Belarus Stress Tests Peer Review

Executive summary

Introduction

In the aftermath of the Fukushima accident, the EU carried out "comprehensive risk and safety assessments" (so called **"Stress Tests" (STs)**) of all its nuclear power plants and also invited interested non EU countries to take part in the exercise.

The Stress Tests were completed with Belarus in accordance with its voluntary commitment, joining the Joint Declaration on comprehensive risk and safety assessments of nuclear plants (stress tests) of June 2011, taking into account a common EU-STs specification that defined 3 topic areas for assessment:

- extreme natural events (earthquake, flooding, extreme weather conditions),
- response of the plants to prolonged loss of electric power and/or loss of the ultimate heat sink
- severe accident management.

Belarus agreed to make use of transparent peer-review (PR) in accordance with the standard procedure and Practical Arrangements were agreed by EU and Belarus in 2017.

During 2017 GAN – Belarusian Regulator - worked to produce the host country national report for the stress test process and this report was submitted to the EC and ENSREG for peer review on 31st October 2017. The report confirmed the design of the Belarusian NPP from type AES 2006 V-491, which is the result of evolutionary development of the Russian VVER (Vodo-Vodyanoi Energetichesky Reaktor) type Pressurized Water Reactor (PWR) family.

The Belarus national stress test report, was published on the ENSREG website and remained open for Public Consultation from Monday 13 November 2017 to Saturday 13 January 2018. Comments/questions received during this Public Consultation were answered by GAN and were subsequently published on the ENSREG Website

After a detailed review of the national report, the peer review mission took place in Belarus from 12th to 16th March. The Peer Review Team (PRT) consisted of 17 experts from EU and non EU Member States with a good balance between nuclear power and non-nuclear countries. The PRT included 2 representatives from the Commission and 3 observers (1 from the IAEA, 1 from the Russian Federation and 1 from Iran).

The experts from the PRT considered that the latest safety standards (IAEA and WENRA) established after the EU stress tests in 2012 should be taken into account during the stress test process for Belarus. This fact has important implications for the review process and the related recommendations.

Peer Review Team's general comments on the Belarus National Report

In the opinion of the PRT the Belarus national report was drafted in accordance with the requirements of the EU stress tests. PRT pays tribute to Belarus's agreement to complete the EU Stress Test process in a relatively compressed timeframe, particularly as it is an *embarking country* developing a new nuclear power programme and, even for more established countries, the process presents a sizeable challenge and learning process. In order to get comprehensive

information on the plant the national report had to be complemented by GAN responses to a large number of written questions[1] and the PRT commends the open and transparent way in which GAN and the licensee sought to address these during the review. For each of the topics of this Peer Review, PRT raises the main following recommendations to be found in details in the present report.

Topic 1: ASSESSMENT RELATIVE TO EARTHQUAKES, FLOODING AND OTHER EXTREME WEATHER CONDITIONS

Earthquake

In general, the seismic design basis seems to be in line with current international practice, IAEA guidelines and the WENRA (2014) Safety Reference Levels. The procedure for definition of DBE is in accordance with Russian and Belarus regulatory requirements and standards, which is different from the widely accepted methods implemented in EU and WENRA countries (references 2016).

The completion of the PSHA 2018 confirmed ground motion values of 0.10 g for the design basis earthquake with the occurrence probability of 10^{-4} per year which was acceptable to the PRT.

Further it will inform the decision for further appropriate safety measures.

However, a systematic assessment of the seismic margins for all SSCs important to safety is currently not available Therefore, to further strengthen the seismic robustness of the Belarusian NPP the PRT recommends that the regulator should consider the PSHA 2018 results in the beyond design basis safety evaluation of the plant and ensure the implementation of appropriate safety upgrading measures.

Flooding

The topography of the site of the Belarus NPP, which is located some 50 metres above the nearest river, adequately protects against river flooding and impact from dam rupture. This is regarded a strong safety feature.

Due to the current state of construction, the PRT recommends that the Regulatory Body should check that plant measures against water ingress into safety related buildings and underground galleries are robustly designed and implemented.

Extreme Weather

The Belarus Power Plants show a high resistance to extreme weather hazards. However, the PRT recommends that the operational procedures associated with the management of extreme weather conditions that were under development should be fully developed and available before commissioning of the Belarusian NPP.

[1] Around 460 questions were prepared by the Peer Review Team, which were a combination of questions developed by the PRT, those from NGOs ("Ecohome", Greenpeace) and other provided by Latvia

Topic 2: ASSESSMENT RELATIVE TO LOSS OF ELECTRICAL POWER AND LOSS OF ULTIMATE HEAT SINK

In the Belarus NR, Robustness and time margins were theoretically demonstrated for all relevant accidents considered in the EU stress tests due to the diversification of the active safety systems with passive ones, big water reserves stored inside the containment and other features of the Belarus NPP.

Particular strengths of the Belarusian NPP include a Passive Residual Heat Removal System through the Steam Generators (SG PHRS) and Passive System for Heat Removal from the Containment atmosphere (PHRS C). Both systems are capable to operate passively and automatically even during station black-out conditions at least for 24 hours in the stand-alone mode. In addition, there is a core catcher capable of capture, cool down and stabilize the molten corium preventing a direct challenge to the containment boundary.

Nevertheless, the PRT concludes, that some issues regarding the safety especially under design extension conditions (DEC) need clarification and enhancement. As an example, despite the autonomy of the passive heat removal systems which are designed to cope with SBO scenarios, the SG PHRS, the PHRS C tanks and the spent fuel pool are refilled with water using a single pump JNB50AP001 (only 1 pump per unit is designed). During a SBO, electrical power for this pump will be supplied by a mobile diesel generator to be connected when required. Owing to the importance of ensuring the functionality of SG PHRS in SBO, the PRT recommends enhancing the reliability by installing an additional redundant pump. Considering the crucial function of the JNB-50 pump for meeting the requirements for DEC, the PRT recommends that a permanent power supply should also be installed to improve the availability of the pump in SBO situation.

Topic 3: ASSESSMENT RELATIVE TO SEVERE ACCIDENT MANAGEMENT

In relation to severe accident management, the PRT recognized that several advanced safety features are implemented in the design. Nevertheless, the overall concept of practical elimination of early and large releases should be more explicitly reflected in an updated plant safety case. Other measures related to habitability of control areas, and further developments of EOP and SAMG's should also be undertaken.

The PRT noted positive aspects taken regarding training, as a training centre is equipped with the full scope simulator with rather unique capabilities to also simulate severe accidents, thus providing additional features for effective staff training.

In addition, PRT noticed with satisfaction that Ministry for Emergency Situations has also established a strong NPP fire brigade, well equipped with numerous mobile appliances ready to respond to fires and other hazards at the plant. In addition, at the country level there are other necessary sources such as heavy machines and transport available to respond to severe accidents.

Conclusion

Although the report is overall positive, it includes important recommendations that necessitate an appropriate follow up. The PRT recommends that Gosatomnadzor in accordance with the principle of "intelligent ownership", should identify the necessary safety improvements in response to the recommendations made in this report by the PRT and those by Gosatomnadzor

itself, and incorporate them into a National Action Plan containing all relevant safety improvement measures and associated implementation schedules. It should also include, as appropriate, recommendations and suggestions from the review of the European Stress Tests[2] . The NAcP should ensure timely implementation of the safety improvement measures in accordance with their safety significance. In consideration of the practice adopted by the EU MS, the PRT further recommends that the National Action Plan be subject to a future review, the approach to a meaningful review being determined by Gosatomnadzor.

[2] ensreg.eu/node513