BULGARIA AND AUSTRIA'S FINAL REQUIREMENTS IN THE ENVIRONMENTAL IMPACT ASSESSMENT PROCEDURE TRANSBOUNDARY CONTEXT

I. Conditions raised by Bulgarian party are quoted, answers are below each condition

1. Answers for Bulgaria's conditions sent by letter of the MoEW on August 2008, for Cernavoda NPP-Units 3 and 4

Condition no.1: "To provide for the elaboration of an assessment of potential impact of emissions in the air on the Black Sea aquatory in case of accident."

Answer

The safety analysis performed for design basis accidents of a CANDU 6 reactor situated in Cernavoda showed that gaseous effluents are a small fraction of the radionuclide inventory and the resulting atmospheric deposits are not radiological significant, especially considering that the distance from Cernavoda Nuclear Power Plant (NPP) to the Black Sea is more than 50 km., therefore there is no significant impact on the marine aqua system.

After the events at the Fukushima NPP, nuclear plant operators have reconsidered how they are ready to respond in case of severe events beyond the design limits originally envisaged.

SNN, as Cernavoda Nuclear Power Plant operator, complied with Community requirements (from specification of Stress Tests), regarding additional measures to be taken to ensure safety during plant operation and also in terms of protecting the population and the environment. Consequently, at Cernavoda NPP, for each unit, including Units 3 and 4, an Emergency Filtered Containment Venting System – EFCVS will be implemented, which in case of a severe accident, will provide a filtered venting of the containment, maintaining pressure inside at a level that would not jeopardize the structural integrity of the containment, which is the last physical barrier for retention of radioactivity. In addition, the system has the function to retain and return inside containment the iodine and radioactive particles retained in the filtering process. Thus, the releases of radioactivity into the atmosphere in case of severe accidents will be reduced (more than 99%) to acceptable levels.

In conclusion, a study regarding a potential radiological impact of the radioactive emissions into the atmosphere in case of an accident, upon the Black Sea aquatory system is no relevant or justified.

No requirement is identified to be included in final Environmental Agreement.

Condition no.2: "To take into account the consequences of potential transboundary pollution of the Black Sea aquatory from the Danube-Black Sea Channel."

Answer

During normal operation the liquid effluent from Cernavoda NPP is discharged into the Danube River. Discharge into the Danube-Black Sea Channel is allowed only in special circumstances and only after getting approval by prior notification of the Environmental, Health and National Commission for Nuclear Activities Control (CNCAN)" Authorities. According to the Cernavoda NPP Units 3 and 4 Design Documentation, accidental discharge of the liquid effluents into the Danube-Black Sea Channel is highly unlikely. Consequently, assessment of the accidental pollution of the Black Sea due to accidentally liquid effluent discharge into Danube-Black Sea channel is not relevant, so, nor necessary.

Condition no.2 will be undertaken in the Environmental Agreement as follows:

"On special situations, discharge into Danube-Black Sea Channel is allowed only based on supplementary approval from the Environmental National and local Authorities, Danube – Black Sea Channel Administration, Health Authority, "Apele Romane" National Administration (Water Company) and the National Commission for Nuclear Activities Control (CNCAN)".

Condition no. 3: "To provide for establishing a system for a regular exchange of information regarding the results of carried out radiological monitoring in the respective region of the Republic of Bulgaria and Romania at competent authority level."

Condition no 3 will be undertaken in the Environmental Agreement as follows:

"Following Unit 3 and 4 commissioning phases, the Romanian Ministry for Environment and Forests will agree with the Bulgarian party on a common program for information exchange regarding the results of the radiological monitoring performed by the two States in the referred regions. Cernavoda NPP U3 & U4 Operator will cooperate and provide to the respective authorities the required data".

Condition no. 4: "The population in the border areas (including the Bulgarian territory) to be acquainted with the results of the annual report of the power plant regarding the implementation of the environmental protection activities."

Answer

According with the applicable national legislation and norms for nuclear activities, Cernavoda NPP has the obligation to report to Nuclear Authority (CNCAN) the results of the environment radiological monitoring program, obligation that is adequately fulfilled by the plant Operator (Cernavoda NPP). According to the Environmental national legislation, Cernavoda NPP has the obligation to report the results of the above mentioned program also to the Environmental Authorities and to inform the public. The plant Operator has developed public information programs, established Public Information Centers and issue to public periodic information papers regarding environment radioactivity monitoring results within the NPP surveyed area. All these measures are mainly designated to Cernavoda town population.

Condition no 4 will be undertaken in the Environmental Agreement as follows:

"Cernavoda NPP will post the Annual Environmental Protection Report (EPR) on its own web-site, both in Romanian and English languages, in order to facilitate the public access (including Bulgarian population from the border regions) to the information regarding the results of implementation of the environmental protection monitoring activities".

Condition no.5 : "To provide for establishing a system for continuous control of the radioactivity in the air, water and soil in the zone for long-term protection measures planning around Cernavoda NPP (with a radius of 50 km), in compliance with Article 35 of the Euratom Treaty."

Answer

Cernavoda NPP developed an environmental radioactivity monitoring program in the vicinity of the plant (up to 30 km around the plant), starting from 1984 (preoperational program up to 1994 and first operational program implemented have started since March 1996); the Monitoring Program was approved by Nuclear Authority (CNCAN), and it has been elaborated in accordance with national legislation which transposes the European requirements and international recommendations for nuclear activities.

We also mention that, in case of a nuclear accident, Cernavoda NPP has mobile monitoring installations, which allow measurements at distances greater than 30 km.

Completely independent from the work of Cernavoda NPP, the Environmental Ministry, through the National Network of Environment Radioactivity Surveillance, runs a program for environment radioactivity monitoring, which covers a 20 km radius around the NPP. Also, towns of Constanta, Calarasi and Slobozia are used as control cities. The results of the monitoring are posted on the website of Constanta Local Environmental Authority (LEPA) and available also on the website of National Environmental Protection Authority (NEPA) as part of the Annual Romanian Environment Report.

Moreover, the Ministry of Health, through the Network of Ionizing Radiation Hygiene Laboratories, runs a radioactivity monitoring program for the drinking water and food from Cernavoda NPP area.

Also, during the EC mission from June 2007, this was deployed for verification of art. 35 / Euratom implementation, the EC delegation concluded that Romania complies with art. 35 / Euratom requirements.
The EC report has been prepared and is available on the EC web-site.

No requirement is identified to be included in the final Environmental Agreement.

Condition no. 6: "An overall radiological monitoring program to be presented in MoEW".

Answer
According to our response to condition 5, both the Ministry of Environment and Forests and the Ministry of Health permanently carry out monitoring programs for environment radioactivity in the Cernavoda NPP area. In addition, the Ministry of Environment and Forests, through the National Reference Laboratory for Radioactivity within NEPA, which is the technical and scientific coordinator of the National Network of Environment Radioactivity Surveillance, reports daily to the EC the data regarding the environment radioactivity in Romania through the EURDEP platform (European Radiological Data Exchange Platform)
These data are available to all EU member States, including Bulgaria. The Ministry of Environment and Forests will transmit, before the commissioning of NPP U3 & U4, an overview of the Environmental Radioactivity Monitoring Program (as approved by Nuclear Authority-CNCAN) to the Ministry of Environment and Water of Bulgaria.

Condition no 6 will be undertaken in the Environmental Agreement as follows:

"Before commissioning Units 3 and 4 of Cernavoda NPP, an overview of the Environment Radioactivity Monitoring Program, as approved by the National Commission for Nuclear Activities Control (CNCAN) will be sent to the Ministry of Environment and Water of Bulgaria."

Condition no. 7: "If possible, to use on-line monitoring of tritium in air and water of the Danube-Black Sea Channel. This proposal is motivated by the necessity of urgent response in case of a potential pollution of the environment with radioactivity and ensuring of a possibility for a due warning of the neighbor countries."

Answer
a) Tritium concentrations in air within the NPP influence area is adequately monitored, by the Operator of the Cernavoda NPP and also by the Environmental authorities. Cernavoda NPP ensures continuous monitoring of tritium in air and tritium in atmosphere in several locations from NPP vicinity, through continuous air sampling and periodically laboratory analyses; therefore, on-line monitoring is not necessary;
b) The tritium level in the Danube-Black Sea Channel is adequately monitored by the NPP Operator and also by the Environmental Authorities, by periodic sampling and

laboratory analyses. The sharp (accidentally) increase of tritium concentration in water inside the channel is avoided by controlling the concentrations of radioactivity of tritium in water before each approved planned discharge. Therefore, on-line monitoring of tritium in water inside the Danube-Black Sea Channel is not necessary, especially as the liquid effluent discharge in the channel is performed only in special cases (once every few years, for a few weeks), in a controlled manner approved by authorities.

c) As stated in the response to condition. 2, accidental releases of liquid effluents in the Danube-Black Sea Channel are extremely improbable.

No requirement is identified to be included in final Environmental Agreement.

Condition no. 8: "The summarized data from continuous air and water monitoring to be presented periodically (for example every three months) to the Ministry of Health and MoEW in order to protect the population"

Answer

The required information is available in the responses provided for condition 3 and 4 above.

Condition no 8 will be undertaken in the Environmental Agreement as follows:

"The common program for information exchange performed by the two States will include a presentation, every three months, to each other, of summarized data from continuous air and water monitoring in the referred regions".

2. **Response for Bulgaria's comments to the letter no. 04-20-124/24.07.21008 of the Bulgarian Ministry of Economy and Energy, in which item 1 makes references to item 12 of the letter no 04-20-146/21.11.2007 which subsequently refers to the items 1 4 5 and 6 from the same letter**

Item:"**12. With reference to the structuring of the report each one of the following items to de described a separate part or an enclosure to it:**

- **The measures aimed to prevent, decrease and compensate the negative impact defined by the investor which have to planned and implemented during the realization of the investment offer;**
- **The conclusion and the recommendations of the report authors for the Environmental Impact Assessment (EIA) regarding the programs for the management of the important aspects on the environment, the self/monitoring plans and accident procedures plans;**
- **List/lists of the enclosed drawings, tables and figures;**
- **List of the used sources of information (bibliography).**

Elaborating the position intended for submission to the Ministry of Environment and Stable Development of Rumania the Ministry of Economy and Energy considers necessary and opportune to pay a special attention to items 1, 4, 5 and 6 of the posed questions having a direct Impact on the development of the nuclear energetic and insuring security."

Answer

In the chapters of EIA where the environmental impact is presented, the EIA elaborator also presents the measures that prevent, decrease or compensate the negative impact, as applicable.

The owner of the Cernavoda NPP Units 3 and 4 as well as the contractor for engineering, construction and commissioning of the Units will have to comply with all national environmental requirements and with the requirements that will be set by the environmental agreement issued by the Romanian environmental authority. All necessary environmental actions will be planned accordingly.

The text of the EIA report includes information on the environmental programs that are already implemented at Cernavoda NPP Units 1 and 2 as well as the approaches for Units 3 and 4. The environmental authority will include the environmental program for Units 3 and 4 in the environmental agreement.

The elaborator of the EIA has chosen the option to include and present the tables within the text rather than in a separate manner at the end of each chapter/report. This is the reason why the list of the drawings, figures and tables is not included in the content of the report.

The elaborator of the EIA report presented the references at the end of each chapter.

Taking into account that the information mentioned above is included in the text of the EIA report we consider that it is not necessary to change the structure of the EIA.

Item **"1. The CANDU project has never been a subject any systematic safety inspections in the European Union. There are only two (2) CANDU 6 Reactors put into operation in the European region, the first one was put into operation in 1986 and the second one – in 2007".**

Answer

During the development of the Cernavoda NPP Project, systematic safety assessments and inspections of the European Union took place. The exchange of information between Romania and EC on nuclear power safety issues historically passed through several phases, as follows:

- The first phase took place during the accession of Romania to the European Union including the conclusion of the EURATOM loan contract for Cernavoda NPP Unit 2 completion. The second phase took place after the accession as Member State of the European Union.

Detailed information on the safety assessments and inspections of the European Union can be found in Appendix 2.1. – Excerpts from the *"Cernavoda NPP Unit 3 and 4 Communication Paper in accordance with Article 41 of EURATOM Treaty".*

- Specifically for Units 3 and 4, EnergoNuclear, the project company for Units 3 and 4 communicated to the European Commission the intention to complete Units 3 and 4 of the Cernavoda NPP in accordance with Article 41 of the Euratom Treaty. The process was a complex one and included systematic safety assessments and inspections, being finalized with the favorable opinion of the European Commission regarding the project (Appendix 2.2.).
- Furthermore, recent safety reassessments have been conducted in response to the Fukushima accident materialized in the "stress tests" required by the European Council, in compliance with the specifications and criteria issued by the European Commission, ENSREG and WENRA. The conclusion of the review conducted by Romanian regulator (CNCAN) is that the risk to the public from the postulated scenarios, including beyond design basis accidents at Cernavoda NPPs is low and is kept under control.
- The full report prepared by the CNCAN can be consulted on the following website: http://www.cncan.ro/assets/Informatii-Publice/ROMANIA-National-Final-Report-on-NPP-Stress-Tests.pdf

Item:**"4. Even though the European operating organizations are open any new project solutions their attention remains still focused on the LWR (Light Water Reactor). As it concerns the other reactor types it is not reckoned having a substantial operational experience needed for their construction, licensing and putting into operation in Europe".**

Answer

Candu type reactor is not a new project solution, neither in Europe nor worldwide.

The two operating units from Cernavoda NPP have demonstrated that operating performances obtained in 16 years for Unit 1 and 5 years for Unit 2 put Cernavoda NPP among the most performant Nuclear Power Plants in the world, regardless of the type of the reactor.

Even though is the only nuclear power plant in Europe equipped with CANDU reactors, as a member of international nuclear operators' organizations, such as COG (CANDU Owners Group) and WANO (World Association of Nuclear Operators), the licensee participates to the various programmes and projects coordinated by these organisations, in order to enhance safety in plant operation through the exchange of information on operating experience.
In 2011, Cernavoda 1 was ranked on 7th place Since In Service (SIS) out of 27 PHWR operating units worldwide and Unit 2 on 1st place SIS.
The Cernavoda 3&4 design is considering modern safety and licensing requirements. Compliance assessments against the latest national and international regulatory documents have been performed:

- **Western European Nuclear Regulators Association (WENRA)**

The review of WENRA clauses shows that Cernavoda Units 3&4 are compliant with the WENRA Reference Levels. The improvements applied to the design of the reference plant, to both deterministic and probabilistic safety analyses (including beyond design basis events) or to the design documentation ensure 100% compliance with the requirements of WENRA.

- **International Atomic Energy Agency (NS-R-1) and Canadian Nuclear Safety Commission document RD-337, "Design of New NPPs"**

RD-337 represents the CNSC adoption of the principles set forth by the IAEA in NS-R-1, Safety of Nuclear Plants - Design, and the adaptation of those principles to align with Canadian expectations.
This regulatory document includes requirements for Station blackout, Mitigation of severe accidents, Hydrogen mitigation, External events, Fire protection, etc.
A compliance assessment of Cernavoda Units 3&4 against RD-337 "Design of New NPPs" has been performed. The review of RD-337 clauses shows that Cernavoda Units 3&4 are compliant with the RD-337, "Design of New NPPs"
Romania has all the expertise needed for the licensing, construction, commissioning and operation of CANDU type reactors, based on the knowledge and experience accumulated with Units 1 and 2 of Cernavoda NPP. Moreover, the construction and commissioning can benefit from the participation on international companies, including European companies having the necessary competences acquired from the work on similar projects.

Item: "5.The CANDU 6 reactor does not have any basic characteristics inherent to the internal safety
- The reactivity ratios has no be negative in all operational stages and project failures defined in the European utility requirements in conformity with the specific volume of the heat transfer medium, the heat transfer medium temperature and the fuel, and the reactor capacity as well".

Answer
In CANDU reactors any changes in reactivity are small (small "reactivity coefficients") and this represents a beneficial safety feature. It should be noted that the neutron lifetime in CANDU

reactors is more than ten times longer than in light water reactors. The longer the neutron lifetime, the slower is the reactor's response to a reactivity insertion.
CANDU 6 units have two completely separate, diverse, independent, fast-acting shutdown systems to stop the nuclear chain reaction for any kind of accident condition – either system on its own is sufficient. These systems are totally independent from the system used to control reactivity in operational states.
The CANDU 6 meets the IAEA Safety Standards. These standards recognize the roles of both the inherent features of the reactor, and engineered safety systems, which complement the inherent features, in ensuring that uncontrolled power excursions do not happen.
Compliance assessments of the Cernavoda Units 3&4 against the European Utility Requirements (EUR) have been performed, as well, during the process of obtaining the European Commission favorable opinion regarding the Project. The assessment results show that the C3/4 satisfies the EUR requirements or the intent of these requirements, bearing in mind the fact that the EUR document has been specifically developed for LWR (Light Water Reactors).

Item: **"6. The fuel burning depth is limited to 7-8 MWd/kgU and for that reason the CANDU reactors generate up to seven times bigger quantity of waste nuclear fuel. There is no long term vision for the safe disposure of the radioactive wastes and the waste nuclear fuel either."**

Answer
The Cernavoda Nuclear Power Plant produces about 90 tons spent fuel per year and reactor.
The spent fuel management strategy of the plant consists of:

- Storage for minimum 6 years in the reactor spent fuel pond;
- Storage in dry interim spent fuel storage in Macstore modules for 50 years on Cernavoda NPP site.

In Romania, by law, the Nuclear Agency & Radioactive Waste (AN&DR) is responsible for disposal of radioactive waste and spent fuel.
According to the National strategy for radioactive waste management elaborated by AN&DR a deep geological repository for spent fuel will be commissioned in 2055.
Also, a near surface repository for LILW-SL will be commissioned by AN&DR until the end of this decade. This repository will accommodate wastes generated by operation (50 years lifetime/unit) and decommissioning of 4 units at Cernavoda NPP. The wastes which cannot be accepted at near surface repository will be co-located with the spent fuel in the deep geological repository.

II. Answers for Austria's recommendation sent by letter no. BMLFUW-UW.1.4.2/0044-V/1/2008:

Condition 1: **Concerning the status of the buildings it is recommended to guarantee that before the resumption of construction work at the containment and that the reactor building the concrete structure is in perfect condition.**

Answer:
Regarding the condition of the U3 & 4 Containment and buildings, an evaluation has been performed by the Design Authority for CANDU reactors which is AECL Canada (now renamed as CANDU Energy) and the results were documented in several reports, dated 2011, which are Owner Property and are included as part of required documentation for Construction License that is to be granted by the Romanian Nuclear Authority CNCAN (CNCAN construction license is issued after the final decision on EIA is taken), documentation not being required as per environmental legislation for issuing the final decision on EIA. These documents conclude that the containment and buildings existing for U3 & U4 are in good condition and enable safely construction, commissioning and operation of NPP U3 & U4.
Moreover, the results of the inspections were confirmed also by Owner's Engineering Consulting Company consisting of a consortium which consists of Tractebel Engineering S.A., Iberdrola Ingenieria y Construction S.A. and AMEC Nuclear International Ltd.

Condition 2: **Concerning the integrity of the reactor fuel it is recommended to proof that no impact by a broken pipe to others is possible. This must be verified by the safety assessment. Moreover, it is recommended to observe the integrity of fuel rods and tubes during operation as an important part of aging management.**

Answer:
Concerning the integrity of the reactor fuel under accident conditions, we specify that this type of event was assessed, among other accidental events assessments that could occur in a CANDU reactor. The design basis accidents involving loss of coolant are analyzed and included in PSAR (Preliminary Safety Analysis Report), the results indicating that the fuel integrity is maintained.
Cernavoda Nuclear Power Plant (NPP) (which will be the Operator also for U3 and U4) is responsible for monitoring and ensuring the integrity of fuel channels during NPP operation. In this respect, Cernavoda NPP has implemented several programs to ensure reliability of the plant critical components, in accordance with international practices, one of which being Plant Life Management (PLiM), which deals with the passive components (including fuel channels) that have a major impact upon energy production in a nuclear safety manner.

Condition 3 Concerning the containment integrity in case of severe accidents it is recommended to install passive hydrogen recombiners, because they are independent from any supply systems.

Answer:
Passive hydrogen recombiners, required for hydrogen control inside Reactor Building, are included in Units 3&4 Design Documentation, which was analyzed within EIA procedure.

Condition 4. While of course it is not mandatory to take account the recommendation of the IAEA draft Safety guide on evaluation of seismic hazard for existing NPP's published in 2007, it is advisable to do so, in order to ensure that latest scientific findings are considered within the plant design.

Answer:
In the framework of the PSR (Periodic Safety Review) for NPP Unit 1, an analysis has been performed in order to verify the compliance of the NPP with the new IAEA safety Standards, including those referring to the seismic hazard. The problems identified during the evaluation are to be addressed in an action plan. For Unit 2 the first Periodic Safety Review will be performed after 10 years of operation.
For Units 3&4 the seismic hazard has been reviewed according with the requirements of the latest IAEA guide and international standards. This study was finished in 2012 and was independently reviewed by IAEA review missions. The last IAEA report related to the seismic hazard for Cernavoda Units 3&4 was issued by IAEA in June 2012 and has no comments or recommendations.
References:

1. IAEA – "Report on 2nd follow up review for the probabilistic seismic hazard analysis and development of design basis ground motions for cernavoda NPP Units 3 & 4", June 2012.
2. PAUL C. RIZZO ASSOCIATES, INC. – "Technical report probabilistic seismic hazard analysis and development of seismic design basis ground motions Cernavodă Nuclear Power Plant Units 3 & 4 Cernavodă, Romania", May 2012

Condition 5: To avoid common mode failure of the water intake and pump house – which is common for all plants – it is recommended to realize a back-up system, that guarantees the removal of decay heat from all plants even rough conditions e.g. in case of an earthquake

Answer:
Units 3&4 project design includes a separate (EHRS) Emergency Removal Heat System, separately from the pomp house, which ensures cooling water in case of earthquake.
Additionally, the proposed design for Units 3&4 provides other alternatives sources for cooling of the reactor core, qualified to extreme events and completely independent from the cooling sources coming from Danube river. These alternatives sources of cooling are based on deep wells capable to provide the cooling water in case of loss of the Danube Cooling Water source.

Also the project includes all the modifications and improvements resulting from the "Stress Tests" assessment results required by the European Commission and European Council after the Fukushima accident.

The Environmental Agreement will contain a condition regarding the use of water from existing deep wells as an alternative source of cooling water, in case of loss of the Danube water source; controlled shut down of the NPP will be also required in case of accident.

Condition 6: **It is recommended to observe the realization of all announced safety improvements and to demand the verification of their function in the safety assessment (PSA level 2), in order to guarantee that early containment failure can be prevented in all event sequences which could cause large releases (>2% of the Cs-I inventory of the core)**

Answer:
So far, for Units 3&4 PSA level 1&2 High Level Assessment has been elaborated in order to demonstrate the achievement of the imposed safety targets for the Core Damage Frequency (CDF) 10^{-5} events/year and for the Large Release Frequency (LRF) 10^{-6} events/year.
The detailed study will be available after finalizing the detailing Design Documentation for the Project of NPP U3 & U4, after the environmental agreement is issued.

Given the above mentioned answers to recommendations no. 1,2,3,4 and 6 we would like to ensure you that the issues raised, taken into account the nuclear character of the project, will be solved within the subsequent technical documentation managed by the nuclear regulator CNCAN, in accordance with the national and international nuclear provisions.
Moreover, we assure you that the recommendations issued by the Austrian party within the transboundary impact assessment procedure for this project are to be fulfilled by implementing the existing requirements of nuclear norms and legislation and during the nuclear licensing process governed by the Romanian nuclear regulatory body (CNCAN).