

ROMANIA



**National Commission
for Nuclear Activities Control**



**Romanian National Action Plan
post - Fukushima**



Revision 4, December 2021

Table of Contents

| | |
|---|----|
| General Information about the Action Plan Post-Fukushima | 1 |
| Annex – Romanian Action Plan post-Fukushima - Summary of improvement activities . . | 3 |
| References | 12 |

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 and in December 2021, 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 4 of the action plan reflects the situation as of December 2021. 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.

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.

Developments of the regulatory framework

Revised regulations and new regulations have been issued in 2020-2021, taking into account the lessons learned from the Fukushima Daiichi accident, as well as of the regulatory and operational experience accumulated in the last 10 years. The most relevant regulations are:

- 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);
- NSN-21 - Fundamental nuclear safety requirements for nuclear installations (first issued in 2017, this regulation has been revised and updated in 2021);

- 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);
- NSN-27 - Regulation on the use of standards for the ensuring, maintaining, assessing and continually improving nuclear safety for nuclear power plants (first issued in 2020 and revised and updated in 2021);
- Updates to the Regulation on the management of emergency situations specific to nuclear or radiological risk (first issued in 2018, revised and updated in 2021), to include more detailed provisions on the public information and communication during emergencies.

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.

The emergency exercises carried out in the last 7 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.

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 2021.

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 equipment located in rooms | SNN | Implemented | - All the major modifications identified initially have been implemented. Additional improvement opportunities |

| Action | Responsible for implementation | Status | Target date for implementation |
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| below plant platform level). | | | have been identified and are under implementation. |
| <p>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.</p> | SNN | Implemented | - |
| <p>7. The regulator to consider routine inspections of the flood protection design features.</p> | CNCAN | Implemented | - |
| <p>8. The peer review recommended that a seismic level comparable to the SL-1 of IAEA leading to plant shutdown and inspection is established.</p> <p>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.</p> | CNCAN | Implemented | <p>Cernavoda NPP has established the SL-1 level.</p> <p>The regulation NSN-06 on the protection of nuclear installations against external events of natural origin has been published in January 2015.</p> |
| <p>9. Elaboration of more detailed regulatory requirements on the protection of NPPs against extreme external events, taking account of the</p> | CNCAN | Implemented | <p>The regulation NSN-06 on the protection of nuclear installations against external events of natural origin has been published in January</p> |

| Action | Responsible for implementation | Status | Target date for implementation |
|--|--------------------------------|-------------|---|
| lessons learned from the Fukushima accident and of the results of the "stress tests" peer reviews. | | | 2015. |
| <p>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.</p> | CNCAN | Implemented | <p>The regulation of NSN-06 includes requirements on the assessment of cliff-edge effects due to external events of natural events.</p> <p>Based on the assessments implemented so far, it was concluded that the existing safety margins are sufficient to prevent cliff-edge effects.</p> |
| Topic 2 – Design Issues | | | |
| <p>11. Procurement and testing of mobile equipment (e.g. mobile diesel generators, mobile pumps, connections, etc.).</p> | SNN | Implemented | - |
| <p>12. Provision of a facility to open the MSSVs after a SBO.</p> | SNN | Implemented | - |
| <p>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.</p> | SNN | Implemented | - |
| <p>14. Specific emergency operating procedures to cope with Station Blackout and Loss of Spent Fuel Pool Cooling events.</p> | SNN | Implemented | - |

| Action | Responsible for implementation | Status | Target date for implementation |
|---|--------------------------------|---|---|
| <p>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.</p> | SNN | Implemented | <p>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.</p> <p>The solution selected for implementation, documented in MPA#EC1973, was to add a new power supply to SCA instrumentation panels from 100 kV mobile Diesels, which are already procured.</p> <p>The design modification package (MWP) also included new, seismically qualified, electrical panels that have been installed.</p> |
| Topic 3 – Severe Accident Management and Recovery (On-Site) | | | |
| <p>16. Validation of the station Severe Accident Management Guidelines (SAMG) through emergency exercises.</p> | SNN | Implemented | - |
| <p>17. Training for severe accident scenarios, including as part of the emergency drills.</p> | SNN | Implemented (Refreshment training is performed periodically) | <p style="text-align: center;">-</p> <p>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).</p> |
| <p>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-connection and supply of light and heavy equipment</p> | SNN | Implemented | - |

| Action | Responsible for implementation | Status | Target date for implementation |
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| 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. |
| 25. Implementation of a design modification for | SNN | Implemented | - |

| Action | Responsible for implementation | Status | Target date for implementation |
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| water make-up to the calandria vessel and the calandria vault | | | |
| 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. |
| 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, mobile diesel engine pumps, fire-fighter engines, radiological emergency vehicles, heavy equipment to unblock roads, etc.) and will be protected against all | SNN | In progress | End of 2024 The target date was initially set for the end of 2015. It was changed several 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 |

| Action | Responsible for implementation | Status | Target date for implementation |
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| external hazards. | | | <p>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.</p> <p>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).</p> |
| 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 sector. | CNCAN SNN | Implemented | - |
| 36. Implementation of recommendations from the 2011 IRRS mission. | CNCAN | Implemented | <p>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 is planned for 2023.</p> |

| Action | Responsible for implementation | Status | Target date for implementation |
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| 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). |
| 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. |

| Action | Responsible for implementation | Status | Target date for implementation |
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| Topic 6 – International Cooperation | | | |
| <p>42. Identification and consideration of additional relevant peer-review services.</p> | <p>CNCAN SNN</p> | <p>Implemented</p> | <p>This is a continuous activity, controlled by the operational experience processes.</p> <p>Several OSART and WANO-PEER Review Missions have been conducted at Cernavoda NPP.</p> <p>An IRRS follow-up was conducted in 2017. The next IRRS mission is planned for 2023.</p> <p>Several relevant benchmarking activities have been conducted by both regulator and licensee.</p> |
| <p>43. Participation in international activities for sharing experience on lessons learned from the Fukushima accident and on actions taken to improve safety.</p> | <p>CNCAN SNN</p> | <p>Implemented</p> | <p>Both CNCAN and the licensee have participated and continue to participate in all relevant international activities.</p> |

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, 8th edition, August 2019, https://www.iaea.org/sites/default/files/romania_nr-8th-rm.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> .