

European Nuclear Safety Regulators Group ENSREG

2nd Topical Peer Review – 'Fire Protection'

Country Review Report

Slovakia

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CONTENTS

1.	Brief overview of the candidate installations	3
2.	Regulatory framework	3
3.	Findings and significant improvements of approaches on the installations from the natio self-assessment	nal 4
	Nuclear power plants	4
	Fuel storage facility	5
4.	Peer-review conclusions	6
4.1	Attributes of the NAR and the information provided	6
4.2	Peer review findings	6
	Definition of the types of findings	9

1. Brief overview of the candidate installations

Installation category	Number of installations	Name of candidate installations				
Nuclear power plant	1	Mochovce 3&4 (Unit 3)				
Research reactor						
Fuel reprocessing facility		-				
Fuel fabrication facility		-				
Fuel enrichment facility		-				
Dedicated spent fuel storage	1 (wet)	ISFSF				
Installations under decommissioning		-				
On-site radioactive waste storage		-				
Total	2					

The following installations were finally selected and included in the national assessment report (NAR).

2. Regulatory framework

The NAR mentions that "the general requirements and principles for fire protection of the NI do not differ from the general requirements and principles applied to other industrial, storage, administrative and production buildings. They are laid down in the Fire Protection Act and in the Construction Products Act". Nuclear and radiation safety in relation to fire safety were considered based on binding conditions defined by UJD SR.

The NAR indicates that "the analyses and fire safety assessments are carried out in accordance with generally binding legislation (a set of laws and decrees) and the UJD SR Safety Guides. (Legislation requires a fire hazard analysis, a probabilistic fire risk assessment and a deterministic fire hazard analysis). The WENRA reference levels, item SV (internal hazards) are transposed into the UJD SR Decree on the requirements for nuclear safety and the safety guide, which are related to the fire protection."

The NAR does not clearly state if the WENRA SRLs SV are binding. In response to the question of the TPR Team¹, Slovakia's answer was "In general, the WENRA reference levels are transposed into national generally binding legal documents (e.g. laws and decrees) and safety guides of the ÚJD SR. Safety guides specify the provisions of generally binding legal documents." WENRA conditions transposed to national legislation are considered as binding.

The NAR mentions that "In the approved design for the construction permit for NPP MO3&4 of 2008, the application of international standards is proposed in the individual parts of the design. These include, for example, the series of standards for the design of the fixed fire extinguishing equipment, heat and flux gas extraction and electrical fire alarm system."

¹ 'The NAR in §1.2 presents the regulatory framework. If not yet clearly mentioned in the NAR, could you indicate whether the WENRA SRLs for NPPs, and RRs (if relevant for your country), which are used as reference for this topical peer review on 'fire protection' (as per the Technical specification) are binding or not in your country? If they are not binding, what is the status of the SRLs (non-binding, guidance, advisory..)?'

The NAR also indicates "Based on recommendations resulting from insurance company audits, insurance company standards have been applied in NPP EBO3&4, NPP MO1&2 and NPP MO3&4 to improve the fire protection of selected civil structures".

3. Findings and significant improvements of approaches on the installations from the national self-assessment

Nuclear power plants

MO3&4 NPP Unit 3

The following **strengths** related to fire protection were reported in the NAR for **Mochovce 3&4 (Unit 3)**:

- The existence of a Plant Fire Brigade (PFB), capable of intervening within minutes of receiving a call for action. PFB personnel have theoretical knowledge and practical experience with the technology and civil structures at the site, locating areas with increased fire hazards, and have practiced cooperation with NPP operational personnel.
- The characteristics of the cabling used, which consists of fire-retardant or fire-resistant cables that significantly reduce the fire hazard and, in addition, it was determined with consideration of the fire load of PVC cables.
- The fire resistance performance of the structures achieved is in many cases beyond the requirements of the design or national legislation.
- Fire partitions in external cable ducts divide the space into smaller sections than required by the applicable standard for cable ducts. In addition, given the characteristics of the cables used, fire partitioning is not required by the applicable technical standard.
- The roof sheathing on the civil structures were made of materials meeting the CROOF (t4) criterion, despite the fact that roof coverings are not located in the fire hazard area of the adjacent building.
- In areas with oil systems, holding tanks have been installed to collect any leaking oil. In the case of the turbine hall, emergency tanks have also been constructed into which leaking oil from the holding tanks is drained.
- The existing staircase areas have been rebuilt based on the current legislation and made into protected escape routes with forced air ventilation.
- Smoke-tight doors have been used beyond the requirements of the legislation and are located on protected escape routes between the fire hallway and other areas, and also in areas with increased smoke generation and around the unit control room and the emergency control room.
- Preservation of the partition wall in the common fire compartment of the turbine hall between unit 2 and unit 3, which significantly eliminates the distribution of combustion products between the units and thus eliminates the harmful effects of a possible fire spreading.
- All fire-resistant structures are maintained in a clear form with information on the fire resistance achieved and related documentation demonstrating the fire resistance.
- In the case of the use of innovative technologies (such as the water mist extinguishing system), deviations from the designer's original intent have occurred due to the granularity and diversity of the protected spaces. These deviations were then accumulated into a special program and test to verify the behaviour of the water mist FES in cable rooms under real conditions.
- Three types of fire safety analyses: fire hazard analysis, deterministic fire hazard analysis and probabilistic fire risk assessment are treated comprehensively. The contribution of fires to the frequency of core/fuel damage at nuclear power plants is low (< 1% for an operating unit). The building that has the largest contribution to the risk of fires is the common turbine hall.

The following **weakness** related to fire protection was reported in the NAR for **Mochovce 3&4 (Unit 3)**:

• Intervention routes, which, due to other legal and technical constraints, may cause delays for the intervening units. This issue is gradually being identified and addressed by appropriate technical solutions.

The following **lessons learned** related to fire protection were reported in the NAR for **Mochovce 3&4** (Unit 3):

- Peer missions identify gaps, bring suggestions for improvement or experience from other operators, that are always treated with high priority and emphasis is placed on their elimination or implementation. The high priority of these tasks is evidenced by the fact that they are monitored by the management of the licensee. For example, an action plan was elaborated to address WANO findings in the 2021 mission and the tasks from the action plan were closed in 2022. WANO mission recognized the Plant Fire Brigade (PFB) as a good practice, highlighting the modern hardware and software, enabling for example the printing of an Exit Card with the specification of the fire location, with the visualization of textual and graphical information for the area.
- Assessment of fire events and proposal of preventive measures and actions to avoid similar events: during the last 38 years of operation of EBO3&4 and MO1&2 NPPs, out of the total number of recorded fires, there have been two small fires (a fire in the turbine hall in 2005 on the electrical feed pump and in 2011 when the TG insulation was on fire), which, if not extinguished, could potentially cause more significant damage. The incidents were documented and evaluated in an "Incident Report".
- Lessons learned from inspections on the implementation in Unit 3 of the fire protection systems reflected in Unit 4. In particular, regarding the damaged fire protection coatings during construction, broken fire barriers during cable installation.

The following **improvements** related to fire protection were reported in the NAR for **Mochovce 3&4** (Unit 3):

- Design developed with current requirements (legal requirements, requirements of regulatory authorities, IAEA safety standards, WENRA reference levels, national and international standards for the design and certification of fire protection equipment) and the experience of the operating plants and as well the recommendations of the insurance companies leading to significant improvements, for example:
 - reducing fire hazard by selecting appropriate building materials;
 - fire-retardant cabling;
 - more efficient fire extinguishing equipment;
 - accurate fire detection in all buildings;
 - improvement of smoke and heat extraction in the turbine-generator room (TG);
 - \circ protected escape routes with fire ventilation and others.

Fuel storage facility

Interim Spent Fuel Storage facility (wet)

The following **strengths** related to fire protection were reported in the NAR for **Interim Spent Fuel Storage facility (wet)**:

- Verified fire resistance of building structures.
- Power cables for selected safety equipment in non-fire propagating design (IEC 332) and with functional fire resistance (IEC 331) according to the above standards in force in 2010.
- Existence of a competent and adequately equipped Plant Fire Brigade on the NI site.

The **weaknesses** related to fire protection were reported in the NAR for **Interim Spent Fuel Storage facility (wet)** and addressed by the following recommendations to improve the level beyond the required legal and regulatory requirements:

- Complete the replacement of fire hydrants on the fire water distribution system in the JAVYS premises.
- Review the components of the fire detection and protection system (FDPS) system in terms of their durability and market availability.
- Replace the cable connections of the FDPS control panels by creating redundancy (one cable contains cores that are redundant, so that redundancy becomes meaningless when the cable breaks).
- Re-evaluate the use of voice alarm in the civil structure.
- Re-evaluate the possibility of controlling important fire equipment (HVAC equipment, ventilation of protected escape routes, fire doors, power shutdown) via the FDPS.
- Elaborate procedures for the repair of damage to fire protection measures (coating, spraying, lining) applied to fire structures.
- Develop operational cards for intervention in the facility construction.
- Develop a clear system of marking of fire closures.

No lessons learned related to fire protection were reported in the NAR for Interim Spent Fuel Storage facility (wet).

No **improvements** related to fire protection were reported in the NAR for Interim Spent Fuel Storage facility (wet).

4. Peer-review conclusions

4.1 Attributes of the NAR and the information provided

The candidate installations are the ones which were the subject of the Board's review prior to the national self-assessment. The recommendations of the Board to consider additional facilities were partially taken into account in the NAR. Radioactive waste storage facilities were partially mentioned in different chapters.

In general, the national report responds to the technical specifications, however specific descriptions provided therein are sometimes unclear or lacking in detail or context to allow to draw conclusions about their safety significance. Consequently, the identification of peer review findings based on the information in the NAR was not straightforward.

There are no comments on the structure of the NAR.

In general, the outcomes of the self-assessment were clearly mentioned.

Adequate information was provided in reply to the written questions.

Additional information and updates provided in reply to written questions and in the national presentations in the country review workshop were taken into account in the definition of the findings below in section 4.2.

4.2 Peer review findings

The self-assessment revealed some weaknesses in the fire protection of the nuclear installations. The findings in the table below were acknowledged as areas for improvement by the TPR Team.

Areas For Improvement mentioned in the NAR as weaknesses and acknowledged as such by the TPR Team					
AFI (1)	Nuclear installation: Mochovce 3&4				
	The intervention time of the intervention units may be delayed due to restricted access to certain rooms.				
AFI (2)	Nuclear installation: Interim Spent Fuel Storage facility (wet)				
	There is a need to complete the replacement of external underground fire hydrants with external over-ground fire hydrants				
AFI (3)	Nuclear installation: Interim Spent Fuel Storage facility (wet)				
	Additional work is needed to review the components and replace the cable connections of the fire detection and protection system (FDPS)				
AFI (4)	Nuclear installation: Interim Spent Fuel Storage facility (wet)				
	There is a need to re-evaluate the use of voice alarm in the civil structure				
AFI (5)	Nuclear installation: Interim Spent Fuel Storage facility (wet)				
	There is a need to re-evaluate the possibility of controlling important fire equipment (HVAC equipment, ventilation of protected escape routes, fire doors, power shutdown) via the FDPS.				
AFI (6)	Nuclear installation: Interim Spent Fuel Storage facility (wet)				
	There is a need to elaborate procedures for the repair, the operability and the identification of fire protection system components.				

The TPR team recommends that Slovakia addresses these areas for improvement in the National Action plan.

During the country review workshop, the findings identified during the peer review phase have been discussed. Based on these discussions, the TPR team concluded on the following finding:

Areas of Good Performance							
Nuclear installation: Mochovce 3&4							
	Finding	A professional multi-functional fire brigade (minimum 18 staff) is deployed on a permanent basis on the NPP site. In addition, an external fire brigade is available whose intervention is planned in the event of a fire. The effectiveness of the joint intervention is verified via annual drills.					
AGP (1)	Justification	The on-site fire brigades on NPP sites perform not only standard firefighting activities, but also have responsibilities related to nuclear safety (such as water delivery water to steam generators, to essential service water, operation of mobile means in case of a severe accident etc.), supporting activities (such as air monitoring in places with a risk of explosive concentrations, dangerous substances or other hazards, implementation of alternative fire-fighting measures during a malfunction, or shutdown of installed firefighting systems,					

	cooperation	and	coordination	of	the	activities	during
	transportatior	.).					
	The presence of these well-resourced on-site fire brigades the NPP sites contributes to responding to actual fires timely and robust manner especially in case of combinatio						ades on res in a ation of
	events/hazard	ls.	-				

Definition of the types of findings

According to the TPR II Terms of Reference, the country group workshop discussions should lead to conclude on the findings categorised as an 'area of good performance' or 'area for improvement'. These are defined therein as follows:

A National area of good performance which should be understood as an arrangement, practice, policy or programme related to fire protection that is recognized by the TPR Review Team as a significant accomplishment for the country and has been undertaken and implemented effectively in the country and is worthwhile to commend.

A National area for improvement which should be understood as an aspect of fire protection identified by the TPR Peer Review Team where improvement is expected, considering the arrangement, practice, policy or programme generally observed in other participating countries. It may also be self-identified by the country itself (i.e. self-assessment) where improvement is appropriate.