European Nuclear Safety Regulators Group
ENSREG

2nd Topical Peer Review – 'Fire Protection'

Country Review Report

Hungary

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1. Brief overview of the candidate installations

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

Installation category	Number of installations	Name of candidate installations
Nuclear power plant	1	Paks NPP (Unit 1,2,3,4)
Research reactor	2	Budapest Research Reactor. Training Reactor of the Budapest University of Technology and Economics
Fuel reprocessing facility		-
Fuel fabrication facility		-
Fuel enrichment facility		-
Dedicated spent fuel storage	1 (dry)	Spent Fuel Interim Storage Facility
Installations under decommissioning		-
On-site radioactive waste storage		-
Total	**4**	

2. Regulatory framework

The current legal regulatory environment regulates the operational requirements of existing facilities in full, with general fire protection rules (National Fire Protection Regulation), complemented by special nuclear requirements in:

- the Nuclear Safety Codes, which covered the structure of architectural fire protection documentation and harmonization of nuclear and fire protection requirements at system level in both the construction and the operational rules among the various nuclear-related regulatory elements;
- the Nuclear Fire Protection Codes and the Radioactive Waste Storage Fire Protection Codes.

Besides, the HAEA Decree 1/2022 stipulates fire protection requirements for the design and operation of nuclear facilities.

The chapter 1.2 of the NAR dedicated to the regulatory framework does not indicate if the WENRA SRLs are transposed in the regulatory framework. However, for each thematic of the TPR II, the NAR indicates the requirements in the Nuclear Safety Codes and in the Nuclear fire safety codes with regard to WENRA SRLs as mentioned in response to the question of the TPR Team[1], Hungary's answer was

[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 relevant WENRA SRLs, as well as their corresponding Hungarian regulations are indicated at the beginning of every chapter in the NAR*".
The NAR indicates the key regulatory requirements related to nuclear safety.

The NAR mentions that "*To date, no dedicated official guidance for the assessment of nuclear fire safety has been developed by the HAEA. The application of the recommendations of NUREG/CR-6850, IAEA SSG-77 and IAEA SSG-3 is considered as good practice in the field of nuclear fire risk assessment*."

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

Nuclear power plants

Paks NPP (Unit 1,2,3,4)

The following **strengths** related to fire protection were reported in the NAR for **Paks NPP**:

- All fire-hazardous activities can only be carried out/started once in possession of a specific work permit granted by a dedicated organizational unit of the licensee, according to his internal working procedures.
- PSA models and documentation of the PAE is updated at least on a yearly basis, taking into consideration all modification to the design as well as the operator experience and both the models and the documentation is submitted to the HAEA.
- Increased interest in participation in international programmes, so as to share experience with foreign nuclear facilities and regulations of other countries.

The following **weaknesses** related to fire protection were reported in the NAR for **Paks NPP**:

- The fire risk analysis identified that transverse corridor A008/2-2 and transverse corridor A008/4-4 next to the wall of the turbine hall contain an oil manipulation tank where spent oil is temporarily stored. Supplementary flame sensor is going to be installed to protect the area. The project is ongoing.
- Regulatory on-site inspections are carried out as scheduled which typically takes place during shutdowns.

The following **lessons learned** related to fire protection were reported in the NAR for **Paks NPP**:

- Every event (in this case related to fire protection) in the NPP and other NPPs are being analysed by the Licensee. In case of any valuable experience occurs a deeper analysis takes place and all the information as well as the solution are shared with other NPPs.
- The fire protection organization regularly carries out the tasks arising from the inspections and maintenance of devices and sensors related to the large number of built-in fire alarm devices operated in the area of the NPP, paying particular attention to the investigations of false fire alarms and to reducing their number.
- Any proposal issued by international organizations and missions (WANO, OSART, insurance company reviews) is being processed by the plant staff and corrective actions are carried out in a scheduled way.

The following **improvements** related to fire protection were specifically reported in the NAR for **Paks NPP**:

- Improvements were implemented gradually in Unit 1 of the Paks nuclear power plant as there were no fire protection requirements for nuclear power plants during the construction period in the 1980's. In particular, the cable room under the control rooms on each unit got fireproof coating against the flame spreading, the cable rooms were divided into several fire sections to limit the spread of fire, and built-in fire extinguishers were installed to protect the diesel generators and the main circulation pumps.
- Additional measures were defined and implemented to address deviations identified in the fire risk analyses, mainly:

- in cable rooms where the cables of safety systems are functionally not completely separable, the cables have been equipped with flame-retardant coating along their entire length;
- in process rooms where separation of safety systems was required, fire cells were installed;
- passive protection of cable ducts installed along the riser cable routes pertaining to safety systems;
- to ensure more consistent limitation of fire spreading in the power plant's units, new fire-retardant doors/ windows have been installed in several places;
- installation of water mist extinguishing equipment;
- in order to reduce water damage, the floor of cable compartments has been waterproofed and the heads of dry sprinkler fire extinguishers in the cable rooms have been replaced by ones with lower water flow rates in accordance with national standards;
- in the turbine building, the protection of some steel support structures has been ensured with an additional certified fire-retardant coating;
- to protect the equipment of oil systems in the turbine hall, water mist extinguishing equipment was installed. In the turbine building, salvagers have been installed around the oil system equipment to prevent possible oil spills;
- 35 local gas fire extinguishing systems per unit have been installed to protect the electrical cabinets of safety systems;
- the ventilation system piping in the safety system rooms has been fitted with additional certified fire protection cladding, which means the installation of fire dampers and of individual certified fire protection cladding on the piping;
- in the controlled access area, safe escape routes are provided by retrofitted fire-retardant doors in the passageways. In the corridors, normally open doors that close on a fire alarm segment the escape route. Escape staircases are available with pressurized, closed and fire doors;
- coordinated movement of scan-doors and smoke deflectors;
- installation of a closed-circuit television network;
- the construction of tanks for the temporary short-term storage of contaminated oil with built-in fire extinguishing equipment at 4 locations in the controlled access area is in progress.

Research Reactors

The following **weaknesses** related to fire protection were reported in the NAR as **generic for both Research Reactors** (BKR and BME OR):

- Both research reactors were constructed on sites which include various facilities and activities, where different stakeholders and organizations need to coordinate. The responsibilities in the facilities are in many cases conflicting and need further clarification. This reflects the weakness of the system, where the different functionalities and responsibilities of the owner, the maintainer, the operator of the nuclear facility and the operator of the site cannot ensure effective and timely decision making and implementation of necessary actions.
- There is a persisting issue regarding the sufficiency of staffing of these facilities which pose a continuous obstacle on carrying out scheduled tasks on time. The issue arises from the shortage of the nuclear expert community and strict requirements on the qualifications of these experts, which significantly limits the number of available experts.

Budapest Research Reactor (BKR)

The following **strengths** related to fire protection were reported in the NAR for **Budapest Research Reactor**:

- Fire safety training is well developed at the operating organization and a significant part of the staff are certified fire safety engineers, which highly increases the quality of related analyses and assessment. A high amount of the reactor operator personnel has fire safety engineer certification and that the operator personnel goes through on a fire safety training on a yearly basis in order to be able to identify potentially hazardous situations and events during the daily scheduled walk-downs.
- Participation regionally competent Professional Firefighting in exercises and trainings in the licensee's area.

The following **weaknesses** related to fire protection were reported in the NAR for **Budapest Research Reactor**:

- Lack of personnel specifically focusing on the changes in laws and regulations, which would ensure that both the fire risk analyses and the internal Fire Protection Regulation is kept up to date.
- In relation to the age of the buildings, during the reinforcement of the structural elements and conservation activities, there is a need to check the installation of materials complying with the fire protection requirements.

The following **lessons learned** related to fire protection were reported in the NAR for **Budapest Research Reactor**:

- The conclusions of the recent fire risk analysis and the self-assessment carried out within the framework of the TPR II led to the following recommendations:
    - the replacement of the more than 30-year-old fire protection systems (doors, dampers) installed at the fire section boundaries of the Research Plant building must be planned and scheduled according to their condition;
    - the removal of the oil storage (auxiliary engine room, diesel gas oil tank: 6,72 m3);
    - the need to review the 'Safety Power Supply' of the Reactor Department regarding its operation, maintenance, and inspection with regard to nuclear technological, fire protection… according to its specifications (diesel generators, battery plants and their associated uninterruptible power distributors);
    - fire alarm system replacement;
    - cable duct checking and repair (if necessary);
    - recalculation of the required gasoline supply for the storage tank, reduction of the fuel quantity.
- The replacement old-type lighting fixtures containing ignition devices and chokes with new, energy-efficient luminaires following the recent fire safety incident.
- During on-site inspection, the co-authorities identified a significant amount of unnecessary combustible materials was spotted in the reactor hall and in the measurement hall and that the corrective actions defined in 2022 were only partly carried out.
- In the internal procedures related to the use of the experimental equipment, there is no requirement to take into consideration fire safety in the planning of modifications.

The following **improvements** related to fire protection were reported in the NAR for **Budapest Research Reactor**:

- Corrective measures were developed to address the deviations identified in the fire risk analyses:
    - rebuilding of the temporary waste storage of room 102 in the reactor hall, using non-combustible materials for the structure and the cover and area equipped with hand-held fire extinguishers;
    - new fire alarm and extinguishing system has been approved. The local (reactor unit) CO2 extinguishing system is now automatic and its display system is compatible with the existing fire alarm system. The purpose of the conversion is to replace the obsolete manually operated reactor hall extinguishing system and the halon extinguishing

equipment as required (the implementation of this measure was confirmed during TPR II experts site visit);
- installation of an automatic fire detection and extinguishing system in the reactor block of the Research Reactor.

Training Reactor of the Budapest University of Technology and Economics (BME OR)

No strengths related to fire protection were reported in the NAR for the **Training Reactor of the Budapest University of Technology and Economics**.

The following **weaknesses** related to fire protection were specifically reported in the NAR for the **Training Reactor of the Budapest University of Technology and Economics**:

- Insufficient availability of certified nuclear fire safety experts in Hungary, which poses a continuous obstacle for the licensee to carry out certain tasks, such as the completion of the fire risk assessment.
- During on-site inspection, the different authorities involved in fire protection oversight identified that in certain areas within the facility a large amount of unnecessary flammable materials were detected in close proximity to cables relevant from the point of nuclear safety and that the Licensee does not keep an inventory/log on the flammable materials transported into the facility (e.g.: packaging materials, paints, etc).

No **lessons learned** related to fire protection were reported in the NAR for the **Training Reactor of the Budapest University of Technology and Economics**.

The following **improvements** related to fire protection were reported in the NAR for the **Training Reactor of the Budapest University of Technology and Economics**:

- Complete building renovation in 2016, as well with a new ventilation, air-conditioning and high-current system, and new, modern wall and floor coverings.
- Large margin in the design of the new high-current system (design with 10 kW of electric power for only kW power consumer) to ensure robustness of all the main cables belonging to the 230V network and therefore minimize the occurrence frequency of cable fires.

<u>Spent Fuel Storage Facility (dry)</u>

Interim Spent Fuel Storage Facility

The following **strengths** related to fire protection were specifically reported in the NAR for **Interim Spent Fuel Storage Facility**:

- All fire-hazardous activities can only be carried out/started once in possession of a fire-ignition permit, which is an internal permit of the Licensee. The appropriate organizational unit of the Licensee is responsible for issuing the fire ignition permit.
- The active fire protection of the facility is a state-of-the-art one due to the reconstruction implemented 5 years ago.
- The full scope inspections are performed twice per year, while the expert-level inspections are carried out on a monthly basis.

No **weaknesses** related to fire protection were specifically reported in the NAR for **Interim Spent Fuel Storage Facility**.

The following **lessons learned** related to fire protection were specifically reported in the NAR for I**nterim Spent Fuel Storage Facility**:

- Deficiencies revealed by the last cycle inspections of the fire protection authority have been eliminated.
- During the on-site inspection, the co-authorities identified one minor discrepancy "*In the process control system of RHK Ltd., the internal Fire Protection Regulation do not specify who*

should be notified by the operational staff in case of a fire safety relevant detection" that has been addressed by a corrective action.

No **improvement** related to fire protection was reported in the NAR for **Interim Spent Fuel Storage Facility** (dry).

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 recommendation of the Board (consideration of on-site NPP waste storage) was not addressed in the NAR.

In general, the information provided in the NAR was sufficient for the peer review.

There are no comments on the structure of the NAR.

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

Replies to the written questions did not allow to clarify all the identified issues.

Additional information and updates provided in reply to written questions, the site visit, and in the national presentation in the country review workshop were taken into account in the definition of the findings below in section 4.3.

4.2 Conclusions from the site visit

The site visit to Budapest Research Reactor was conducted by the TPR II team on 23 May 2024.

During the site visit a number of topics, based on questions shared in advance with the counterparts, were discussed e.g. fire-detection system; fire-suppression provisions; fire brigade response; PSR; managing responsibilities at the site; modernisation of the passive fire protection features; ventilation system (configuration and operational aspects); fire prevention management of combustible material, ignition sources and fire loads.

Also, a number of areas were visited, e.g. the reactor building, reactor hall, battery room, control room, ventilation building, measurement hall and rooms for diesel generators.

The TPR II team noted:

- in the area of organisational factors and safety culture, progress made in tackling the issues related to complex responsibilities at the site;
- the licensee has allocated significant resources to improve fire safety for this installation subject to ageing and designed in accordance with old standards. A lot of modifications, modernisations are scheduled (e.g. earthquake resistance improvement, replacement of diesel generators). A corrective action plan is developed and agreed with HAEA in the frame of PSR and TPR II. Part of the corrective actions are ongoing or already implemented;
- outside business hours, if the fire detection system is triggered in certain premises, the firefighters must wait for the on-call operator to arrive in order to enter the buildings. This is likely to delay response time for firefighting;
- the possibility to improve physical separation of certain components (i.e diesel generators, ventilators) in order to prevent the propagation of a fire between them.

The TPR II team appreciated the willingness and cooperation of Hungary to host a site visit to the Budapest Research Reactor.

4.3 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 of 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:** Budapest Research Reactor and Training Reactor The site conditions create conflicting responsibilities between the site owner and reactor operator organisation, which complicates the approval processes for certain modifications or corrective actions.
AFI (2)	**Nuclear installation:** Budapest Training Reactor No inventory of the flammable materials transported into the facility (e.g. packaging materials, paints).
AFI (3)	**Nuclear installation:** PAKS NPP Lack of detector for an area with combustible materials temporary storage.

The TPR team recommends that Hungary 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 findings:

Areas For Improvement		
Nuclear installation: PAKS NPP		
AFI (4)	**Finding**	Fire detection systems for buildings other than the reactor and turbine buildings and water extraction plant are not seismically qualified and not independent between adjacent compartments. A risk-based justification is not provided.
	Justification	There is inadequate justification of seismic qualification of the fire detection system (for buildings other than the reactor and turbine buildings and water extraction plant) and no information on how the level of independence between fire detection systems in adjacent compartments is achieved and sustained under hazard conditions. The lack of seismic qualification of the fire detection systems and their level of independence in adjacent compartments to cope with hazard conditions should be justified by the fire safety analysis.
AFI (5)	**Finding**	There is a need to reassess the detection strategy in area/rooms with harsh environment, in particular high radiation, according to FSA, and consider the adoption of appropriate fire detection solutions where needed.
		Fire detection systems are installed in the NPPs according to UNE-EN 54. Fire detectors are placed in substantially all process rooms of the NPP units. Exceptions are rooms where extreme ambient or radiation conditions do not make it possible to

	Justification	install such fire detecting/alarm equipment. The number of such rooms is low and, in such rooms, the process-related signals are taken into account during the identification of fire cases. The situation is not in line with SSG-64 and the WENRA SRL on fire detection that require a dedicated fire detection system that allows for an early and reliable fire detection and localisation, in those areas/rooms for which this need has been identified by the FSA.
Nuclear installation: Budapest Research Reactor		
AFI (6)	**Finding**	Insufficient physical separation between redundant safety-related components (i.e. diesel generators, ventilators).
	Justification	The insufficient physical separation between redundant safety-related components creates a risk of common cause failure due to potential propagation of a fire.

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

Areas of Good Performance		
Nuclear installation: PAKS NPP		
AGP (1)	**Finding**	There is a permanent presence of a well-resourced on-site fire brigade.
	Justification	The well-resourced fire brigade contributes to responding to fires in a timely and robust manner.
Nuclear installation: BUDAPEST RESEARCH REACTOR		
AGP (2)	**Finding**	A significant number of the staff and reactor operator personnel are certified fire safety engineers.
	Justification	These competences increase the quality of related fire safety analyses and assessment.

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.