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CONSTRUCTION OF A NEW NPP IN BELARUS

Expert Statement on the Justification of Investments into Nuclear Power Station Construction in the Republic of Belarus – Evaluation of the Environment – Edition 06.07.2010

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1 INTRODUCTION

The government of Belarus decided to construct a nuclear power plant (NPP) with a capacity of 2,300–2,400 MWe. In 2009, Belarus published the Preview EIA Report (EIA REPORT 2009). The Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management decided to take part in the transboundary EIA procedure.

The Russian project NPP-2006 of the Generation III VVER was chosen for the Belarusian NPP. The government of Belarus is convinced that this project conforms to modern international nuclear safety and radiation protection requirements. The Austrian review of the Preview EIA Report was focused mainly on the safety and risk analysis, with the goal to assess if the EIA allows making reliable conclusions about the potential impact of transboundary emissions in case of accident conditions at the plant. For that purpose, safety features, equipment and procedures for severe accident management should be explained in detail. In total 20 open questions were formulated in the Austrian Expert Statement (UMWELTBUNDESAMT 2009).

In March 2010 Austria received answers related to these questions (REPLIES 2010). The authors of the Expert Statement evaluated the answers given by Belarus and summarized their evaluation in a further report (UMWELTBUNDESAMT 2010a). As a result of this assessment some questions were found to be sufficiently answered, some misunderstandings could be clarified and several questions were formulated for discussion during the Bilateral Consultation Meeting, which took place in Vienna on May 10th 2010. Due to time constraints it was not possible to discuss all questions in a sufficient manner. After the Bilateral Consultation Meeting the Belarusian experts submitted answers to the open questions in written form (ANSWERS 2010a). All information which was received by the Austrian experts has been assessed in the last report on the Preview EIA Report (UMWELTBUNDESAMT 2010b). This Report conclusion lists several points for which additional information should be provided by the Belarusian side:

Short-term issues:

- Statement on the basic design of the core-catcher and the potential disadvantages of this design.
- Systematic presentation of all BDBA scenarios mentioned so far, with more detailed explanation of accident sequences and the reason for selection.
- Statement on the merits and shortcomings of probabilistic methods, as seen by the belarusian experts, in particular discussion of the justification of the cut-off value of 10^{-7}/year for severe accidents.

Long-term issues:

- Information on the detailed design of the core-catcher.
- Information of the detailed design of other safety systems.
- Information on accident analyses performed specifically for the NPP Belarus.
- Information on probabilistic risk analyses performed specifically for the NPP.

In October 2010 Austria received some more information from the Belarusian Ministry of Natural Resources and Environmental Protection concerning the open points listed above (ANSWERS 2010b). This information covers the basic design of the core catcher, the systematic presentation of all BDBA scenarios

and the discussion of advantages and disadvantages of probabilistic assessment. The effort of the Belarusian side to provide the requested information as far as it is possible before the detailed design process of the NPP Belarus will start, is appreciated.

In March 2011 the Austrian experts received the final version of the Environmental Impact Assessment (EIA) Report on the construction of a new NPP in Belarus (EIA REPORT 2010). Hereby we assess this report.

2 OVERVIEW

Chapter 6 of the Final EIA Report (EIA REPORT 2010) contains the description of the nuclear power plant. It contains a much more detailed description of the project, the systems and components compared to the Preview EIA Report (EIA REPORT 2009). The focus of description lies on changes for VVER 1200 compared to VVER 1000 reactors.

Specific characteristics and requirements (section 6.2) are described and information about the development of the NPP-design of the AES 2006 is given. Chapter 6 also refers to international institutions, which examined the AES 2006 design, e.g.: IAEA Safety Review Mission Reports (from Chinese VVER plants: Tianwan, Liaoning). However, these documents are not available to us.

The safety criteria and project limits in section 6.7 are just the same as mentioned in the Preview EIA Report.

Compared to the Preview EIA Report passive safety systems are described in more detail. But there is no systematic description of the safety assessment, which would support the presented worst beyond design base accident (BDBA).

Chapter 15 of the Final EIA Report includes the assessment of transboundary impacts from the Belarusian NPP: This chapter starts with the targets, the NPP has to fulfill:

" lowering of probable emergences at the energy blocks with serious damage of the reactor active zone up to the level of 10^{-6} 1/year per one reactor and greater surges outside the limits of the area, for which there are necessary quick countermeasures outside the area, at the level 10^{-7} 1/year per reactor;

- *restriction of maximum emergency with the surge of the main dose of creating nuclides into the surrounding environment under heavy undesigned emergency with probability 10^{-7} 1/year per reactor with the level 100 TBq of cezium-137.*
- *lowering maximum emergency surge (ПАВ) of the main dose creating nuclides into the surrounding environment under heavy undesigned emergency with probability 10^{-7} 1/year per reactor, up to the level, under which: the excluded necessity to introduce immediate measures, including both obligatory evacuation, and long lasting settle out of the population outside the borders of the area beyond 800 m ..." (final EIA p 465)*

Table 156 of the Final EIA Report describes the BDBA scenario as follows: 10-50% melting of the core, release of (volatile) radionuclides from the core into the containment. The same source term is used for the assessment of transboundary emissions. The assumptions for the accident conditions are described in chapter 15 of the Final EIA Report as follows: The integrity of the containment is preserved as a minimum within 24 hours. Release into the environment is assumed only due to the containment leak-rate of 0.2% per day. The release is assumed to take place at the ground level and to last only 1 day. This release scenario is said to have a frequency of occurrence of 10^{-7} per reactor and year. The assumed source term (Table 170 EIA REPORT 2010) is the same as stated in the Preview EIA Report version (p.116) – with a more comprehensive list of radionuclides.

Two scenarios with different emissions of ^{131}Iodine and ^{137}Caesium are used for the dispersion simulation of a severe accident assumed ("heavy undesigned emergency"). The release is assumed to last 1 hour. The dispersion is calculated over 24 hours (EIA REPORT 2010, Table 172), with a stable wind direction and no precipitation.

The result of the assessment of this limited release scenario is presented in the final EIA Report as follows:

Table: (Table 180, EIA REPORT 2010).

The yearly doses of irradiation over the population, as the result of undesigned emergency are shown in Table 180.

Table 180 – Doses for irradiation over the population (Source: EIA REPORT 2010)

Distance, km	Effective dose, mSv	Dose for irradiation over the thyroid gland*, mSv
800	0,019	0,297
900	0,016	0,249
1000	0,016	0,212
1200	0,014	0,162

Table 180 is a continuation of Tables 178 and 179 (EIA REPORT 2010). The calculation model is a simple dispersion model for dose assessment related to the distance of the emission source. This type of assessment is usually used for determination of emergency measures near the plant. For long range transport of radioactive emissions usually more sophisticated models are used. (FLEXRISK 2011).

After the Bilateral Consultation Meeting and receipt of the information from Belarus after the Consultation (ANSWERS 2010a), the status regarding important open questions was as follows:

Apart from shortcomings in the structure of the answer on the complete spectrum of initiating events, the in-formation provided in written form after the Consultation is of very general nature. For example, the transients in the second list correspond to those listed in the IAEA Safety Guide on level 1 PSA (IAEA 2010). This is probably still due to the fact that specific information on the Belarus NPP cannot be provided until the specific design process for this plant has made some progress. No information has been provided on the uncertainties of the PSA results. (UMWELTBUNDESAMT 2010b).

However, the origin of the source term in question is made clear. The Final EIA Report does not demonstrate that a containment bypass accident scenario can be excluded in principle. Specific information on the Belarusian NPP will be available later as the specific design process evolves. According to the second Belarusian Answer (ANSWERS 2010b) a systematic provision of BDBA scenarios with a more detailed explanation is considered to be beyond the scope of the EIA. Information on the probabilistic risk studies specifically for the NPP Belarus will be received during the design of the project. The results of the PSA Level 1 and 2 for the NPP Belarus are of high relevance for Austria. It would be useful that in the course of the Regular Bilateral Experts Meetings between Belarus and Austria the results of the PSA could be presented and further discussed.

The questions concerning DBA and BDBA scenarios have been answered in general by the written answers provided after the Bilateral Consultation Meeting (ANSWERS 2010a). In (ANSWERS 2010b) a more precise listing of DBA and BDBA is included.

The conclusion regarding all information we received in written form after the Bilateral Consultation in 2010 is:

Concerning all open questions Belarus claims, that specific information for the NPP cannot be provided, because it is yet to be elaborated in the following specific design process.

“Based on the review of all information we received from Belarus so far and from EIA Reports related to other Russian NPPs, it is clear that there is a cut-off value for the probability of severe accidents:

Only beyond design basis accidents are considered with a probability of occurrence > 10^{-7} per reactor and year (the limit for the probability of a core damage accident is 10^{-6}/yr). Accidents with a probability < 10^{-7} per reactor and year are classified as practically impossible. From our point of view, such accidents cannot be excluded in principle. Due to the limits and shortcomings of probabilistic analyses, accidents should not be excluded from consideration on the basis of probabilistic arguments alone.“ (UMWELTBUNDESAMT 2010b).

Meanwhile, the Western European Nuclear Regulator’s Association (WENRA) has published a statement on safety objectives for new nuclear power plants (WENRA 2010). Among other points, it is stated that accidents with core melt, which would lead to early or large releases have to be practically eliminated. Practical elimination, in the sense of the WENRA statement requires a thorough understanding of the phenomena involved and cannot be based on probabilistic assessment alone. This statement further confirms the position of the authors as outlined in the previous paragraph.

The Final EIA Report presents no further information concerning initiating events, uncertainties of PSA results related to DBA as well as BDBA scenarios and source terms.

3 CONCLUSION

In all cases related to the questions which are still open, Belarus claims that specific information for the NPP Belarus cannot be provided at present because it will be elaborated during the upcoming specific design process. Therefore specific information on the Belarus NPP will be available later as the specific design process evolves. Especially open questions related to the safety analysis and to the results of the PSA are still not resolved by the Final EIA Report. Based on that, transboundary impacts in case of accidents at the foreseen NPP of Belarus cannot be excluded at the present stage. Nonetheless the results of the PSA Level 1 and 2 for the NPP Belarus are of high relevance for Austria. It would be useful that in the course of the future Regular Bilateral Expert Meetings between Belarus and Austria the results of the PSAs should be presented and further discussed.

Furthermore we want to remark, that the lessons from the accident in Fukushima-Daiichi presumably will lead to new questions for all nuclear power plants. Hence, it is possible that there will be modifications in the NPP Belarus project which will have to be taken into account and discussed in the course of the future development.

4 ABBREVIATIONS

BDBA.....Beyond Design Basis Accident

DBA.....Design Basis Accident

EIA.....Environmental Impact Assessment

NPP.....Nuclear Power Plant

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