ROMANIA

National Commission for Nuclear Activities Control

Romanian National Action Plan post - Fukushima

Revision 5, January 2024

Table of Contents

GENERAL INFORMATION ABOUT THE ACTION PLAN POST-FUKUSHIMA

Following the Fukushima Daiichi accident occurred in March 2011, the Romanian authorities and the nuclear industry performed reassessments of nuclear safety and emergency preparedness arrangements and implemented improvements, in line with the international efforts in this direction.

There are currently several public reports (listed in the References) which document the actions taken by the National Commission for Nuclear Activities Control (CNCAN) and Cernavoda Nuclear Power Plant (NPP) to take account of the lessons learned from the Fukushima accident.

A national action plan has been developed for bringing together the actions identified from regulatory reviews, self-assessments, peer-reviews and generic recommendations at international level. This action plan, presented in the annex to this report, has been elaborated by CNCAN, based on the safety reviews performed after the Fukushima accident, taking account of the guidance provided by ENSREG. The action plan was issued for the first time in December 2012 and has been reviewed and revised in December 2014, in December 2017, in January 2020, in December 2021 and in January 2024, respectively.

CNCAN has been monitoring the licensee's progress in the implementation of the planned improvements and continues to perform safety reviews and inspections to ensure that all the opportunities for improvement are properly addressed taking account of the lessons learned from the Fukushima accident.

All the most important safety-related upgrades have been implemented.

The revision 5 of the action plan reflects the situation as of December 2023. The action plan is reviewed annually by CNCAN to verify the progress with its implementation and revised, as necessary, to reflect any relevant new information and developments.

All the actions in the national action plan post-Fukushima have been completed, except for the new on-site emergency control centre, which is due to be completed by the end of 2024.

On the overall, it can be concluded that Romania has made good progress in the implementation of regulatory framework improvements and design upgrades to take account of the lessons learned from the Fukushima accident and improve the nuclear safety of the Cernavoda NPP.

Other significant updates, for the last reporting period, that are worth of being mentioned in relation to the implementation of improvement actions based on lessons learned from the Fukushima accident, are provided as follows.

<u>Developments of the regulatory and legislative framework</u>

Revised regulations have been issued in the period 2022-2023, taking into account the lessons learned from the Fukushima Daiichi accident, as well as of the regulatory and operational experience accumulated in the last 12 years. The most relevant regulations are:

- NSN-05 – Regulation on operational limits and conditions for nuclear installations (first issued in 2015, it was modified in 2023 to include additional requirements);

- NSN-07 - Nuclear safety requirements on the response to transients, accident management and on-site emergency preparedness and response for NPPs (first issued in 2014, this regulation has been revised and updated in 2020 and modified in 2023 to include additional requirements);
- NSN-18 - Nuclear safety requirements on event reporting and analysis and on the use of operating experience feedback for nuclear installations (first issued in 2017, it was revised to include additional requirements and republished in 2022);
- NSN-20 – Regulation on the nuclear safety policy and independent nuclear safety oversight for nuclear installations (first issued in 2015, it was revised to include additional requirements and republished in 2022);
- NSN-22 - Regulation on the licensing of the nuclear installations (first issued in 2019, it was modified in 2023 to include additional requirements);
- NSN-23 - Regulation on the training, qualification and authorization of nuclear installations personnel with nuclear safety related jobs (first issued in 2017, this regulation has been revised and updated in 2021 and modified in 2023 to include additional requirements).

In 2022, CNCAN submitted for Government approval a legal initiative in order to have CNCAN self-financed and to allow CNCAN to offer more competitive salaries for its personnel and increase staffing, in order to resolve chronic understaffing issues. This initiative included several modifications to the Law 111/1996 on the safe deployment, regulation, licensing and control of nuclear activities:

- provisions for self-financing;
- increase in the number of positions in the organizational structure of CNCAN;
- improved salary levels;
- provisions on nuclear safety culture and on the role of CNCAN in promoting nuclear safety culture;
- provisions on training and qualification for regulatory personnel;
- explicit provisions on the technical review and assessment activities performed as part of regulatory oversight;
- more detailed provisions on the authority and responsibilities of CNCAN;
- specific provisions for the licensing of the modules of a nuclear installation comprising of several identical modules (applicable also to nuclear power plants using small modular reactors);
- supplementary requirements on the licensees for nuclear installations to ensure and further develop their own technical capability, access to specialized technical assistance, effective supply chain arrangements, state-of-the-art training programs and sufficient staffing levels of qualified personnel.

The modifications to the Law 111/1996 have been approved by the Parliament in 2023 and have come into force.

Design improvements

Cernavoda NPP has continued upgrading the safety of its operating units, taking account of the latest standards, new regulatory requirements, available operational experience feedback and the results of research and development activities.

All the major design improvements have been already mentioned in the previous reports post-Fukushima. These include provisions for enhancing the capability for monitoring plant parameters in severe accident conditions.

Upgrades to the full-scope simulator

The full-scope simulator for Cernavoda NPP has been enhanced to include severe accident simulation capabilities using a version of the Modular Accident Analysis Program (MAAP5-CANDU). This upgrade enables more comprehensive practical training for the operators and also better management of the emergency preparedness exercises involving severe accident scenarios.

Improvements of accident management and emergency preparedness and response

The main improvements to the regulatory framework and to licensee's arrangements have been described in the previous reports. CNCAN has continued to perform plant inspections on the procedures, training, equipment and resources available for responding to transients, accidents and emergency situations. As a result of these regulatory oversight activities, new event-based emergency operating procedures have been required to be issued and validated by the licensee and new requirements have been formalized in regulations.

The emergency exercises carried out in the last 9 years at Cernavoda NPP have systematically included severe accident scenarios, including those that can be initiated by extreme external events, using lessons learned from the Fukushima accident.

In October 2023, a full-scale national nuclear emergency exercise, "Valahia 2023," was organized by CNCAN in cooperation with the IAEA, with an international component, the ConvEx-2c exercise.

Work is in progress at Cernavoda NPP for establishing a new seismically qualified location for the on-site emergency control centre and the fire fighters. The current estimated date for the completion of this new centre is the end of 2024, with operation scheduled to start in 2025.

This location will include important intervention equipment (mobile diesel generators, mobile diesel engine pumps, fire-fighter engines, radiological emergency vehicles, heavy equipment to unblock roads, etc.) and will be protected against all external hazards. The initial completion date, set for the end of 2015, was changed several times due to legal and administrative issues related to transfer of property of the physical location. Until the completion of this action, equivalent measures have been implemented to ensure that all intervention equipment (mobile Diesels, Diesel fire pump, fire trucks, and so) are protected from external hazards (e.g. the equipment have been relocated so that they would not be impaired by external events).

In addition, the existing on-site emergency control centre was evaluated for seismic robustness and was reinforced. Also, the off-site Emergency Control Center is operational.

ANNEX

Romanian Action Plan post-Fukushima - Summary of improvement activities

The latest status of the Romanian National Action Plan is summarized in the table below, which provides an outline of the main improvement activities resulting from the post-Fukushima safety reviews performed to date. The table identifies, for each action, the organization(s) responsible for implementation (SNN - the licensee, CNCAN, or both), the status of the action (implemented, in progress, planned or under evaluation) and the target date for completion. The status of the actions reflects the situation as of December 2023.

CNCAN monitors the licensee's progress in the implementation of the planned improvements and continues to perform safety reviews and inspections to ensure that all the opportunities for improvement are properly addressed taking account of the lessons learned from the Fukushima accident.

Action	Responsible for implementation	Status	Target date for implementation
Topic 1 – External events (earthquakes, floods and extreme weather conditions)			
1. Review the specific procedure which is in place for extreme weather conditions in order to include the appropriate proactive actions for plant shutdown.	SNN	Implemented	-
2. Identification of potential measures to improve protection against flooding.	SNN	Implemented	-
3. Provision of on-site of sand bags to be used as temporary flood barriers, if required.	SNN	Implemented	-
4. Improvement of the seismic robustness of the existing Class I and II batteries.	SNN	Implemented	-
5. Design modifications to replace selected doors with flood resistant doors and penetrations sealing (for improving the volumetric protection of the buildings containing safety related	SNN	Implemented	- All the major modifications identified initially have been implemented.

Action	Responsible for implementation	Status	Target date for implementation
equipment located in rooms below plant platform level).			Additional improvement opportunities have been identified and are under implementation.
6. The seismic walk-downs and subsequent seismic robustness analyses done as part of the seismic margin assessment have not revealed a need for any safety significant design change. However, several recommendations resulted from these inspections, which have been included in the regular plant seismic housekeeping program. These do not impact on the seismic margin assessment.	SNN	Implemented	-
7. The regulator to consider routine inspections of the flood protection design features.	CNCAN	Implemented	-
8. The peer review recommended that a seismic level comparable to the SL-1 of IAEA leading to plant shutdown and inspection is established. It was suggested to the regulator to consider implementing adequate regulations. Currently the actions taken by the licensee following an earthquake are based on decision making criteria that include the estimated damage to the plant (walkdowns using a specific procedure) rather than on pre-defined level.	CNCAN	Implemented	Cernavoda NPP has established the SL-1 level. The regulation NSN-06 on the protection of nuclear installations against external events of natural origin has been published in January 2015.
9. Elaboration of more detailed regulatory requirements on the protection of NPPs against extreme external events,	CNCAN	Implemented	The regulation NSN-06 on the protection of nuclear installations against external events of natural origin has been published in January 2015.

Action	Responsible for implementation	Status	Target date for implementation
taking account of the lessons learned from the Fukushima accident and of the results of the "stress tests" peer reviews.			
10. The peer review concluded that there is only little information about margins to cliff edges due to external events and weak points. Further work is proposed in this area and it is recommended that CNCAN obtains good quality programs from licensees and ensures that the work is appropriately followed up.	CNCAN	Implemented	The regulation of NSN-06 includes requirements on the assessment of cliff-edge effects due to external events of natural events. Based on the assessments implemented so far, it was concluded that the existing safety margins are sufficient to prevent cliff-edge effects.
Topic 2 – Design Issues			
11. Procurement and testing of mobile equipment (e.g. mobile diesel generators, mobile pumps, connections, etc.).	SNN	Implemented	-
12. Provision of a facility to open the MSSVs after a SBO.	SNN	Implemented	-
13. Provision of connection facilities required to add water using fire fighters trucks and flexible conduits to supply the primary side of the RSW/RCW heat exchangers and SGs under emergency conditions.	SNN	Implemented	-
14. Specific emergency operating procedures to cope with Station Blackout and Loss of Spent Fuel Pool	SNN	Implemented	-

Action	Responsible for implementation	Status	Target date for implementation
Cooling events.			
15. The option of charging the batteries or the installation of a supplementary uninterruptible power supply for the SCA is being considered by the licensee as a potential improvement.	SNN	Implemented	A few options to supply plants critical parameters from SCA, during severe accident (SBO), from a seismically qualified power supply, were analyzed and documented. These options are in addition to existing modification for supplying SCA panels from the large mobile Diesel generators, which is implemented. The solution selected for implementation was to add a new power supply to SCA instrumentation panels from 100 kV mobile Diesels (these have been procured, tested and are maintained and tested periodically in accordance with plant procedures). The design modification package (MWP) also included new, seismically qualified, electrical panels that have been installed.
Topic 3 – Severe Accident Management and Recovery (On-Site)			
16. Validation of the station Severe Accident Management Guidelines (SAMG) through emergency exercises.	SNN	Implemented	-
17. Training for severe accident scenarios, including as part of the emergency drills.	SNN	Implemented (Refreshment training is performed periodically)	In the period 2020-2021, the full-scope simulator has been upgraded with severe accident simulation capabilities using a version of the Modular Accident Analysis Program (MAAP5-CANDU).
18. Special agreements were established with the local and national authorities involved in the emergency response in order to ensure that in case of a SBO coincident with loss of primary UHS the plant has absolute priority to grid re-	SNN	Implemented	-

Action	Responsible for implementation	Status	Target date for implementation
connection and supply of light and heavy equipment and the necessary diesel fuel.			
19. Accident management provisions for events in the spent fuel pools (natural ventilation for vapours and steam evacuation, seismically qualified fire-water pipe for water make-up).	SNN	Implemented	-
20. Improvement of the existing provisions to facilitate operator actions to prevent a severe accident in SFB (water level and temperature monitoring from outside the SFB building).	SNN	Implemented	Design improvements have been implemented at both units. Water level gauges were installed to allow operators SFB level measurement in case of severe accident from an accessible location. Portable devices will be used for water temperature measurement.
21. Installation of PARs for hydrogen management.	SNN	Implemented	-
22. Installation of dedicated emergency containment filtered venting system for each NPP unit.	SNN	Implemented	-
23. Additional instrumentation for SA management e.g. hydrogen concentration monitoring in different areas of the reactor building.	SNN	Implemented	-
24. Improvements to the reliability of existing instrumentation by qualification to SA conditions and extension of the measurement domain.	SNN	Implemented	The design changes implemented at both Cernavoda Units to improve survivability to SA addressed the following parameters: - R/B pressure, - Calandria Vault level, - Moderator level, - Heat Transport temperature.

Action	Responsible for implementation	Status	Target date for implementation
25. Implementation of a design modification for water make-up to the calandria vessel and the calandria vault	SNN	Implemented	-
26. Verification of the completeness of event-based and symptom-based EOPs for all accident situations.	SNN CNCAN	Implemented	-
27. Severe accident management requirements to be included in a regulation.	CNCAN	Implemented	The regulation with requirements on severe accident management (NSN-07) was first issued in January 2014 and was revised and updated in 2020. Additional requirements have been included in this regulation in December 2023.
28. MCR habitability analysis to be continued (e.g. assessment of total core melt with voluntary venting, implementation of close ventilation circuit with oxygen supply).	SNN	Implemented	-
29. Review of Level 1 PSA & completion of Level 2 PSA (to include SFB accidents).	SNN	Implemented	-
30. Measures have been identified (and will be implemented) that aim to improve the reliability of the: (i) communication system and (ii) on-site emergency control centre.	SNN	Implemented	-
31. Cernavoda NPP will establish a new seismically qualified location for the on-site emergency control centre and the fire fighters. This location will include important intervention equipment (mobile DGs,	SNN	In progress	End of 2024 The current estimated date for the completion of this new centre is the end of 2024, with operation scheduled to start in 2025. The target date was initially set for the end of 2015. It was changed several

Action	Responsible for implementation	Status	Target date for implementation
mobile diesel engine pumps, fire-fighter engines, radiological emergency vehicles, heavy equipment to unblock roads, etc.) and will be protected against all external hazards.			times due to legal and administrative issues related to transfer of property of the physical location. Further delays were caused by difficulties in procuring specialized services and equipment to meet the regulatory requirements imposed for this project. IAEA technical support has been requested and received on these matters, including through the organization of a "Workshop on best practices adopted by Member States on design and qualification to external hazards of an On-Site Emergency Control Center for NPP site" in February 2020. Until the completion of this action, equivalent measures have been implemented to ensure that all intervention equipment (mobile Diesels, Diesel fire pump, fire trucks, and so) are protected from external hazards (e.g. the equipment have been relocated so that they would not be impaired by external events).
32. Review of SAMGs taking account of plant modifications and upgrades performed after Fukushima.	SNN CNCAN	Implemented	-
33. The development of SAMGs specifically for shutdown states is under consideration.	SNN	Implemented	-
Topic 4 – National Organizations			
34. Improvement of on-site emergency organization.	SNN	Implemented	-
35. Review of lessons learned from the Fukushima accident with regard to organizational factors and applicability to national organizations in the nuclear	CNCAN SNN	Implemented	-

Action	Responsible for implementation	Status	Target date for implementation
sector.			
36. Implementation of recommendations from the 2011 IRRS mission.	CNCAN	Implemented	The recommendations from the 2011 IRRS mission with regard to regulation and oversight of nuclear installations have been implemented. New recommendations and suggestions have been issued by the follow-up mission received by CNCAN in October 2017. A new IRRS mission has been received in October - November 2023.
37. Review of the national regulatory framework for nuclear safety to identify and implement actions for improvement.	CNCAN	Implemented	All the main regulations relevant for nuclear safety and emergency preparedness and response have been revised. Nevertheless, the improvement of the regulatory framework is considered a continuous activity.
Topic 5 – Emergency Preparedness and Response and Post-Accident Management (Off-Site)			
38. Review the existing protocol with Public Authorities in order to ensure the necessary support for the Cernavoda NPP personnel in case of severe accident, when the roads are blocked due to extreme meteorological conditions, natural disasters (earthquakes, flooding, etc.) or other traffic restrictions.	SNN	Implemented	-
39. Installation of Special Communication Service phones in each Main Control Room (Intervention Support Centre) and Secondary Control Area.	SNN	Implemented	-
40. An alternative off-site emergency control centre is being developed.	SNN	Implemented	The new offsite emergency control center has been tested during several drills (the first was in December 2015).

Action	Responsible for implementation	Status	Target date for implementation
41. A review of the national off-site response is in progress to take account of the lessons learned from the Fukushima accident.	CNCAN + other national authorities	Implemented	The regulations and the national plan for emergency preparedness and response have been revised.
Topic 6 – International Cooperation			
42. Identification and consideration of additional relevant peer-review services.	CNCAN SNN	Implemented	This is a continuous activity, controlled by the operational experience processes. Several OSART and WANO-PEER Review Missions have been conducted at Cernavoda NPP. The last IRRS mission was completed in November 2023. Several relevant benchmarking activities have been conducted by both regulator and licensee.
43. Participation in international activities for sharing experience on lessons learned from the Fukushima accident and on actions taken to improve safety.	CNCAN SNN	Implemented	Both CNCAN and the licensee have participated and continue to participate in all relevant international activities.

REFERENCES

1) The revisions of the Romanian National Action Plan post-Fukushima, https://www.ensreg.eu/EU-Stress-Tests/Country-Specific-Reports/EU-Member-States/Romania

2) Romanian National Report for the Convention on Nuclear Safety, 9th edition, August 2022, https://www.iaea.org/sites/default/files/22/08/romania_nr_9th_cns_.pdf

3) National Report of Romania for the 2nd Extraordinary Meeting under the Convention on Nuclear Safety (May 2012) http://www.cncan.ro/assets/Informatii-Publice/06-Rapoarte/RO-National-Report-for-2nd-Extraordinary-Meeting-under-CNS-May2012-doc.pdf

4) Reports on the implementation of the European "stress tests" by Romania: http://www.ensreg.eu/EU-Stress-Tests/Country-Specific-Reports/EU-Member-States/Romania