Answers to Austria's questions

We would like to thank you and express our gratitude for taking the time to carefully read the RIM posted for public consultation, including cross-border consultations, as required by the ESPOO Convention. To alleviate your concerns, we have sought to provide extensive explanations and clarifications to your questions.

As RIM provides the necessary information and the environmental impact assessment resulting also from the study of CNE Cernavodă documents and discussions with nuclear specialists, below are the answers provided to your questions:

1. What is the current status of the establishment of DIDR-U5?

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 .

2.Could you please specify what is the current status of the development of the LILW-SL warehouse?

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 ț ional e 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.

3. Could you please explain whether the U1 refurbishment activities will involve the Spent Fuel Storage Basin and, if so, what will happen to 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.

4. Do the conditions in the RIM procedure have a binding effect on subsequent procedures, in particular the nuclear law procedure ? What would happen if the RIM consultations receive a negative opinion from the public?

4.1 Do the conditions in the RIM procedure have a binding effect on subsequent proceedings, in particular nuclear law proceedings?

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 fulfillment 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.

4.2 What would happen if a negative opinion is received from the public during the RIM consultation?

Answer: SNN's main public relations goal is to increase public acceptance of nuclear energy by gaining public confidence in this significant source of energy production.

The Cernavodă NPP can be visited by representatives of institutions, organizations, schools, universities, from Monday to Thursday, except for planned shutdowns, external evaluation missions, regulatory controls, etc. The Nuclear Power Plant has two Information Centres, one in Cernavodă and one in Constanța, where seminars on different topics are organized, involving school and high school students.

In order to have a comprehensive approach to community consultation, in 2011, CNE Cernavodă decided to finalize the community communication and consultation program by setting up the Community Information and Consultation Council (CICC). The members of the Council are citizens of Cernavodă and the villages of Saligny and Seimeni, representatives of non-governmental organizations, representatives of local authorities, representatives of important institutions (School, Police, Hospitals, agriculture, religious organizations, etc.), representatives of private institutions.

The purpose of setting up the CICC is to identify the issues, concerns, interests of the community and to provide CNE Cernavodă with consultations, advice, opinions on community expectations in all areas of interest, to continuously improve the activities on site and to contribute to the well-being of the community.

Notices, Meeting Minutes and Terms of Reference can be found on the CNE Nuclearelectrica/ Cernavodă website: www.nuclearelectrica.ro.

External communication activities include daily news broadcasts on local radio stations "Public Service Announcement", distribution to the local community of the magazine "Infoplus for Neighbors" and the newsletter "Monthly News".

SNN SA pays great attention to events dedicated to the promotion of nuclear energy. Information about events taking place at SNN SA and its subsidiaries is provided to the press through press releases, press conferences, interviews and on the company's website https://www.nuclearelectrica.ro .

As regards the public opinion expressed in the national consultations, we inform you that:

- According to the legal provisions in force in Romania, both the application for development consent and the environmental information are made available to the public and people are given the opportunity to comment on the project and its environmental effects, public consultation being an essential feature of the EIA process.
- All milestones are presented both on the website of the Ministry of Environment, Water and Forests and on the website of Nuclearelectrica SA. The documents related to these stages are also uploaded on the website of the Ministry of the Environment (Retehnologization of Unit 1 of CNE Cernavodă and expansion of the Intermediate Fuel Burning Storage with MACSTOR 400 modules | Ministry of the Environment (mmediu.ro)) and can be accessed by interested parties.
- During the quality assessment phase of the environmental impact report, the environmental studies prepared by certified experts were submitted to public debate.

- The public debate was organized by the Ministry of Environment, Waters and Forests, in Cernavodă, in a hybrid system (with physical presence and online presence), giving all interested parties the opportunity to participate in this debate, even if they could not physically come to the meeting room.
- After the presentation of the project and environmental impact studies, a question and answer session was held.
- The public had no questions and no negative opinions on the environmental studies submitted under Law 292/2018.

At the moment, the CNE Cernavodă Unit 1 Refurbishment and DICA Extension with MACSTOR 400 modules, which are of national importance, are considered by the Romanian state as priority investment projects.

5. Please provide the results of the nuclear safety analyses for the refurbishment of CNE Cernavodă U1 and the extension of the DICA with MACSTOR-400 modules (if they have been completed in the meantime).

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 sub-projects.

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 analyzed 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 analyzed 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-cernavoda/)

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

6. Please describe in more detail how the cumulative radiological impact has been estimated for the period of the refurbishment and beyond.

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. Table 116 describes the cumulative radiological impact on the whole site of CNE Cernavodă, taking into account Units 1 and 2 in operation and future SNN projects. The assessment was made for all environmental factors.

Tab. 116 Qualitative assessment of the RADIOLOGICAL impact on environmental factors, by cumulation with other projects and operational activities on the CERNAVODA NPP site

Cumulative impact scenario with other projects and activities on the site	Radiological description of the scenario	Cumulative impact assessment/quantification	Remarks
Stage I_2024 - 2026 **IN MAIN EXECUTION** DIDR-U5+ construction MACSTOR 200/400 construction + U5-DEI 2016 construction (CFSU) + Construction CTRF + U1 and U2 in operation + MACSTOR 200 TIP in operation	At this stage, as the objectives DIDR-U5, U5-DEI 2016 (CFSU) and CTRF will be under construction, the only activities with radiological impact on the environment will be those specific to the operation of the two nuclear units and the operation of the DICA, and the radioactive effluent emissions from the Cernavodă CNE site will be similar to those before the start of implementation of the construction projects.	The cumulative radiological impact on environmental factors is minor, local, reversible, with short-term effects.	During the operation of U1 and U2, so far, the only radionuclide detected in environmental samples taken in the vicinity of the CNE Cernavodă site, outside the site, was tritium - within the limits set by CNCAN.
Stage II_2027 - 2029 **STOP RETUBING,** **RESEARCH and CONSTRUCTION** Stop U1, retubing, tests + DIDR-U5 in operation + Tests with H3 / CTRF + U2 in operation + MACSTOR TIP in operation + TIP MACSTOR 400 construction + Construction U3/U4	According to international experience, after the reactor has been shut down for refurbishment, during the emptying, drying and decontamination of the active systems, tritium emissions from U1 are expected to increase by up to an order of magnitude in the first year (but below the legal limits) and then to return to the pre-refurbishment level once the reactor is restarted. Radioactive emissions from U2 will be maintained at the level corresponding to the period of operation. The commissioning of the CTRF could contribute to a gradual decrease of tritium emissions from the two units as a result of the removal of tritium from the tritiated heavy water in the moderator circuits.	The cumulative radiological impact on environmental factors is minor, local, reversible, with short-term effects.	The radioactive emissions corresponding to the period of preparation and implementation of the retube activities at U1 are estimated on the basis of experience from the Darlington Refurbishment Project.
Stage III_2032- 2037 **ALL NUCLEAR TARGETS IN** **OPERATION ON THE CNE SITE** Simultaneous operation U1 cycle 2 + U2 + U3+ U4 + DICA in operation + CTRF running + DICA MACSTOR 400 construction+ module CTRF in operation	Under the conditions of successful implementation of the U1 refurbishment project, the radioactive emissions of the unit will be at most at the pre-refurbishment level when the unit resumes operation. As a result of the commissioning of the CTRF, by applying the tritium removal treatment of tritiated heavy water tritiated heavy water from the moderator circuits of the two units (U1 and U2), their tritium emissions will gradually decrease.	The cumulative radiological impact on environmental factors is insignificant, local/regional, reversible, with long-term effects.	Tritium removal is essential to maintain low tritium emissions from the site when operating four nuclear units simultaneously.

Cumulative impact scenario with other projects and activities on the site	Radiological description of the scenario	Cumulative impact assessment/quantification	Remarks
	With the commissioning of units 3 and 4, the level of radioactive effluent emissions at 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 detrition 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.		

7. Could you confirm that the physical protection events have been analyzed and, if so, that they do not have a significant impact (from a radiological point of view)?

Answer: Yes, we confirm that physical protection events have been analyzed 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.

8. Could you present the radiological consequences of the scenario involving the impact of an aircraft on the 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.

9. Have you also taken into account the impact of a military aircraft (flying to/from the 57th Air Base "Captain Aviator Constantin Cantacuzino")? 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.

10. Please present in a transboundary context the results of severe accidents that may affect the nuclear installations in operation at a given time on the CNE Cernavodă site (i.e. during the refurbishment project and afterwards).

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.

11. Please present in a transboundary context the cumulative radiological impact of the nuclear installations in operation at a given time on the CNE Cernavodă site (i.e. during the refurbishment project and afterwards).

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.

12. The Cernavoda-1 reactor has been in operation since 1996. CANDU reactors have a design lifetime of 30 years.
The lifespan will be extended from 2029 by 30 years, according to information on the Nuclearelectrica website. This would result in a total lifetime extension of up to 33 years.

Answer:
The 30-year design lifetime is a constraint for the nuclear fuel channels and fiders (piping), components of the primary heat transport system, which will be replaced after 245,000 EFPH (effective rated power operating hours). The replacement of fuel channels and fiders is the main

activity of the refurbishment project. Before the 245,000 EFPH limit is reached, Unit 1 will be shut down in a controlled shutdown and nuclear fuel unloading for the refurbishment activities will begin. During the refurbishment period, the unit will be shut down, with the reactor decommissioned, until 2029. Therefore, the refurbishment period, estimated to last up to 3 years, cannot be counted as years of power operation. The total life extension of Unit 1 is 30 years, not 33 years. For the second operating cycle, the operating permit also includes a retention period after the final shutdown in preparation for decommissioning.

13. Alternative:

The Espoo Convention and the RIM Directive require the assessment of project alternatives. In RIM documents, alternatives are only given for retrofitting options.

However, ***we call for the RIM report to present energy production alternatives to life extension****. As a response to the climate crisis, energy efficiency and energy saving measures must be the most important options for an alternative scenario, new electricity generation should be based on renewable energies with steadily decreasing costs and faster availability.*

A long-term forecast of Romania's energy needs should be part of the RIM Report.

Answer: The project proposed for analysis and approval concerns the production of energy through the nuclear process, through the modernization of an existing facility, still in operation and regulated by CNCAN and the Ministry of Environment, and the alternatives considered refer only to this process of energy production on the site intended exclusively for nuclear activities.

As shown in the RIM in chapter 2. DESCRIPTION OF APPROPRIABLE ALTERNATIVES, subchapter 2.1 General considerations, for the project "Refurbishment of the Cernavodă U1 NPP and expansion of the intermediate spent fuel repository with MACSTOR - 400 modules", it was considered appropriate to define specific criteria for the project, taking into account with discernment the recommendations of the General Guide, due to the following particular aspects:

- the location of the project is entirely within the CNE Cernavodă site, designated for nuclear activity by CNCAN, therefore alternative locations for the project cannot be considered;
- The technological alternatives studied are specific to the nuclear field and are part of existing CANDU projects at international level (so their sustainability is certified).

It is also noted that in the General Guidance for the stages of the EIA procedure of 20.02.2020, "the do nothing scenario cannot be considered a feasible policy option, as some projects are very clearly needed and are required by policies at national, regional or local level".

Through the information presented in the Baseline Environmental Assessment (RIM) Scenario chapter, it has been justified that the operation of the U1 unit to date has been safe for both the operating staff and the environment, and it appears that the refurbishment of U1 and the implementation of DICA-MACSTOR 400 are technically feasible, allowing the extension of the operating lifetime by another operating cycle, under appropriate conditions of nuclear safety and economic efficiency.

Long-term forecasting of Romania's energy needs is the subject of state energy policies, the subject of other procedures - distinct from this environmental procedure.

The project "Refurbishment of Unit 1 of CNE Cernavodă and Expansion of the Dry Intermediate Spent Nuclear Fuel Repository with MACSTOR 400 modules" is an example of the application of the National Strategy for Circular Economy (SNEC). The overall objective of SNEC is to provide the framework for the transition to the Circular Economy by implementing the Action Plan for Circular Economy (PAEC).

The refurbishment of the U1 nuclear power plant corresponds - with action - to the second principle on which the circular economy is based: keeping products and materials at their highest use value for as long as possible.

U1 refurbishment refers to capital repair, modernization and upgrading by replacing and/or modifying equipment or systems of the unit to significantly extend its lifetime. The refurbishment creates the opportunity to improve reactor safety. After refurbishment, the reactor's service life will be extended by one 30-year cycle.

By implementing the RT-U1 and DICA MACSTOR 400 projects, the amount of additional energy delivered to the National Energy System compared to the initial project is 720 million MWh.

The redesign (Symbol R1 in the 'Strategic Framework 9R' of the Circular Economy Strategy) has been highlighted by the redesign of the MACSTOR 200 module, ensuring that the DICA modules occupy space more efficiently.

In the initial project, the energy delivered to the National Energy System (NES) was 449 million MWh, and with the implementation of the RT-U1 Project and DICA MACSTOR 400, it will be about 1169 million MWh.

Consequently, in terms of avoided emissions of greenhouse gases such as CO_2 , N_2O, CH_4 - by implementing the RT U1 - MACSTOR 400 project, the additional amount of CO_2 that would have been emitted into the atmosphere if coal (lignite) had been used instead of nuclear fuel is 215,000,000 tons of CO_2 . This amount does not include the CO_2 equivalent emission of nitrogen dioxide (N_2O) and methane (CH_4) of approximately 94.5 million tonnes CO_2 - CH_4 equivalent and 10.5 million tonnes CO_2 - N_2O equivalent: the benefits of U1 modernization in terms of reducing the environmental pressure by replacing greenhouse gas emitting fuels.

While renewable energy and efficiency measures are vital components of a sustainable energy mix, they currently lack the capacity to replace reliable and consistent nuclear power generation, especially during periods of low renewable generation, such as calm windless weather or overcast conditions. In addition, nuclear energy is an integral part of Romania's climate change commitments as it produces minimal greenhouse gases. This positions nuclear energy as a complementary source alongside renewables to address both energy security and environmental objectives. The continued operation of nuclear installations thus plays a key role in Romania's energy system, providing a significant and reliable source that supports the stability of the energy grid and balances the variability of renewable sources.

14. Long-term operational risks of the reactor type

The design of CANDU-6 reactors dates back to the 1970s and is already outdated, especially in terms of the possibility of severe power variations in the event of failure of the safety

system and vulnerability to external hazards. Pressure tube ageing is also a current problem for existing CANDU systems.

Answer: As stated in the RIM, the primary retrofit activity is the replacement of the pressure tubes and calandria tubes, which are part of the fuel channel assembly.

- Retubing the Unit 1 reactor involves several steps, described below:
  - Dismantling the fittings. In this step, the 380 inlet feeder pipes and the 380 outlet feeder pipes, i.e. all pipes including coupling assemblies, instrumentation tubing and temperature detectors, are disassembled.
  - Dismantling fuel channels, pressure tubes and calandria tubes and preparing them for disposal as radioactive waste. After the completion of the fider dismantling work, the retubing cranes are assembled and the platform for dismantling the pressure tubes and calandria tubes is installed.
- After installing the platform, the following activities are performed:

  o cutting the compensating bellows;

  o Cutting the pressure tubes in the area of the joint with the end fittings;

  o removing the end fittings of the channels;

  o removal of the calandria tube inserts;

  o removing the pressure tubes, together with the calandria tubes and spacer rings.

Once the inspections have been completed, work will proceed to install the new fittings, calandria tubes and pressure tubes together with the associated assemblies.

Therefore, in the new lifecycle, the reactor will operate with new pressure tubes, thus eliminating the problem presented in the question on ageing pressure tubes.

As presented in Romania's national report to the Convention on Nuclear Safety https://www.iaea.org/sites/default/files/22/08/romania_nr_9th_cns_.pdf , the CNE Cernavodă project has been continuously modernized, based on periodic nuclear safety review, alignment with current standards, operating experience, new nuclear safety analyses, research and development activities. Although the basic design of the CANDU-6 reactor dates back to the 1970s, it is an operationally validated design that has proven its safety and has been continuously improved and upgraded.

15. Site risks

Romania is one of the most seismically active regions in Europe. The Cernavodă site is located in the Vrancea area. Stress tests in 2011 found that this hazard was not properly recognized.

Answer:

After the Fukushima Daiichi accident, in the context of the "stress tests" carried out at European level, a comprehensive nuclear safety analysis was undertaken on the protection of CNE Cernavodă against external events. Extensive information on this subject has been provided in Romania's National Report for the 2nd Extraordinary Meeting under the Convention on Nuclear

Safety, which is publicly available.
(http://www.cncan.ro/assets/Informatii-Publice/06-Rapoarte/RO-National-Report-for-2nd-Extraordinary-Meeting-under-CNS-May2012-doc.pdf)

A seismic safety margin assessment has been performed for CNE Cernavodă, for an earthquake at the Resistance Capability Review (RLE) level set at a reasonably high seismic ground motion, based on the site seismicity and plant-specific design characteristics. The evaluation of the seismic safety margin shows that, compared to the initial design basis earthquake of 0.2g (maximum acceleration at ground level), which has an estimated frequency of occurrence of 1E-3 events/year, all SSCs (systems, structures and components) that are part of the set of systems required for safe shutdown after an earthquake would continue to perform their nuclear safety function up to 0.4g, corresponding to an earthquake level that has an estimated frequency of occurrence of 5E-5 events/year. This margin is considered adequate as it meets the internationally applied safety objectives for new nuclear power plants. Additional margins beyond 0.4g exist but have not been quantified.

The seismic hazard analyses have been independently reviewed and validated by specialized international organizations, using the most effective and modern methodologies and standards, in collaboration with relevant Romanian institutes. The independent analyses confirmed the robustness/earthquake resistance of the systems and structures of both units of CNE Cernavodă.

To provide additional safety margins, a reasonably higher PGA (peak ground acceleration) = 0.4g HCLPF (High Confidence Low Probability of Failure, 95% confidence level) was determined in the seismic capacity assessment of the plant.

CNE Cernavodă uses appropriate values for seismic motions for equipment seismic qualifications. The theoretical response spectra used for CNE Cernavodă as a design basis for seismic qualification have been validated using data from the Seismic Monitoring System which has accelerometers installed at ground and at several elevations. This system is capable of monitoring and recording ground and structure motion during earthquakes.

Seismic activities are monitored with the help of INFP (National Institute for Earth Physics). The condition of nuclear and non-nuclear buildings is monitored through a dedicated program that tracks the behavior of structures over time.

As regards the Seismic Monitoring System, CNE Cernavoda has an action plan underway for the purchase and installation of an additional, independent, structure monitoring system to provide a signal on the basis of which to manually trigger the shutdown of the plant in the event of a strong earthquake. Project implementation is expected to be completed in December 2024.

There is also a seismic event response program in place at CNE Cernavodă, based on the recommendations of the EPRI guidelines.

16. Risk of severe accidents

The most important question is: can an accident occur in the older design NPPs that would have a significant impact on the surrounding areas, but also on other countries?

Even if a severe accident has a very low probability, the risk is not eliminated. The RIM report needs to provide more data on the assessment of the consequences of severe accidents; limiting dose calculations to 100 km is insufficient. Data on source terms should be provided.

The flexRISK research project shows that a failure of the active zone with early tire failure in Cernavodă-1 could release a large part of its radioactive inventory, valued at 8.16 PetaBecquerel Cs-137. The following flexRISK figure shows the weather-related risk that Europe could be contaminated with Cs-137 above 37 KiloBecquerel Cs-137 per m2 in such an accident.

Under unfavorable weather conditions, many countries in Europe could experience high caesium contamination of more than 37 kBq/m2; the weather-related risk for Austria is 0.22%. It is not sufficient to calculate doses for a distance of up to 100 km.

Safety standards for new plants cannot be implemented for old plants. The risk of a serious accident increases with the age of a nuclear power plant. But it's not just material and design problems. The risk of terrorist attacks has increased and old plants are not able to withstand modern threats.

Unfortunately, it can no longer be ruled out that nuclear power plants could become targets in a war, especially if they are close to the Russian border.

Because of climate change, the risk of flooding has increased, the risk of extreme weather events has also increased.

The RIM report will include an assessment of how the risk changes with the ageing of the facility and due to new threats such as terrorism, war and climate change phenomena.

The RIM report will also include highest source term accident calculations for which the risk is non-zero and dispersion calculations for the whole of Europe.

Response: The project submitted for the RIM (CNE Cernavoda U1 and DICA MACSTOR400) is located within the existing site at Cernavoda. During the implementation of the Project, the source term associated with the CNE Cernavoda site is not changed from the existing one. Thus, it is expected that an additional accident scenario will not be necessary, as all related nuclear and radiological safety assessments have already been updated in accordance with the latest international standards and national regulations. Since within the Romanian Government, the Nuclear Regulatory Authority and the Environmental Regulatory Authority are separate authorities, nuclear and radiological assessments, limits and conditions, accident scenarios and emergency plans are subject to specific rules (see http://www.cncan.ro/legislatie/norme/) issued on the basis of Law 111/1996 (updated).

The risk of severe accidents has been assessed in the licensing basis nuclear safety analyses, in accordance with applicable standards and regulations, using both deterministic and probabilistic methods. The estimated frequency of event sequences that could lead to early severe failure of the reactor active area as a direct result of an uncontrolled power excursion with subsequent failure of all control systems and early shutdown systems (ATWS - anticipated transient with reactor shutdown failure) is below 1E-8 events/year. The assumptions used to calculate these frequencies are conservative.

Based on international experience including data from the Chernobyl and Fukushima accidents, even assuming a source term of a few PBq of Cs-137 (which for a CANDU reactor would be too

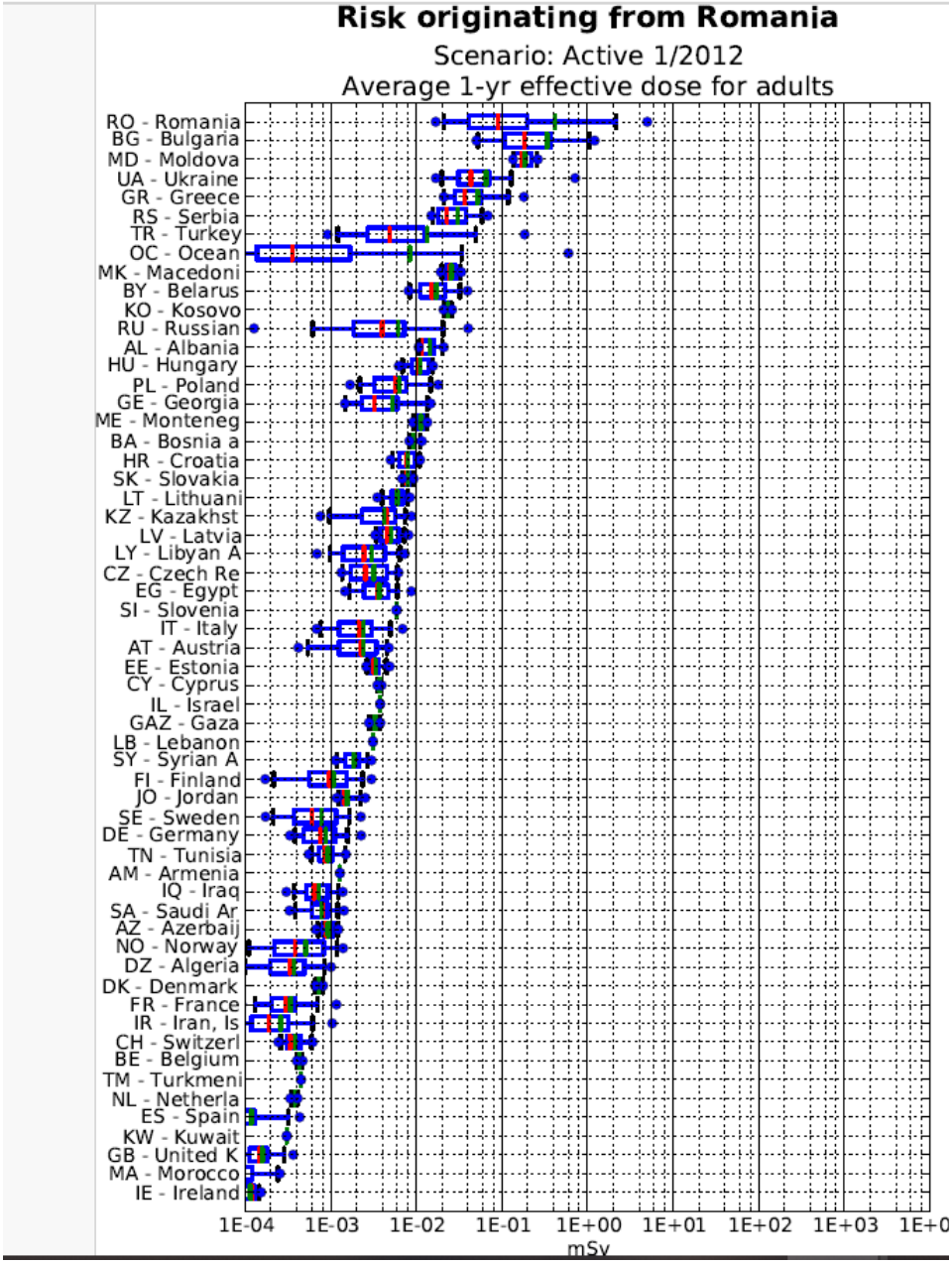
conservative), ionizing radiation doses at distances greater than 300 km from the site of a severe nuclear accident are very low, in the microSievert (μSv) range, below the legal limit of 1 mSv/year for members of the public, lower than the typical annual natural background radiation of about 2.4 mSv/year and well below levels that would pose a health risk or require protective action or have a significant adverse impact on the environment.

The risk caused by flooding and severe weather scenarios has been assessed as part of the post-Fukushima stress tests, may not lead to severe accidents and has been presented in this publicly available report: http://www.cncan.ro/assets/Informatii-Publice/06-Rapoarte/RO-National-Report-for-2nd-Extraordinary-Meeting-under-CNS-May2012-doc.pdf

The design of the CNE Cernavodă units has been continuously modernized and improved, both in terms of nuclear safety and physical protection, as well as national preventive and protective measures, taking into account the latest applicable challenges and threats.

A quick assessment of the dispersion modeling mentioned in your report on the web pages:
- https://flexrisk.boku.ac.at/en/results.html and
- https://flexrisk.boku.ac.at/en/evaluationCountryExport.phtml#form , shows that the aggregate risk for Austria in the event of a severe accident involving the destruction of the active sites of both units of CNE Cernavodă, under conditions of immediate damage to the insulation of the envelope (highly unlikely scenario), the annual dose to an adult person would be between 0.3 microSv and 3.5 microSv , i.e. less than half a day of additional exposure to the natural background radiation.

With regard to a report extracted from the above mentioned assessment, the table "Risk from Romania Scenario: Active 1/2012 1-year mean effective dose for adults" can be used as an example. The source term of the project remains unchanged, so it can be assumed that the values reported by the flexrisk method available on the mentioned webpage are public information.



In 2012, following the FUKUSHIMA event, Units 1 and 2 of CNE Cernavodă were equipped with Emergency Filtered Containment Venting Systems (EFCVS - Emergency Filtered Containment Venting System) - installed at each unit. The purpose of the EFCVS is to reduce the residual risk associated with severe nuclear accidents. The EFCVS protects the reactor envelope, which is the last physical barrier to contain radioactivity, against loss of integrity in the event of over-pressurization due to hypothetical severe accident sequences and minimizes any releases of radioactivity to the environment in the unlikely event that they could not be avoided.

The EFCVS is installed in a special designated room of the EFCVS building, in close proximity to the reactor building of each CNE unit. According to projected calculations, pressurized air from

the reactor building passes through this system and the overall retention efficiency remains 99.99% for aerosols and >99% for iodine.

17. Nuclear waste management

Before any life extension or new construction, Romania should ensure nuclear waste management:

Romania is currently far from having a final repository for spent fuel.

Answer: The relevant information on the Deep Geological Repository (DGR) program in Romania, provided by ANDR, is as follows:

According to the National Strategy, LILW-LL and the spent nuclear fuel generated by CNE Cernavodă will be stored in a Deep Geological Repository (DGR) which is planned to be commissioned in 2055.

ANDR has carried out and finalized the public procurement procedure for "Services for the elaboration of an Action Plan for the implementation of a deep geological repository in Romania". The contract will run until the end of 2024 and aims to accomplish the following activities:

- Action plan to implement the RDG in Romania
- The strategy for implementing the RDG in Romania in line with all current national and international requirements
- Preliminary study on the restriction of the number of candidate groups
- Detailed presentation of a mechanism to restrict the number of host rock options (to 2-3 formations)
- Strategy for the selection of geological formations for the development of the Geological Disposal Program for the safe management of spent nuclear fuel, high-level radioactive waste and low- and intermediate-level long-lived radioactive waste
- Preliminary study on the implementation of the Underground Research Laboratory (URL/URF)
- Action Plan for the preparation of the Preliminary Nuclear Safety Assessment Report (generic PSAR) for the Romanian DGR
- Assistance in maintaining the collaboration between CNCAN, ANDR and other institutions interested in the implementation of the DGR: clarification of the legislative and regulatory framework for the implementation of the steps in the future Action Plan.

The conceptual design of the DGR and a research and development plan to support implementation of the repository are planned to begin in 2025, with the repository to be in place in 2055.

18. The text states that the initial lifetime of the reactor was designed to be 30 years and that extensive modernization is needed to ensure continued safe operation.
How are components that cannot be replaced managed? For example, the reactor pressure vessel or other primary side components.

Answer : For the components that are not replaced in the planned shutdown for refurbishment, the ageing management programs implemented by CNE Cernavodă are followed. These programs are developed in accordance with CNCAN regulations (e.g. NSN-17 Nuclear Safety Standards on Ageing Management of Nuclear Installations) and nuclear safety standards issued by the IAEA.

Where, following inspections, any components are found not to meet the technical criteria, they will be replaced.

In order to extend the service life of U1 (long term operation), the SSCs (systems, structures and components) of the plant have undergone Condition Assessment and have been reviewed for compliance with the design basis and nuclear safety analysis. Actions have been planned for implementation prior to the refurbishment, as well as for implementation during the planned shutdown for refurbishment works.

Also, the methodology for the selection of SSCs for the implementation of the Aging Management Program, as well as the Analyses with time-related assumptions relevant to the aging management associated with each SSC in U1, in accordance with the IAEA standard SSG-48 "Aging Management and Development of a Program for the Long-term Operation of Nuclear Power Plants" and the national standards issued by CNCAN (NSN-17), were developed.

The ageing management program for CNE Cernavodă is continuously reviewed and aligned with the latest nuclear safety standards issued by the IAEA and CNCAN rules, and the best practices in the nuclear industry are incorporated and used. The policy of the National Company "Nuclearelectrica SA" regarding the long-term operation throughout the whole lifetime of the nuclear power plant at Cernavodă is documented in the company's procedures and is based on technical assessments and a comprehensive strategy for the long-term operation of Unit 1 (LTO - Long Term Operation).

Accumulating national and international operational experience helps to determine which important structures may be affected by ageing, which need to be replaced and which cannot be replaced, and for which the projected lifetime will effectively limit the total lifetime of the plant. For the cases where an initial lifetime has been estimated for the NPP components and their operational experience, in-service inspections and the results of research and development activities have shown that a longer operation than originally assumed is feasible.

According to the permitting rules in force, retrofitting and LTO are considered part of the operation phase and are covered by specific limits and conditions in the operating permit.

The updated U1 Final U1 Nuclear Safety Report (FSR) includes information on the condition assessment of systems, structures, components and equipment and the identification and revalidation of assessments on time boundary analyses relevant to the ageing management of the nuclear installation.

Plant Life of Plant Management (PLiM) programs are developed for components with a major impact on nuclear safety, production or the environment, requiring proactive identification of ageing mechanisms. The systems, structures and components, selected for the PLiM program, are within the scope of the LTO project. For major impact components (so called "PLiM components"), such as: steam generators, nuclear fuel channels, trusts, heat exchangers, turbogenerator, process computers, power transformers, back-up diesel generators, reactor building and other civil structures with nuclear safety function, piping and piping elements, PLiM manuals have been developed under the guidance of the PLiM program. Each PLiM program manual includes the list of structures and components included in the scope of the program, the relevant parameters for ageing assessment, inspection intervals and acceptance criteria being included in the reference documents used to define the technical basis.

For all PLiM components (active and passive), the condition and remaining lifetime in the installation are analyzed by a Life Assessment (LA) study against acceptance criteria and nuclear safety margins and individual Life Cycle Management Plans (LCMPs) are developed to achieve the projected lifetime or long term operating period. If differences or new recommendations for addressing degradation mechanisms emerge from the life assessment studies compared to the original program defined in the PLiM handbooks, the PLiM handbooks are revised accordingly.

If it was identified that the defined programs did not adequately address the effects of degradation mechanisms, recommendations (actions, design changes, improvements, etc.) needed to mitigate the effects of aging were submitted. These recommendations were grouped into four distinct categories:

- recommendations for replacing or refurbishing components;

- inspection recommendations;

- "Best Practice" recommendations (additions to technical programs/initiation of new technical programs, technical analyses, strategies to address technical issues in applying industry best practices to PLiM activities);

- recommendations to ensure the availability of spare parts.

They are divided into 4 categories in terms of implementation period:

•Recommendations to be implemented before retrofitting;

•Recommendations to be implemented during retrofitting;

•Recommendations to be implemented after the retrofit;

•Good practice recommendations.

All of the activities identified and prioritized in the framing processes, condition assessment recommendations, and project modifications were reviewed in an integrated manner by plant experts and approved by the organization's management. Subsequently, these recommendations were used to compile task lists of refurbishment activities, which in turn will serve for long-term safe operation and refurbishment project development.

Based on the CA (condition assessment) SSC condition assessment reports and all inspection/test results during the planned outage for the U1 refurbishment, CNE Cernavodă will review and update all program manuals, inspection strategies (frequencies, technology, methods, etc) for both units. CNE Cernavodă is in continuous contact with relevant international industry experience. For more complex ageing issues, collaboration agreements are in place with CANDU Owners Group (COG) to benefit from international operating experience, lessons learned and the latest research and development (R&D) results. CNE Cernavodă has been part of the COG R&D Program since 2006 and also collaborates with local design and research institutes. In 2016 CNE Cernavodă joined the IGALL Program (International Generic Ageing Lessons Learned) in order to maintain close collaboration with other CNEs, more experienced in implementing AMPs.

CANDU reactors do not have a reactor pressure vessel (they have pressure tubes). CANDU reactors have a Calandria vessel which contains the low temperature and low pressure moderator. Based on international operational experience and analysis to date, there are no challenges associated with extending the lifetime of the Calandria vessel for a second 30-year operating cycle. Inspections of the Calandria will be carried out during the refit.

19. Is the replacement of steam generators responsible for final heat dissipation being considered? If not, what methods are used to verify that the components concerned continue to meet safety standards?

Response: The Unit 1 Design Authority's assessment of the condition of the structure, systems and components did not identify the need to change the steam generators. This equipment is included in the ageing management program and is subject to regular inspections in accordance with specific standards. The ageing management program is developed in accordance with CNCAN regulations and IAEA standards and is approved by CNCAN.

Aging management program for steam generators: The program manages the ageing of the steam generators of CNE Cernavodă. The management scope of this program includes both the primary side components (the tubes) and the secondary side components that are contained in the steam generator (i.e. the secondary side internals).

SG (Steam Generators) Inspection Program: Steam generator subcomponents are selected for inspection according to the requirements of **CAN/CSA-N285.4-2009**:

- - Inspection tubes/primary part
- - Secondary inspection:
  - Visual inspection of the tube sheet; the first set of U-tube support bars; the annular gap; an upper region of the tube bundle (including the top of the U-bent tubes and the corresponding supports);
  - The internal components (primary cyclanes, secondary cyclanes, appropriate decks, reheat drain manifold, emergency water supply manifold, etc.); downcomer
  - Incoloy 800 material tubes reduce the potential for stress corrosion and intergranular attack defects, so the condition of SG tubes is very good.

However, the condition of the tubes is monitored and deposits on the tube plates are periodically removed to minimize problems with local chemistry and pH.

Since, based on international operating experience, steam generators are susceptible to damage to tube backing plates and other internal components due to flow-assisted corrosion (FAC), these components are monitored by the eddy current inspection method and visual inspections for tubes, nozzles and walls.

- A 10-year framework agreement was signed in 2011 with the designer and manufacturer of the steam generators (Babcock & Wilcox) and the Life Assessment (LA) study for U1 was received in 2012. The conclusion of the LA : the condition of the steam generators of U1 is very good after 15 years of operation and without any problems they are expected to achieve and extend their projected lifetime, if the current operating conditions are maintained.

- Updated studies for the lifetime of steam generators were conducted in 2021. The results confirm good condition after 25 years. All component states are acceptable, except for the primary moisture

separators, for which replacement is required during the planned shutdown for retrofitting to allow another 30-year duty cycle.

The Steam Generator Lifetime Management Program has been reviewed and evaluated against the recommendations of IAEA report IAEA-TECDOC-1668, as well as the IGALL AMP116 Aging Management Program for Steam Generators and other associated guidance issued by EPRI, with no non-conformities identified.

20. The war in Ukraine has highlighted the vulnerability of nuclear power. It also showed that when nuclear power plants become a theater of war, even accidental hits can cause considerable damage. No one expects war in EU countries, but nevertheless, are there considerations during LTO to improve reactor safety aspects as part of LTO?

Answer: The main objective of CNE Cernavoda is to ensure nuclear safety and security. The operation of the plant and future investments for Long-Term Operation (LTO) are established on the principle of reliable and safe continuous improvement.
For the level of risk associated with the war in Ukraine, the national legislative framework implemented identifies, in addition to the SNN-SA-CNE Cernavodă SNN-SA-CNE Cernavodă's Responsibility, the main State Authorities that are authorized to take over the Emergency Management Role. Thus, the basic attributes and the organizational response are established by Resolution no. 557/2016, issued by the Romanian Government, and focus on the management of different types of risk. The Resolution entered into force on August 26, 2016 and has been recently updated and consolidated . The Resolution was published in the Official Gazette, Part I no. 615 of August 11, 2016 and includes the amendments made by the following acts: HG 1234/2021; HD 151/2023; last amendment on February 24, 2023. Thus, for nuclear related situations, the picture of responsibilities is presented below (within the annex to the updated HG 557/2016 https://legislatie.just.ro/Public/DetaliiDocument/248122):

Nr. crt	Type of risk	Leads the responsible authority	Secondary responsible authority	AREAS OF ACTION				
				Prevent*	Answer		Recovery / Remedy*	
					Operational coordination	Support missions	Investigate/Evaluate	Restoring normality
1	Accidents, breakdowns, explosions, fires or other events in nuclear or radiological activities	CNCAN	MAY, MECRMA, MS	CNCAN, ANDR, MAI, MT MMAP, MENCS	MAY / CNCAN / ANDR	MAI, CNCAN, ANDR, MECRMA MApN, MMAP, MADR, MS MT, STS, MAE, local public administration authorities, other organizations according to	CNCAN, ANDR MAI, MMAP MENCS, MP, MS Local public administration authorities	CNCAN, ANDR MAI, MMAP, MS Economic operators/Authorization holders

						the field of competence		
2	Radiological risk	CNCAN	MAY, MApN, MS	ANDR CNCAN MS MS MAY MMAP	MAY	MAI, CNCAN, MECRMA, MApN MMAP, MS, MT, STS, MAE, ANDR, local public administration authorities, other organizations and structures according to the field of competence	MDRAP ANDR, MS, MP MENCS, local public administration authorities	MDRAP, MS ANDR, local public administration authorities, economic operators/authorization holders

Following the Fukushima accident and the EU-wide "Stress Tests", a comprehensive list of nuclear safety related design improvements for Units 1 and 2 of CNE Cernavodă has been developed and implemented. All these improvements provide enhanced protection against severe accidents, making a significant contribution to the nuclear safety objective for nuclear installations, as laid down in Article 8a of Directive 2014/87/Euratom and transposed and complemented by national regulations and regulatory guides issued by CNCAN.

In addition to the more notable nuclear safety improvements implemented shortly after the Fukushima accident, which are presented in publicly available reports, we have continued to increase the safety of the CNE Cernavodă units by implementing important improvements during each planned shutdown (every 2 years), based on operating experience, technological developments, new or revised and updated safety analyses.

All these improvements contribute to the enhancement of all levels of protection in the deep sea, including accident prevention and mitigation, and thus result in increased safety margins/lower risk (as quantified in the periodically updated Probabilistic Safety Assessment Probabilistic Safety Assessment - Living PSA).

Core Damage Frequency (CDF) and Large Release Frequency (LRF) resulting from the Probabilistic Safety Assessments (PSA) for the in-service Cernavodă NPP units are significantly lower than the reference values chosen in accordance with the principles outlined in paragraph 27 of INSAG-12 and we expect that the improvements planned for implementation during the refurbishment will allow the quantitative targets set in the regulations to be met as fully applicable to the new NPP.

In keeping with our commitment to continuous improvement, an additional comprehensive list of project modifications to be implemented at Unit 1 has been prepared and is being planned for the retrofit project. These project changes resulted from:

- Periodic Nuclear Safety Review (in accordance with Article 8c of Directive 2014/87/Euratom);
- CNCAN regulatory authority requirements specified in the rules in force;
- Project modifications already implemented in Unit 2;
- Project modifications to be implemented in Units 3/4;
- Design modifications from CANDU plant operating experience, research results and development of technical standards;
- Improvements identified as needed from U1 operational experience and ageing management.

21. The dangers posed by terrorism and cyber attacks on nuclear installations are becoming increasingly present.

Answer:

Romania has comprehensive legislation, regulations and arrangements for nuclear and cyber security, including for the interfaces between nuclear security and physical protection. The baseline physical protection system design basis threats and implementation arrangements are regularly updated. The most important regulations on physical protection and protection against cyber threats have been reviewed, updated and supplemented in the period 2021-2023.

It should be noted that the documents supporting the public information presented below are classified and subject to confidentiality requirements under national and European laws, standards and directives. The project-based technical documents underlying the safety and security assessments/assessments and Action Plans/Emergency Plans are issued and/or approved by the competent authorities (specialized services of the Nuclear Regulatory Authority, Ministry of Interior, Ministry of Defense, IGSU).

CNE Cernavodă is continuously developing and improving the Physical Protection System, which ensures the protection and security of nuclear installations and materials. Thus, in compliance with the requirements of CNCAN regulations, CNE Cernavodă has implemented the Cyber Security Plan for the systems, components and equipment that have nuclear security, radiological protection, physical protection, nuclear safeguards and emergency response functions.

CNE Cernavodă identifies, assesses and manages the interfaces between physical protection, nuclear safety and radiological safety, at the level of systems, structures, components and equipment, as well as at the level of activities carried out within the processes related to:

- Physical protection;
- Design configuration control;
- Emergency planning and preparedness.

At CNE Cernavodă, a process of periodic verification and review of the technical basis for the on-site emergency plan is being carried out. The following types of events have been analyzed and taken into account for the development of the emergency plan:

- radiological/nuclear events;
- medical events;

- chemical events;
- fires;
- events that may lead to the loss of the Main Control Room (MCR);
- radioactive material transportation and transfer events;
- external events (severe weather events, floods, landslides, earthquakes, fires from natural sources, events caused by external human activities, epidemics/pandemics);
- events of total loss of power supply and of final source of cooling (loss of power supply from the national grid, total interruption of power supply from all AC sources, loss of primary source of cooling, loss of final source of cooling together with total loss of power supply from AC sources);
- severe nuclear accidents;
- combined events (conventional industrial accident coinciding with a radiological accident, natural disasters combined with a severe nuclear accident);
- physical protection events.

In 2014, the CNCAN rules on the protection of nuclear installations against cyber threats entered into force, which set out the general requirements for the protection of systems, components and equipment, including instrumentation and control software and computer networks (SCE - systems, components and equipment), belonging to nuclear installations, against cyber threats. These rules on cyber security of nuclear installations were revised, updated and supplemented in 2021. In accordance with these rules, CNE Cernavodă provides protection against potential cybersecurity threats for certain categories of SCE and ensures, through proactive and reactive measures, the confidentiality, integrity, availability, authenticity and non-repudiation of electronic information, resources and services in cyberspace. CNE Cernavodă has identified those SCEs that require protection against cyber threats (hereafter referred to as Digital SCEs) and for which it has implemented a cyber security plan, in accordance with the requirements of CNCAN rules.

The methodology for identifying the digital SCEs, for which CNE Cernavodă provides protection against cyber threats, was established by the team responsible for ensuring the compliance of CNE Cernavodă activities/processes/documentation with the requirements of CNCAN rules, appointed by decision of the CNE Cernavodă Branch Director.

The analysis of digital systems in CNE Cernavodă was performed considering the following categories of systems and components:

- SCE with nuclear safety, radiological protection, physical protection and nuclear safeguards functions;
- ECS with emergency response functions, including communication systems used in emergency situations.

SCEs requiring protection against cyber threats have been identified, taking into account potential cyber incidents that would have the following consequences:

- a negative impact on the functioning of the SCE;
- a negative impact on the integrity or confidentiality of data and/or software programs;
- unavailability and/or limitation of access to systems, services and/or data.

The SCE Digital Inventory has been verified and validated on site and is reviewed/updated annually or whenever necessary, taking into account operating experience, periodic safety assessments and audits, in accordance with the requirements of CNCAN rules.

The finalization of the analysis of the digital systems at CNE Cernavodă was achieved by classifying the ECS according to the potential consequences of a cyber attack and determining the systems requiring risk assessment. For this purpose, the specific model from the IAEA standards was chosen, after which a deep protection model with 5 security levels was defined. The cybersecurity requirements are applied gradually, depending on the potential consequences of a cyber attack.

Thus, a set of generic requirements is being complemented by an increasingly rigorous set of requirements, from level 5 to level 1, which apply to all digital equipment. CNE Cernavodă has analyzed the vulnerabilities to potential threats, implemented corrective actions to ensure incident prevention as well as early incident detection (for situations where preventive measures are ineffective) and developed the cyber incident response plan in accordance with the rules in force, as well as the response procedures to the generic/specific scenarios identified. For all identified digital SCEs with nuclear safety, radiological protection, physical protection, nuclear safeguards and emergency response functions, the Cyber Protection Plan (classified document) for CNE Cernavodă was established and approved by CNCAN.

The recommendations resulting from the assessment reports and risk analyses developed for the identified systems, contained in the Cyber Protection Plan, have been included in an integrated plan of corrective and improvement actions. The regulatory and control authorities are at the level of the relevant structures within the central authorities (CNCAN, MAI, MAPN, SRI).