loss of its capacity to contain radioactive materials and on-site traffic accident involving the waste transfer container transporter (WTF) are analysed by AECL as well as in the basic licensing document developed for obtaining the necessary authorizations for the operation of DIDR-U5. These documents are the property of the permit holder.

As for the accident scenarios with the leakage of tritiated heavy water from the moderator circuit due to a pipe rupture and damage to the spent nuclear fuel in the storage pond, they are analysed for Unit 1 in operation and the results are presented in the Final Nuclear Safety Report, which is the basic authorization document for the operating permit issued by CNCAN. In the case of the planned refurbishment outage, the impact resulting from such an accident is substantially lower than in the case of Unit 1 power operation. Therefore, the results of the analyses and the response measures foreseen for the conditions of Unit 1 power operation are also covered for the conditions of the planned refurbishment outage.

The summary of the nuclear safety analyses, which has been made available to the public in the process of renewing the operating license for Unit 1, can be found at the web address http://www.cncan.ro/transparenta-decizionala/sedinte-publice -anunturi-minutes/renewal-of-operating-licensing-u1-and-didsr-from-cne-Cernavodă).

The nuclear safety analyses, in their entirety, are documents that are not available to the public for security and physical protection reasons.

***Evaluation*** The question has been answered, but in a negative way: the results of the nuclear safety analyses have not been provided, firstly because they are not ready (which raises the question on which basis the operation license for U1 has been extended), and secondly because such results are not required to be provided for the EIA, according to the respondents. While this is true in the sense that none of the EU Directives specifically require to include the nuclear safety analyses results in the EIA for an NPP, the EIA Directive requires (in Art. 3 para.1) the environmental impact assessment to “identify, describe and assess in an appropriate manner, in the light of each individual case, the direct and indirect significant effects of a project…”. This is not the case for the discussed EIA. The Romanian counterpart further mentions that there are no requirements at the EU and international level for nuclear safety analyses for refurbishment activities; while this is true in a strict sense, refurbishment operations are often considered as major changes in an NPP, or changes that may affect the safety of the plant, for which the international safety standards do require a review of the safety assessment. Moreover, there are national requirements for updating the safety analyses when applying for the extension of the operation licence (Article 34(3) of the Romanian Regulations on nuclear installations’ authorisation 336/2019). In addition, according to the IAEA Guidance No. NG-T-3.11 “Managing the Environmental Impact Assessment for Construction and Operation in New Nuclear Power Programs”, nuclear safety should be addressed in the EIAR in a dedicated section that should include “a review of the nuclear related aspects of the safety of the plant, it should describe the nuclear safety requirements and principles as well as their implementation in the design, construction and operation of a nuclear power plant.” While nuclear safety is mentioned in the EIAR, there is no dedicated section that comprehensively describes how the nuclear safety will be ensured during the LTO of U1 and the operation of the extended DICA.

***Conclusion*** It is suggested to request an additional clarification from the Romanian counterpart on the basis of the extension of the validity of the U1 operation licence as long as the nuclear safety analyses of the U1 operation after refurbishment have not been yet been updated, as required by the Romanian regulations; it is also suggested to request the Romanian counterpart to present in a more comprehensive manner the radiological impact of the proposed project in the EIAR.

**Q5-1) We did not ask to see the Safety Assessment Report of Cernavoda NPP, but the results of the nuclear safety analyses updated for the long-time operation of U1; based on your answer, we understand that these analyses are not ready yet. On which basis was then extended the validity period of the Operation License of Cernavoda NPP U1 until 2061?**

***Answer*** The regulatory framework for the operation licensing process is following the nuclear law provisions (Law 111/1996 updated) and the CNCAN Nuclear Safety Norm 22 (NSN-22- see link - Licensing of Nuclear Facilities ) issued by CNCAN Order *no. 336/2018 for the approval of Regulations for licensing of nuclear facilities*. Specifically, within NSN-22, the actual operating license of U1 is in accordance with the provisions, limits and conditions stated generally in Section 6 "Operating License". There are specific requirements addressing operating license management within a long outage for unit refurbishment. The specific requirements following the NSN-22 provisions are detailed under the *General Limits and Conditions* section of the Operating License of U1.

The licensing decision is based on the demonstration of the compliance with the dose criteria in the regulations, using the conservative bounding analyses. In order for the licensee to maintain the licenses, the safety analyses need to be periodically verified and revalidated (i.e. shown to be still bounded by the licensing basis analyses), taking into account any design changes, new research results, operating experience and any new computational tools and methods that become available.

For the last operating period of Unit 1, until refurbishment, the safety analyses have been updated to account for the aging effects, to establish updated parameters for the safety systems settings and to reflect the current operating power level (which is lower than 100% full power as considered in the bounding licensing basis analyses).

The bounding safety envelope provided by the licensing basis analyses remains unchanged, but, at the same time, the licensee is required by legislation to periodically review, revise and update the safety analyses and the operational limits and conditions, at least every 10 years and each time there are relevant modifications, to demonstrate that design basis and licensing basis remain valid. This approach is in line with the international standards.

The validity period of the operating license of the Cernavodă NPP U1 has been extended based on the bounding safety analyses, which are not affected by the refurbishment. However, the final safety analysis report (FSAR) is a living document and is updated on a continual basis.

An updated FSAR for each unit is submitted to the CNCAN every two years, because design and process upgrades are implemented in accordance with the continuous improvement principle. The updated FSAR contains the safety demonstration for the nuclear power plant, taking into account the physical status of the installation, the impact of ageing, the safety upgrades performed and the current safety requirements, among other factors. In addition, a PSR is also performed every ten years.

Some additional considerations on the subject of safety analysis, are summarized below:

The design basis accident analyses for Cernavoda NPP, documented in the Final Safety Analysis Report, which is the main licensing basis document, include the following initiating events and combinations of events:

- loss of regulation / loss of reactivity control;
- LOCA events (large LOCA and small LOCA);
- single channel events (spontaneous pressure tube rupture, channel flow blockage, end-fitting failure, feeder stagnation break);
- fueling machine events;
- pipe breaks in HT auxiliary systems;
- loss of off-site power (complete and partial loss of Class IV electrical power, single heat transport pump trip and seizure of a primary heat transport system main pump);
- loss of heat transport system pressure and inventory control (pressurization events and depressurization events);
- loss of secondary circuit pressure control (pressurization and depressurization events)
- feedwater events (feedwater line breaks outside or inside containment, loss of steam generator feedwater flow);
- steam main breaks outside or inside containment;
- steam generator tube failure;
- multiple steam generator tubes failure;
- combinations of steam and feedwater system events with loss of class IV power (off-site power).
- moderator system events;
- end shield cooling system events;
- design basis earthquake,
- initiating events originating from shutdown state (loss of normal shutdown state heat sink – shutdown cooling system and design basis earthquake).

In accordance with the conservative safety philosophy and design basis approach of the reactor designer (AECL – Atomic Energy of Canada Ltd, currently known as CANDU Energy), the majority of the above-mentioned process systems failures (initiating events) were analyzed for the case in which the ECCS and the containment subsystems are available, and also in combination with various failures/impairments to either ECCS or containment subsystems. Feedwater events and steam main breaks were also analyzed in combination with loss of Class IV power. Large LOCA and small LOCA events are analyzed also in combination with loss of off-site power and with impairments to either ECCS or containment system functions.

The design basis accident analyses have two main purposes:

- to demonstrate to the nuclear regulatory authority the compliance with defence in depth and the dose criteria for accident conditions, as established in the national regulations and this includes demonstration of the prevention of severe accidents;
- to provide the basis for the operational limits and conditions, which include the safety systems settings and limiting conditions for operation.

For the first purpose, i.e. for the demonstration of compliance with dose criteria for accident conditions, bounding analyses have been prepared, considering conservatively the maximum inventory of fission products, for an equilibrium core. At the same time, for the second purpose, the safety analyses have been performed and revised at different moments during the operational lifetime of the nuclear power plant, taking into account different operating conditions, such as fresh core, equilibrium core, aged core, in order to adjust the safety systems settings as necessary (but still within the bounds of the design and licensing basis analyses).

After refurbishment, the reactor core will contain fresh nuclear fuel and a very low inventory of radioactive materials, but this is not of interest in the licensing basis analyses, which are done with the most conservative assumptions. What is of interest for the core with fresh nuclear fuel is the establishment of the safety systems settings, based on the calculations for the core reactivity. Before the core will reach equilibrium conditions, the safety analyses will be once again updated, considering all the relevant factors required in the regulations. However, these safety analyses will still remain bounded by the standard licensing basis analyses for a CANDU-6 unit, because the maximum inventory of radioactive materials in the reactor core considered for the equilibrium conditions is the same.

The current licensing basis analyses include also design extension conditions, among which severe accident scenarios and the updates to these analyses need to be performed whenever there are design changes with an impact on these analyses, or there are new computer codes or computational methods developed and validated or new relevant information becomes available.

***Evaluation*** Question answered (according to the provided explanation, the SA Report of Cernavoda NPP is reviewed every 2 years, and the results of the Periodic Safety Review have been indeed considered when issuing the extended Operation License; a Safety Case Report for Cernavoda Unit I NPP Extended Operation is also mentioned in the extended Operating License, which also includes specific requirements for the refurbishment period and for restarting the operation of U1 after the refurbishment, one of these being to update the nuclear safety analyses).

***Conclusion*** No need for further action.

**Q6) Please describe in more details how the cumulative radiological impact has been estimated for the refurbishment period and after that.**

***Answer*** In accordance with the provisions of Law no. 292/2018 on the environmental impact assessment of certain public and private projects, in force as of January 9, 2019, published in Monitorul Oficial of Romania, Part I no. 1043 of December 10, 2018 and the form in force applicable as of October 15, 2024, aligned with the mandatory provisions of Directive no. 52/2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (Text with EEA relevance), in force since May 15, 2014, published in the Official Journal of the European Union No. 124 of April 25, 2014, the requirements/methodology of the cumulative impact assessment implemented by the independent experts-certified environmental companies is in accordance with all factors and data assessments described in Article 5 of the said law.

Thus, with regard to your question on how the cumulative impact associated with the period during which the retrofitting works are planned has been estimated, please note that this subject is dealt with in subsection 5.2.12 of the RIM "Cumulation of effects with those of other existing and/or approved projects whose areas of influence overlap totally or partially with that of the project assessed, both during the construction and the operational period" .

The cumulative radiological impact was estimated taking into account current activities and future projects as known at the time of the RIM study.

***Evaluation*** The question was answered, but only by repeating the information already provided in the EIAR. The provided explanation ("The cumulative radiological impact was estimated taking into account current activities and future projects as known at the time of the RIM study") is not sufficient to understand how the conclusions in Table 116 were drawn. For instance, what does "minor" in Table 116 mean? Why is the cumulative effect of all units in operation estimated to be "insignificant"? A footnote under Table 108 specifies that an insignificant negative impact means, from a radiological point of view, that the impact does not produce visible effects, "the negative nature being given by the values detected by measurements against the background of the area, due to current activities on the Cernavodă NPP platform". Minor negative effects are not defined. Apart from this, it is not mentioned how the significance of the cumulated effects was estimated. As explained in the EC Guidance on the preparation of an Environmental Impact Assessment Report (Directive 2011/92/EU as amended by 2014/52/EU), "the coexistence of impacts may increase or decrease their combined impact. Impacts that are considered to be insignificant, when assessed individually, may become significant when combined with other impacts."

***Conclusion*** It is suggested to request additional clarifications from the Romanian counterpart on the meaning of "minor negative impact" and the methodology used for combining the radiological effects and attributing them the significance stated in Table 116 on the EIAR.

**Q6-1) Could you please provide more details (than those already given in the EIAR) about the assessment of the cumulative radiological impact? More precisely,**

**a. please define the meaning of "minor negative impact" used in Table 108;**

**b. please indicate the method used for estimating the significance of cumulated radiological impacts (as stated in Table 116)**

***Answer*** The cumulative impact assessment was carried out by a multidisciplinary team of about 18 experts with recognized competences according to the legislation in force, coming from organizations certified for environmental studies and certified by CNCAN.

The cumulative impact assessment considered the following aspects:

- Identification of existing and/or proposed projects in the project implementation areas with a potential cumulative impact in relation to the proposed project, on the environmental factors for which the proposed project may generate positive/negative effects;
- Analyzing the likelihood of these projects to generate cumulative forms of impact (to contribute with additional effects and/or synergistic effects with the project under analysis);
- Assessing the significance of the cumulative impact.

As defined in the General Guide applicable to the stages of the impact assessment procedure approved by Order No. 269/2020, the significance of an impact is given by two components:

- The magnitude of the impact, which is given by the characteristics of the project and the effects it generates
- Sensitivity is understood as the sensitivity of the receiving environment to change, including its capacity to accommodate the changes the Projects may bring about.

The importance of the impact or its overall significance is the result of multiplying the amplitude/magnitude of the impact (small, medium, large) by the sensitivity of the receiver (low, medium, high).

The significance of an impact can be: major (significant), moderate, minor, no impact (or insignificant).

As a result, the terms used in the EIA are in accordance with the applicable General Guidelines, respectively:

- A "no impact or insignificant impact" project means that the impact does not generate visible or measurable effects on the natural state of the environment.
- A "minor impact" project indicates that it has an impact of small magnitude, falls within standards and/or is associated with receptors of low or medium value/sensitivity.

and is determined as follows:

1. Small Magnitude + Low/Medium Sensitivity
2. Medium Magnitude + Low Sensitivity.

See attached Table 11 - Determination of the significance of the impact according to the magnitude and sensitivity of the receptor, from the General Guidelines Ord. 269/2020.

Regarding the radiological impact of the U1 refurbishment project implementation and the subsequent operation of the refurbished U1, as well as that associated with the extension and operation of the DICA with MACSTOR 400 modules, the following sensitive receptors were considered as sensitive receptors: the representative person from the population on the one hand and the natural environment in the vicinity of the plant (with its components: soil, water, air and biodiversity) on the other hand. For the representative population representative person, the estimated annual effective dose due to exposure to radionuclides present in releases of radioactive effluents from the nuclear installation was used as an impact indicator, which was analyzed in relation to its associated dose constraint. From the retrospective analysis, for the whole period of U1 operation, it was observed that this indicator was below 10% of the corresponding dose constraint. For the implementation period of the refurbishment, the estimates were made in relation to predicted emissions based on the experience of other similar refurbishment projects, also resulting in falling, with a significant safety reserve, within the dose constraint set for U1 operation.

Regarding the radiological impact on the environmental factors, both the previous monitoring data and impact studies, as well as the results of the monitoring carried out by the authors of the assessment showed that, under the conditions of operation on the site of the Cernavodă NPP U1 for 27 years and U2, simultaneously with U1, for 15 years, no radionuclides specific to the operation of CANDU reactors, other than tritium, whose activity concentrations were low, could be detected in the environmental compartments in the vicinity of the plant, considering its very low radiotoxicity.

Why is the cumulative effect of all units in operation estimated to be “insignificant”?

The assessment of the cumulative radiological impact on the environmental factors, as presented in Table 116 of the EIA, took into account the effects of the impacts presented in the regulatory acts, specific to each approved project that is being carried out or to be developed on the Cernavodă NPP site (e.g. environmental agreements and approval decisions - see Annex 5 to the EIA).

The EIA elaborator has assessed for each stage described in Table 116 whether the impacts of the project subject to this environmental assessment act together with the impacts of other projects to be carried out/developed on the site and whether they affect the same environmental factor or receptor (e.g. combined effect in the area of influence).

As a result, the assessment of the cumulative radiological impact has been carried out on the basis of the worst-case scenario in terms of impact.

According to the analysis, the projects described in the table, which are being implemented on the site, could have cumulative effects during the execution phase of the project with a temporary, punctiform, local character, the potential cumulative impact on the relevant environmental components being estimated as minor.

The significance of the cumulative radiological impact during the operation of all the nuclear objectives on the Cernavodă NPP site, identified as insignificant, is given by the sum of the positive effects of the CTRF commissioning with the effects of the simultaneous operation of 4 nuclear units on the site. Thus, since the four units are similar, it can be assumed that the impact of their normal operation would be at most double the impact of their current operation, unless the contribution of CTRF to maintaining a low tritium inventory in the active circuits of the four units is taken into account, with the consequence that the radioactive emissions of each unit would be lower than at present. In terms of the exposure of the representative person in the population, it will be at most double the current level, which is still less than 20% of the dose constraint for a single unit, so a minor impact. Also, as regards the impact on other environmental factors, the tritium concentration levels are expected to be at most double the current values (as tritium in the form of tritiated water does not accumulate in the environment), which is still insignificant, considering its very low radiotoxicity.

Regarding the definition of the minor negative effects referenced in Table 108:

The minor negative effects of an impact indicate a discomfort within acceptable limits, for which there are no effects on the health and quality of life of the population, as quantified in the multiple environmental studies approved by both the environmental authority and CNCAN over the last 20 years, studies that were the basis for the issuance of the operating permits for the operation of the Cernavodă NPP.

***Evaluation*** Question answered (an elaborated explanation is provided, however the main conclusion remains, i.e. only a qualitative assessment of the cumulative impact of all nuclear installation in normal operation conditions has been performed).

***Conclusion*** For the radiological impact, a quantitative assessment of the cumulative impact of the nuclear installations to be built/operated at the Cernavoda NPP site for another 30 years on should be carried out under both normal and accident conditions (see also section 2).

**Q7) Could you confirm that security events have been analysed, and if yes, that they have no significant impact (in terms of radiological consequences)?**

***Answer*** Yes, we confirm that physical protection events have been analysed and have no significant impact including radiological consequences. For security and proprietary/confidentiality rights reasons, the licensee's documentation cannot be made available to the public and is only reviewed and approved by the designated national authorities.

The licensee's physical protection (nuclear safety) plan covers all protection events identified in the project-based threat document issued by the Nuclear Regulator and the authorities responsible for national security (Romanian Intelligence Service, Ministry of National Defense, Ministry of Internal Affairs). CNCAN verifies and approves the Physical Protection Plan and conducts regulatory assessments and inspections, including the oversight of emergency exercises that include combined threats/nuclear safety-nuclear security-physical protection-radiological events to verify completeness and accuracy of implementation for the capabilities of the licensee's response force, as well as for internal and external (local and national) emergency response teams.

The emergency response plan implemented by CNE Cernavodă is based on a comprehensive analysis of internal and external nuclear safety, radiological, physical protection, chemical, cyber security, internal and external events and their impact on the critical infrastructure within the plant site, covering combined emergency situations and appropriate measures to mitigate the risks and reduce the consequences of the event to the lowest practicable level. In addition to regular exercises involving only the CNE Cernavodă Emergency Response Structure/Emergency Response Team, a General Emergency Exercise is planned and conducted annually, which also includes national authorities with responsibilities in Emergency and Crisis Management Plans.

***Evaluation*** The question was positively answered. Since security events and their analysis are indeed confidential, asking for more details is not necessary.

***Conclusion*** No need for further action.

**Q8) Could you present the radiological consequences of the scenario involving the impact of an aircraft on DICA?**

***Answer*** The structure of a MACSTOR storage module is compact and robust with significant strength reserves with a high safety margin for the design basis loads. These features limit potential damage induced by an aircraft impact to the DICA. A no-fly zone, in which air traffic is prohibited, has been established by the Romanian authorities for the CNE Cernavodă site, reducing the probability of an aircraft crash to negligible levels. However, a conservative deterministic analysis (with assumptions chosen to generate a worst-case estimate of the consequences) for an event involving an aircraft crash on the intermediate storage of spent nuclear fuel was carried out for the purpose of emergency planning and preparedness. Different types of aircraft were assumed to crash accidentally on the intermediate spent nuclear fuel repository, regardless of the very low probability of such events. Deterministic analyses were performed with highly conservative assumptions. The results of these analyses showed that, in the event of an aircraft crash, followed by a fire affecting the intermediate storage of spent nuclear fuel, the potential exposure of the population in the vicinity of the site would be below generic intervention levels for sheltering and evacuation. The safety analyses are not public documents. CNE Cernavodă's emergency plan and procedures include emergency measures and actions applicable to the DICA installation equipped with MACSTOR 200 modules and will be extended to apply to a larger site that will additionally contain MACSTOR 400 modules.

***Evaluation*** Once again, the answer states that "safety analyses are not public documents". We didn't ask to see the nuclear safety analyses, we asked for the results. The information provided in the EIAR and the answer to this question are not sufficient to understand whether the aircrash scenario (which is declared to have been analysed) considered the increased inventory of DICA or only the current inventory (of the SF stored in the existing MACSTOR200 modules). The fact that a no-fly zone over the Cernavodă site has been established is also irrelevant in case of a war.

***Conclusion*** It is suggested to ask the Romanian counterpart for more details on this scenario (the results of the analyses, and a description of the scenario used for the analysis).

**Q8-1) We did not ask to see the Safety Assessment Report of DICA, but the results of the safety analyses will give us the radiological consequences of the potential accidents; could you please provide the results, and a description of the scenario used for analyzing the aircraft crash on DICA event?**

***Answer*** Various types of aircraft, both civilian and military, were assumed to crash accidentally on the dry spent fuel storage, irrespective of the very low probability of such events. Deterministic accident analyses have been performed with conservative assumptions.

Dry spent fuel storage facilities are not vulnerable to loss of coolant because they are cooled by natural convection that is driven by the decay heat of the spent fuel itself. Thus dry-storage facilities differ from reactors in that their cooling is completely passive. To obtain a release of radioactive material, the walls of the fuel container, storage cylinder and storage module must be penetrated from the outside, or the container must be heated by an external fire to such an extent that the containment envelope fails. However, many dry-storage modules must fail or be attacked simultaneously to produce significant releases.

For the MACSTOR facility it is not physically possible that an aircraft crash would affect more than one storage module. For the purpose of conservative analyses, to support emergency planning for the worst-case scenarios, it was considered that an entire storage module is affected by an airplane crash resulting in a fire. Assumptions were made with regard to the quantity of the aircraft fuel consumed in the fire, the duration of the fire, the height of the release and the meteorological data. Although it is very unlikely that the entire storage module would be uniformly affected by a fire, for the purpose of calculating radiological releases it was conservatively assumed that all the fuel bundles in the storage module at full capacity are damaged.

The results of these deterministic analyses showed that the potential exposure to the population in the vicinity of the site would be below the generic intervention levels for sheltering (10 mSv) and evacuation (50 mSv), based on the average calculated doses. The doses calculated for different scenarios with over 99% confidence are of 100 mSv.

The analyses for various accident scenarios are considered security sensitive documents and are not public documents, therefore no further technical details can be provided. The legal provisions stating the legacy of such information classification are included in the CNCAN Safeguards Regulations (NGN-02-see link - Detailed list of materials, devices, equipment and information for non-proliferation of nuclear weapons and other nuclear explosive devices) and/or Government Decision 916/2002 (updated) completed by provisions of NSN-22 section 2 article 7 ((NSN-22-see link - Licensing of Nuclear Facilities) issued by CNCAN Order no. 336/2018 for the approval of  Regulations for licensing of nuclear facilities ) and the CNCAN Nuclear Security Regulations (NPF-01 – see link : Nuclear Physical Protection Regulations).

***Evaluation*** Once again, the answer specifies that "*the analyses for various accident scenarios are considered security sensitive documents and are not public documents, therefore no further technical details can be provided*". The nuclear safety analyses for SF storage facilities – as well as for NPPs - are indeed classified by the Romanian legislation as sensitive information, however we did not ask to see the entire analyses, but their results, and not even all the results, but only those of the severe accidents that may affect other countries. Moreover, the "Guide on the content of the EIA report for the Cernavoda NPP Unit 1 refurbishment and extension of DICA with MACSTOR 400 modules", published by the Romanian Ministry of Environment[1] requires the project proponent to describe in the report the significant effects that the project might have on the environment, for all stages of both subprojects (i.e. U1 refurbishment and extension of DICA), and these effects should include "*the risks for human health, for cultural assets or for the environment, due to accidents, disasters, sabotage, armed attack*". Sabotage and armed attacks are security events, and such events should have been analyzed too, and their results included in the report.

The answer provides some numbers, but only as potential exposure to the population in the vicinity of the site in case of an aircrash on DICA (which seems to be in average below the generic intervention levels for sheltering (10 mSv) and evacuation (50 mSv), while the "doses calculated for different scenarios with over 99% confidence are of 100 mSv."). Averaging the doses calculated in different scenarios is at least unusual; if there are scenarios in which the resulting doses from an accident affecting DICA would be in the order of 100 mSv, then the local population would need to be evacuated and an emergency response plan for such situation should be established.

[1] https://www.mmediu.ro/app/webroot/uploads/files/Indrumar%20RIM_Retehnologizare%20U1%20si%20extindere%20DICA_Cernavoda.pdf

***Conclusion*** The results of the analyses of aircrash scenarios that may affect the extended DICA (i.e. with the new, double modules) should be presented the EIAR (see also section 2).

**Q9) Have you considered the impact of a military aircraft (flying to/from the 57th Air Base "Captain Aviator Constantin Cantacuzino") too? If yes, could you present the results?**

***Answer*** Military airplanes were considered in the deterministic analysis mentioned above. The results of the conservative coverage analyses performed showed that, in the event of an aircraft crash followed by a fire affecting the intermediate spent nuclear fuel repository, the potential exposure of the population in the vicinity of the site would be below generic shelter and evacuation response levels. The probability of such an event is extremely low (< 1E-8 events/year).

The physical protection analyses are not public documents.

***Evaluation*** The question was answered, but once again by stating that "physical protection analyses are not public documents"; while we didn't ask to see the such analyses, the results of the analyses of such events, even with very low probabilities, should be presented in the EIAR. Paragraph 58 of the UNECE Guidance on the applicability of the Convention to the lifetime extension of nuclear power plants specifies that: "Generally, the extended lifetime of a nuclear power plant has impacts that are similar to those of a new nuclear power plant considered in its initial operation. These impacts include the following: […] b) Impacts resulting from accidents, including accidents within the design basis and within the design extension conditions, as well as beyond design basis accidents[35]." Footnote 35 further mentions that "For the types of accidents to be considered based on the IAEA Safety Glossary: Terminology used in Nuclear Safety and Radiation Protection. 2018 Edition, see the list in annex I of this guidance." The list in Annex I includes beyond design basis accidents, design basis accidents, design extension conditions, and severe accidents, as defined in the 2018 IAEA Safety Glossary.

***Conclusion*** It is suggested to ask the Romanian counterpart for more details about this scenario (the results of the analyses, and a description of the scenario used for the analysis), which is not a security event.

**Q9-1) A military aircraft crash on DICA is not necessarily a security event; a mal-function could happen and the crash could be unintentional. The fact that a no-fly zone over the Cernavoda site has been established is irrelevant in case of a war, and unfortunately there is currently a war close to Romanian borders. Could you please provide the results, and a description of the scenario used for analyzing the military aircraft crash on DICA event?**

***Answer*** We have already mentioned that the structure of a concrete MACSTOR storage module is compact and robust, with significant resistance reserves with a high safety margin for the design loads. These characteristics limit the potential damage induced by an impact of an aircraft on DICA.

The probability of aircraft crash, for both civilian and military aircrafts, is lower than 1E-8 events/year.

Nevertheless, a conservative deterministic analysis has been performed for an event involving an aircraft crash on the dry spent fuel storage, for the purpose of emergency planning and preparedness. Various types of aircraft, both civilian and military, were assumed to crash accidentally on the dry spent fuel storage, irrespective of the very low probability of such events. Deterministic analyses have been performed with very conservative assumptions.

The results of the deterministic analyses showed that, in case of aircraft crash followed by a fire affecting the dry spent fuel storage, the potential exposure to the population in the vicinity of the site would be below the generic intervention levels for sheltering (10 mSv) and evacuation (50 mSv), based on the average calculated doses. The doses calculated for different scenarios with over 99% confidence are of 100 mSv.

These technical analyses for various accident scenarios are considered security sensitive documents and are not public documents. The legal provisions stating the legacy of such information classification are included in the CNCAN Safeguards Regulations (NGN-02-see link - Detailed list of materials, devices, equipment and information for non-proliferation of nuclear weapons and other nuclear explosive devices) and/or Government Decision 916/2002 (updated) completed by provisions of NSN-22 section 2 article 7 **(NSN-22-see link:** Licensing of Nuclear Facilities**) issued by *CNCAN Order no. 336/2018 for the approval of Regulations for licensing of nuclear facilities*) and the CNCAN Nuclear Security Regulations (NPF-01 – see link:** Nuclear Physical Protection Regulations).

Cernavoda NPP emergency plan and procedures include the emergency measures and actions applicable to the DICA facility when it contains the MACSTOR 200 modules and will be extended to apply to a larger site that also contains an added number of MACSTOR 400 modules.

***Evaluation*** Same as for Q8-1 (the answers are very similar).

***Conclusion*** Same conclusion as for Q8-1.

**Q10) Please present in a transboundary context the results of the severe accidents that may affect the nuclear installations in operation at any one time on Cernavodă NPP site (i.e. during the refurbishment project and after that).**

***Answer*** Deterministic conservative nuclear safety analyses have been performed for severe accident scenarios at CNE Cernavodă. These analyses cover scenarios with very low estimated frequencies of occurrence, most of them in the range of 1E-6 to 1E-8 events per year and others with even lower frequencies. The purpose of these analyses was to support emergency planning and preparedness for the population in the vicinity of the site, taking into account lessons learned from the Fukushima Daiichi accident. In order to obtain calculated emissions large enough to justify protective actions, such as evacuation and relocation of the population in the immediate vicinity of the site, conservative assumptions (e.g.

various failures of the reactor envelope containment system in addition to other system failures that would intervene to mitigate the consequences of a severe accident) were used to ensure that even highly unlikely events are thoroughly evaluated. The calculated doses under such conditions, which would require evacuation and relocation of the population in the vicinity of the site, would have negligible transboundary impact due to dilution and long-range dispersion.

Based on exceptional international situations including data from the Chernobyl and Fukushima accidents, doses of ionizing radiation at distances greater than 300 km from the site of a severe nuclear accident are very low, in the order of microSieverts (μSv). The values are well below the legal limit of 1 mSv/year for members of the public, are lower than the typical annual natural background radiation of about 2.4 mSv/year, and are well below levels that would pose a health risk or require protective action.

Based on conservative analyses, as well as lessons learned from international experience, we do not anticipate any significant cross-border radiological impact.

Therefore, while CNE Cernavodă maintains robust nuclear safety and emergency response measures to protect the local and regional population in the event of emergencies, the potential for radiological consequences affecting other countries is extremely low.

The above considerations remain valid for the duration of the refurbishment project, when the nuclear fuel is removed from the reactor's active reactor area and the risk of severe accidents associated with operation at rated power will be eliminated. In addition, given the design improvements that will be implemented during the refurbishment, the potential for radiological consequences affecting other countries will be even lower after restart.

***Evaluation*** An answer is provided, but only at a level of estimations, without providing the actual results (of the severe accidents analyses). The answer states that "The purpose of these analyses was to support emergency planning and preparedness for the population in the vicinity of the site, taking into account lessons learned from the Fukushima Daiichi accident"; according to the Nuclear Safety Directive (Art. 6(e)), the license holders shall "provide for appropriate on-site emergency procedures and arrangements, including severe accident management guidelines or equivalent arrangements, for responding effectively to accidents in order to prevent or mitigate their consequences. Those shall in particular: (ii) address accidents and severe accidents that could occur in all operational modes and those that simultaneously involve or affect several units". It would be interesting to know whether the Emergency Response Plan of Cernavodă NPP covers severe accidents and simultaneous accidents, and, in particular, if such simultaneous accidents have been analysed and what the results were.

***Conclusion*** It is suggested to ask the Romanian counterpart (1) to specify if the On-Site Emergency Response Plan covers simultaneous accidents (2) if such accidents

have been analysed, and if so, what the results were, and (3) to include the results of the DEC, including severe accidents, in the EIAR.
*[formulated as Q11-1]*

**Q11) Please present in a transboundary context the cumulative radiological impact of the nuclear installations in operation at any one time on Cernavodă NPP site (i.e. during the refurbishment project and after that).**

***Answer*** The answer is given in RIM - Tab. 116 Qualitative assessment of the RADIOLOGICAL impact on the environmental factors, by cumulation with other projects and operational activities on the CERNAVODA NPP site, also presented in the answer to question no. 6 of this list.

ALL NUCLEAR OBJECTIVES OPERATING on the NPP Site
Simultaneous operation U1 cycle 2 + U2 + U3+ U4 +
DICA in operation +
CTRF running +
DICA MACSTOR 400 module built +
CTRF in operation

Under the conditions of successful implementation of the U1 refurbishment project, the radioactive emissions of the unit on resumption of operation will be at most at the level before the refurbishment. As a result of the commissioning of the CTRF, the tritium removal treatment of tritiated heavy water tritiated in the moderator system circuits of the two units (U1 and U2) will gradually decrease tritium emissions from these two units.

With the commissioning of units 3 and 4, the level of radioactive effluent emissions from the CNE Cernavodă site will increase corresponding to the period of the operating cycle of these units, but, as will be justified on the basis of the level of tritium concentration in the reactors' active systems, the application of the tritium removal process (detritus) will lead to a limitation of the upward trend of emissions. Thus, the simultaneous operation of the four units, with the CTRF installed and functioning properly, is expected to reduce tritium emissions from the site to a lower level than at present. The cumulative radiological impact on environmental factors is insignificant, local/regional, reversible, with long-term effects.

***Evaluation*** The explanation provided does not add to what is already provided in the EIAR, where the transboundary impact (if any) of the cumulated effects is not discussed. See also the evaluation of the answer to Q10.

***Conclusion*** Same suggestion as for Q10).

**Q11-1) According to your answer, severe accidents' analyses have been performed, in order to "support emergency planning and preparedness for the population in the vicinity of the site, taking into account lessons learned from the Fukushima Daiichi accident". The Nuclear Safety Directive requires the license holders to provide for appropriate on-site emergency procedures and arrangements, which shall address "accidents and severe accidents that could occur in all operational modes and those that simultaneously involve or affect several units". Could you please specify if such simultaneous accidents have been analysed, and if yes, what are their results?**

***Answer*** Details on the severe accident analyses performed for Cernavoda NPP are provided in response to the last question. The scenarios analyzed cover all the states and modes of operation.

A scenario that would involve simultaneous severe core damage accidents in more than one CANDU unit of the Cernavoda NPP site is not credible. The reactor units are located at more than 150 m one from another, are fully independent (have no shared systems) and have substantial safety margins to cope even with extreme external events significantly beyond the initial design basis.

Notwithstanding, severe accident scenarios that could hypothetically affect both units have been analyzed. Several Station Blackout scenarios, Loss of Ultimate Heat Sink scenarios and the combination of these two categories of scenarios have been analyzed as part of the "Stress Tests" post-Fukushima for the operating units of Cernavoda NPP and safety upgrades have been implemented, as described in the public reports documenting these assessments http://www.cncan.ro/assets/Informatii-Publice/06-Rapoarte/RO-National-Report-for-2nd-Extraordinary-Meeting-under-CNS-May2012-doc.pdf ; https://www.ensreg.eu/EU-Stress-Tests/Country-Specific-Reports/EU-Member-States/Romania.

Accident scenarios that would affect both units are evaluated for the sole purpose of testing and validating the emergency preparedness and response arrangements, including the material resources and the qualified personnel needed for staffing the operating shifts and the shifts of the emergency response personnel, including the technical support group, firefighters, physical protection response force and other categories of personnel with roles and responsibilities in the management of emergency situations.

***Evaluation*** Question answered only partially (simultaneous accidents have been analysed "*for the sole purpose of testing and validating the emergency preparedness and response arrangements*"); for the second part of the question, a reference is made to the last answer (see the next paragraph).

***Conclusion*** No further action is needed for the first part of the question; for the second one, same conclusion as the next one.

**Additional recommendation: Austria should ask the Romanian counterpart to revise the EIAR, by inserting a section dedicated to the radiological impact assessment, where the radiological consequences of DEC including severe accidents should be presented in sufficient details to allow a meaningful estimation of the potential transboundary impacts (i.e., with a description of the scenarios used, the source terms considered, and the analysis results in terms of doses to the population up to 1000 km from Cernavoda).**

***Answer*** According to the nuclear law provisions (Law 111/1996 updated) and the Nuclear Safety Norm 22 (NSN-22-see link - *Licensing of Nuclear Facilities*) issued by *CNCAN Order no. 336/2018 for the approval of Regulations for licensing of nuclear facilities*, completed by Law 292/2018 (regarding environmental assessment for public and private projects), the radiological impact assessment, where the radiological consequences of DEC including severe accidents should be presented in sufficient detail to allow a meaningful estimation of the potential transboundary impacts (i.e. with a description of the scenarios used, the source terms considered, and the analysis results in terms of doses to the population up to 1000 km from Cernavodă) are subject to Nuclear Regulator licensing requirements and developed within the Licensing Basics Documents within the nuclear installation authorization process. As mentioned also above, these detailed assessments and scenarios are not public information and are subject to review and approved by Nuclear Regulator within the licensing process. Therefore, EIAR, developed according with the provisions of Law 292/2018 (aligned to EU applicable Directive) presents only the available public information related to radiological impact assessments and potential impact as required in Appendix 4 of the previously mentioned law.

**General considerations regarding the calculation of doses for long-range distances**

The current computer codes for dose dispersion and impact assessments are not designed to provide meaningful results beyond 300 km. This limitation is a constraint recognized at international level in safety analysis tools and methodologies. Validation of computer codes for the assessment of radiological consequences at distances beyond 300 km is challenging due to complexities like mesoscale and synoptic-scale weather systems, topography, and long-range transport mechanisms. The uncertainties associated with calculations of radiological consequences for distances beyond 300 km do not allow for a meaningful estimation of the potential transboundary impacts. Moreover, systematic validation beyond ~1,000 km cannot be achieved, because of the lack of consistent and comprehensive observational datasets. Studies for long-range dispersion are used for scientific research, not regulatory and decision-making purposes.

Nevertheless, in order to estimate the radiological consequences of severe accidents, in addition to the hypothetical scenarios covered by the licensing basis safety analyses for severe core damage events, the actual data collected from the measurements of the contamination levels and the effective doses resulted from severe accidents occurred in Chernobyl and Fukushima Daiichi can be used for comparison.

The amount of Cs-137 released from the Chernobyl-4 accident is estimated to be of approximately 85 PBq, which was considered to represent 20% to 40% of the total inventory in the RMBK-1000 reactor core. The RBMK-1000 used slightly enriched (2% U-235) uranium dioxide fuel. The Chernobyl reactors did not have a pressure-proof reactor containment. (https://world-nuclear.org/information-library/safety-and-security/safety-of-plants/chernobyl-accident ; https://www.oecd-nea.org/jcms/pl_28292/chernobyl-chapter-ii-the-release-dispersion-deposition-and-behaviour-of-radionuclides)

The total amount of Cs-137 released from the 3 affected units in the Fukushima Daiichi accident is estimated to be of approximately 15 PBq. The Fukushima reactors also used enriched uranium fuel. The Fukushima Daiichi reactors had Mark I containment buildings. (https://world-nuclear.org/information-library/appendices/fukushima-radiation-exposure ; https://www.oecd-nea.org/upload/docs/application/pdf/2021-09/7525_bsaf.pdf)

The total inventory of Cs-137 in the reactor core of the CANDU-6 design, which uses unenriched natural uranium, is of approximately 50 PBq, which is several times lower than the total inventory of the Chernobyl 4 reactor. The CANDU-6 reactors have robust containment buildings and have been backfitted with modern hydrogen mitigating systems and emergency filtered venting systems which prevent containment failure from severe accident scenarios. Even with the unrealistic assumption that the entire inventory of one CANDU-6 unit would be released to the atmosphere, a scenario that is not physically possible, the radiological consequences for Austria would be negligible, because of the large distance (the shortest distance between Cernavodă, Romania, and the nearest Austrian town is of more than 800 kilometers).

A scenario that would involve simultaneous severe core damage accidents in more than one CANDU unit of the Cernavoda NPP site is not credible. The reactor units are located at more than 150 m one from another, are fully independent (have no shared systems) and have substantial safety margins to cope even with extreme external events significantly beyond the initial design basis. However, Station Blackout scenarios, Loss of Ultimate Heat Sink scenarios and the combination of these two categories of scenarios have been analyzed as part of the “Stress Tests” post-Fukushima for the operating units of Cernavoda NPP and safety upgrades have been implemented, as described in the public reports documenting these assessments http://www.cncan.ro/assets/Informatii-Publice/06-Rapoarte/RO-National-Report-for-2nd-Extraordinary-Meeting-under-CNS-May2012-doc.pdf ; https://www.ensreg.eu/EU-Stress-Tests/Country-Specific-Reports/EU-Member-States/Romania . Accident scenarios involving both units are evaluated for the sole purpose of testing the emergency preparedness and response arrangements.

Based on international experience with exceptional situations of severe accidents occurred at nuclear power plants with releases to the environment, comprising data from the Chernobyl and Fukushima accidents, radiological doses at distances greater than 300 km from the site of a severe nuclear accident are very low, in the range of microSieverts (μSv).

In accordance with the information provided in the following links https://pubmed.ncbi.nlm.nih.gov/2294074/ ; https://pubmed.ncbi.nlm.nih.gov/2094123/ ; https://www.nature.com/articles/pr1994202 ; https://www.ages.at/en/environment/radioactivity/caesium-137-in-austria the effective doses incurred from the radioactive fallout from the Chernobyl accident were lower than 1 mSv in the first year. Even if the Chernobyl accident resulted in a massive radioactive release, directly into the atmosphere, the doses in Austria were low because of the large distance from the point of release (the shortest distance between Chernobyl, Ukraine, and the nearest Austrian town is more than 1000 kilometers).

All the protective measures recommended in the IAEA publications cover distances up to a maximum distance of 300 km from the accident location; however, it is recognized that specific food restrictions may be considered for distances greater than 300 km if found necessary, but there is no specific recommendation available on this matter. https://www-pub.iaea.org/MTCD/Publications/PDF/te_953_web.pdf ; https://www-pub.iaea.org/MTCD/Publications/PDF/te_955_prn.pdf ; https://www-pub.iaea.org/MTCD/Publications/PDF/EPR-NPP_PPA_web.pdf ; https://www-pub.iaea.org/MTCD/Publications/PDF/EPR-Protection_Strategy_web.pdf

Average national doses in European countries, determined as results of the Chernobyl accident, were less than 1 mSv in the first year, with progressively decreasing doses in subsequent years. The average dose over a lifetime in distant countries of Europe was estimated to be about 1 mSv. These doses are comparable to an annual dose from natural background radiation (the global average is 2.4 mSv) and are, therefore, of little radiological significance.

Radiological impact assessments are typically constrained to a distance of 300 km, beyond which doses are expected to be negligible based on historical evidence from major accidents such as both Chernobyl and Fukushima. At such distances, even large source terms such as those resulted from Chernobyl and Fukushima accidents, which are not physically possible for CANDU-6 reactors, lead to potential doses below the 1 mSv/year regulatory limit, comparable to natural background radiation.

Moreover, to put things in perspective, it is worthwhile to compare the perceived risks associated with the nuclear industry with the demonstrated risks associated with other sources of potential exposure to harmful substances. For example, it is important to note that there are many other activities that present an exposure to harmful factors on a day by day basis and that put people at significantly higher risk (e.g. pollution, smoking etc.) than the hypothetical scenarios of nuclear accidents in EU countries: https://www.eea.europa.eu/en/analysis/maps-and-charts/austria-air-pollution-country-2023-country-fact-sheets ; https://www.meduniwien.ac.at/web/en/about-us/news/detailsite/2018/news-im-maerz-2018/doctors-against-smoking-six-million-deaths-a-year-from-smoking-14000-in-austria/ ; https://globalactiontoendsmoking.org/research/tobacco-around-the-world/austria/ .

Based on all the above considerations, we can affirm that even a hypothetical worst case severe accident scenario at Cernavoda NPP would not present a significant adverse transboundary impact for the Austrian population and environment.

***Evaluation*** The answer provided by Romania – according to which the radiological impact assessment for the purposes of EIA is subject to licensing by the nuclear regulator - is incorrect; there is no such provision in the Romanian legislation. Moreover, according to the MoE "Guide on the content of the EIA report for the Cernavoda NPP Unit 1 refurbishment and extension of DICA with MACSTOR 400 modules", published by the Romanian Ministry of Environment, the SNN SA shall provide in the EIAR "*pertinent information obtained as a result of nuclear safety analyses and documents issued in conformity with the nuclear safety legislation […]. Within this description, information, data and results owned by the SNN, and obtained from the nuclear safety analyses for normal operation and for accident situations, can be used*."

The radiological consequences of two DEC-A events are presented, however only for the local population. For the DEC-B event, the highest Cs-137 release is presented, but without the radiological consequences (i.e. the doses to the population due to such a release). There is also a statement saying that "*the current computer codes for dose dispersion and impact assessments are not designed to provide meaningful results beyond 300 km. This limitation is a constraint recognized at international level in safety analysis tools and methodologies*." This is incorrect; dispersion modelling at higher distances (up to 1500 km) is possible. Of course that the estimations are affected by uncertainties at higher distances, but this doesn't mean that there are no computer codes able to calculate the atmospheric dispersion at distances higher than 300 km.

***Conclusion*** It is suggested to issue a requirement for revision of the EIA report by inserting a dedicated section treating the radiological impact in a comprehensive manner, as required by the MoE Guide. The results of the nuclear safety analyses should be provided and interpreted in a transboundary context. Severe accidents affecting U1, extended DICA, and all units in operation on Cernavoda NPP site should also be addressed. The results of the analyses of aircrash scenarios, as well as of security events (such as sabotage and armed attacks on the nuclear installations) should be also included.

# 2 CONCLUSIONS AND RECOMMENDATIONS

Following the review of the Romanian answers to the clarification questions submitted it is concluded that they fail to present in a comprehensive manner the potential radiological impact of the project, in particular in case of severe accidents. While a significant impact on Austria might not be expected, this should be demonstrated by the project proponent in the EIA report.

According to the Romanian MoE Guide for the EIAR content for Cernavoda NPP U1 refurbishment and for the extension of DICA with MACSTOR 400 modules, the project proponent shall identify and quantify the transboundary nature of the impact, and respectively, the potential impact of the project on the states potentially affected, and in particular on the four countries who participate to the transboundary EIA procedure, Austria being one of them. The project proponent is not only allowed - by this Guide - to use the results of nuclear safety analyses, but is even required to provide such information in the EIA report. Security events must also be analysed, together with accidents and disasters that may affect the human health and the environment.

Various statements (e.g. atmospheric dispersion not possible for distances higher than 300 km) and answers (such as the one claiming that nuclear safety analyses are sensitive and their results cannot be disclosed, or that aircrashes on DICA are security events thus being confidential) can in no way be followed. Some information (like the pretended legal provisions asking the radiological impact assessment to be subject to licensing by the nuclear regulator) is misleading. The comparison of nuclear risks with the risks of polluted air and smoking is irrelevant; instead of that, the required information would have been much more appreciated.

As such, the EIA report for Cernavoda NPP U1 refurbishment and for the extension of DICA with MACSTOR 400 modules fails to present in a comprehensive manner the potential radiological impact on Austria. It seems that the report has not been elaborated in accordance with the applicable Guide, and the project proponent did not provide required information, which should have been included in the report.

Therefore, it is recommended to revise the EIA report, by inserting a section dedicated to the radiological impact, where the radiological consequences – as resulted from the nuclear safety analyses - of normal operation, accident conditions (of any nature), including severe accidents, and security events, affecting each nuclear installation subject to modification, as well as all of them in the same time, should be addressed and presented in a transboundary context.

# 3 GLOSSAR

CANDU ............................... CANadian Deuterium Uranium

CNCAN ............................... Romanian Nuclear regulatory authority

DBA ................................... Design Basis Accident

DICA .................................. Dry Interim Spent Fuel Storage Facility

DIDR .................................. new Interim RW Storage Facility

EIA ..................................... Environmental impact assessment

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

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

FSAR .................................. Final safety analysis report

GW..................................... Gigawatt

H3 ...................................... Tritium ( hydrogen isotope)

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

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

LL ....................................... Long lived (radionuclides)

LTO .................................... Long Term Operation

MEWF ................................ Romanian Ministry for Environment, Waters and Forests

MACSTOR ......................... Dry storage module for SNF

MS...................................... Member state (of the EU)

NATO................................. North Atlantic Treaty Organisation

NPP.................................... Nuclear power plant

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

SE....................................... South east (Europe)

SEA .................................... Strategic Impact Assessment

SL ....................................... Short lived (radionuclides)

SNF .................................... Spent Nuclear Fuel

SNN .................................... Societatea Nationala NUCLEARELECTRICA, S.A

SSC .................................... System Structures & Components

SEA ..................................... Strategic Impact Assessment

UBA .................................... Umweltbundesamt

UVP..................................... Umweltverträglichkeitsprüfung

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